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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JANUARY 3, 1868.

THE PAST AND THE FUTURE.

IN commencing the Eighty-eighth Volume of the MECHANICS' MAGAZINE, let us first tender our thanks to the public for the liberal support which has been accorded to us during the past forty-five years. This period has witnessed vast progress in the practical application of science, and the last few years have testified to a wonderful expansion in this direction. Although an outline of the history of this journal has recently appeared as a notice in our columns, as well as an intimation of the improvements to be introduced, it may be as well briefly to refer to those matters again, as we are happy to record an accession of new subscribers. The MECHANICS' MAGAZINE first appeared in 1823, a small pamphlet as compared with the present issue. In 1859 Science had so progressed as to oblige us to double its size. To keep pace with the times we were again obliged, three years since, to enlarge its size and to increase the number of its pages, and we now find it necessary to further increase the number of pages, as in the present issue, which increase will be repeated from time to time, as circumstances may require. The patent interest will continue to form the chief feature of the MECHANICS' MAGAZINE, and an increased number of illustrated descriptions of inventions will regularly appear. Besides this it will be our aim to keep our readers informed upon the most recent mechanical improvements, or, in other words, to carry them from Theory into Practice, from the Patent Office where the ideas of inventors are fostered and nurtured, to the foundry, workshop, and factory, where these ideas become developed into facts. The arts and sciences are now represented by gentlemen practically skilled in each special department, and by a thorough re-organization of our staff we shall be enabled to keep our readers thoroughly informed upon every subject of scientific interest. We commence with new paper and type, and our journal will be found to be improved in many other respects, not the least of which is the double page engraving we this week present to our readers, and which will be repeated as appropriate subjects offer themselves for illustration.

Having said this much for ourselves, let us now proceed to follow our annual custom and place before our readers the main events in science during the past year. We will also follow the subject a little farther, and endeavour to indicate the probable course of scientific research, and the possible results which may be expected during the year now opening upon us. First, then, as to the past. Looking generally at the year just closed we cannot record any brilliant scientific achievement or the accomplishment of any great engineering success. The plain truth of the matter is that trade and commerce have not yet recovered from the severe checks they experienced in 1866, and which have been added to not a little during the past year. Commercial prosperity underlies practical scientific progress, and when commercial failures and monetary panics occur they are sure to influence the advancement of science, which is so dependent upon capital for its practical development. But although science—and engineering science especially—has been so checked and retarded, we are happy to see that there are general signs of amendment, and it is to be hoped that with the coming spring, and a return of commercial confidence, we may soon see our engineering establishments in full and active work again. These once set going, and legitimate enterprise again vigorously pushing onward, progress will extend to all around, and prosperity will follow in its wake.

MECHANICAL ENGINEERING.

IN the department of mechanical engineering attention has been given during the past year to the perfecting of rock-boring, and coal-cutting machines. In view of the important works in tunnelling now being carried out, or in contemplation, it is well that no opportunity should be lost to improve the means of facilitating the progress of these tedious and expensive operations. With regard to coal-cutting machines, it is of the first consequence that our present coal supply should be maintained without increased cost either to the producer or the consumer. The increasing depth of workings renders it necessary that labour should in some way be both cheapened and economized. The coal-cutting machine does this most effectually, and something more, for those in which compressed air is used greatly aid the ventilation, and render work in coal mines both lighter and more healthy. We are glad to observe that a movement is on foot to give prizes for the best machine of this class. This step will greatly assist in the development of this application of mechanical science. No great or special features present themselves here for notice, unless we except the engines by Messrs. Penn for the "Hercules," and those of the "Inconstant" of 1,200 and 1,000-horse power respectively. These were described in the MECHANICS' MAGAZINE for September 20 last, and are only now referred to as features of the past year's work. A very useful centrifugal pump has been brought out by Mr. Bernays, in which the revolving fan is entirely relieved from the pressure of water on its outer surface. Friction and, consequently, wear and tear, are thus greatly reduced, less power is absorbed, and the pump may be driven at a lower speed than the ordinary centrifugal pumps with full effect. The subject for adapting locomotives for working steep gradients, has also received some attention from Mr. Thomas Page, C.E., who uses a broad driving wheel, biting into a roughened stone tramway. So far as experiments go, this system answers well, but the test of practice has yet to determine its value. Meanwhile, we have undeniable evidence of the success of Mr. Fell's system on the Mont Cenis Railway. Mr. Fell uses a central rail, which is gripped by four horizontal wheels, and from which great adhesion is obtained. Looking forward, we may anticipate in the ensuing year some further improvements in the machinery we have already noticed. Serious attention, however, should be given to mining engineering. Remembering the calamities which have occurred during the past year, it is incumbent upon all interested in mining property to see that a greater degree of immunity is secured for the future, by the adoption of proper preventive means, and our engineers will do well to give their attention to improvement in this direction. The economy of fuel in the steam engine and in the arts and manufactures, is another important point to which the attention of engineers should be directed, as, owing to the limited extent of our coal fields, there is a certainty that the time must come when coal will be costly to produce, however much that period may be deferred by the aid of machinery.

NAVAL ARCHITECTURE.

UNQUESTIONABLY shipbuilding has presented greater features of novelty and interest during the past year than are to be found in any other direction. The principal activity in the trade has taken place in connection with the production of war vessels. The cessation of the American war, which created a demand not only for vessels of extraordinary speed, but for vessels possessing this quality in combination with a light draught of water and great fuel-carrying powers, threw a great many vessels of this class upon the hands of merchants. In most cases they were built of steel, and of scantlings so slight as to excite astonishment even in the most daring professional minds. Many of these vessels have been purchased during the past year by the Turks and by the Greeks, for use in connection with the Cretan rebellion, and it is a noteworthy fact that two of these vessels have been destroyed, or nearly so, by explosions—that of the Turkish Government, built and engined on the Clyde, having burst her boiler abroad, and that of the Greek Government having met with a somewhat similar fate on the Mersey. None of these vessels were, however, war-ships proper, but were blockade-runners, converted, so far as was practicable, into armed craft.

Among real vessels of war built or finished during the year by private firms for foreign governments may be noticed the Danish turret ship "Prince Hendrik," built by Messrs. Laird for the Dutch Government; a turret ship and a Monitor now building by Messrs. Napier for the same government; a small broadside ship just launched by the Thames Company for the Greek Government; the frigate "Crown Prince," built by Messrs. Samuda for the Prussian Government; and the "William I.," building by the Thames Company, also for the last-named government. All these ships are armour-clad. The "Prince Hendrik" is chiefly remarkable from the fact that she is a "belt and box" ship, with a turret standing up through the top of the armoured box, the ship being completed at both ends by unplated extremities coming up flush with the top of the box, as in the "Pallas," "Bellerophon," "Enterprise," and most of Mr. Reed's ships, and a short forecastle being fitted forward. By the adoption of these devices a much greater height of freeboard than the "Scorpion" and "Wivern" possess is obtained, and the "Prince Hendrik" will no doubt prove possessed of much superior sea-going qualities to theirs in the ordinary acceptance of that term. Her armour, however, is almost as slight as theirs, and her speed is 12 knots. The turret ship of Messrs. Napier is without the "box," and more resembles the "Affondatore" as regards the protection of the bases of the turrets with armour. The Monitor is more of the American type of ship. The little Greek broadside or end-on ship just launched at the Thames Works is a remarkably well-designed little vessel, having very thick armour for her size, and the promise of good speed. It is exceedingly improbable, however, that she will fairly attain the high contract speed of 14 knots loaded for sea, notwithstanding the improvements introduced into her engines; and it must be said that her battery is very confined, and her draught of water several feet more than the smallest iron-clads of the Royal navy. We have great confidence, however, in this proving a very efficient and powerful little ship. The "Crown Prince" is undoubtedly a great success as a ship of the "Bellerophon" type, on dimensions less than those of the "Bellerophon," and with thinner armour. She is a very fast and very handy ship, and shows that Mr. Reed was perfectly correct in denying that an iron-clad must necessarily be of extreme length and unwieldy in action in order to steam fast. She reflects great credit on Messrs. Samuda, and upon the makers of the engines, Messrs. Penn, and will be a valuable ship to the Prussians. But the "William I." will be still more valuable, as she ought to be, considering her size and cost, for she will be, when launched, the most powerful iron-clad afloat in the world. Her armour is 8-in.; she will carry about 30 heavy guns, some of those on the upper deck, as well as those on the main deck, having armour to protect them, and possessing a range of fire all round the horizon. She will steam at nearly 15 knots, and will therefore probably be the fastest as well as the most powerful of iron-clads. She was designed for the Sultan of Turkey by the

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Chief Constructor of our navy, but has passed into the hands of the Prussians.

In our own navy the past year has been a most eventful one. We have made great progress with the "Hercules," a ship in some respects superior, although in others inferior, to the great Prussian ship. In her we shall have an iron-clad invulnerable at least at the water-line, with 18-ton broadside guns, and an enormous bow fire; with a full-rig, a high speed, a great handiness, together with Captain Scott's excellent mechanism for revolving and otherwise working the guns carried out under his own eye. We have also made great progress with the Admiralty turret ship "Monarch," which Captain Coles deems a mockery of his plan; and fortunately Messrs. Laird have pushed along as rapidly with the "Captain," which is to be the perfect embodiment of Captain Coles' ideas. These two ships will, we trust, be got to sea together next year. Nor are these all the turret ships laid down by the Government, for Messrs. Palmer, of Jarrow-on-Tyne, are building a powerful iron-clad turret Monitor for the ort of Melbourne upon a new plan, designed by the Chief Constructor, in which the turrets, instead of standing upon the low open deck, American fashion, spring from the armour-clad breastwork, covered by a deck 8 feet higher, through which all the hatchways pass, the object being, of course, to give greater security to the ship against loss by sinking. In other respects the turrets are on the plan of Captain Coles. It may be interesting to add that Messrs. Napier are building two other iron-clads for our Government, and Messrs. Laird a third, and a fourth is being laid down at Pembroke Dock, the principal features of these ships being the possession of twin screws, and of an armour-plated upper deck battery, projecting over the side, and commanding a direct fire sight, right astern, and all round the horizon. Twin screws are also adopted in the Melbourne Monitor, and in the composite gun-boats about to be mentioned.

The past year has been marked also by the adoption by the Admiralty of the composite system on a large scale. A whole fleet of twin-screw gunboats, with iron frames and two layers of wood plank, are being built in the Royal dockyards, and in various private yards, the first of them being tried under steam at the time we write. This vessel is named the "Beacon;" she was built at Chatham, and was subjected, soon after launching, to a most severe trial of her strength by the bursting of the caisson at the entrance of the dry dock in which she lay. The manner in which she stood the ordeal of being dashed bodily against the masonry of the dock showed that she is thoroughly well constructed and fastened. One peculiarity of her fastenings consists in the screws of the inner layer of plank being tapped through the frames themselves.

Another form of composite construction is being carried out by the Admiralty in the "Inconstant," "Volage," and "Active," three fast unarmoured ships building, the first at Pembroke dockyard, the other two at the Thames Iron Works. In all these ships an iron skin is being first worked over the frames, and the doubled strakes of teak are worked upon it, and fastened to it. They are, therefore, iron ships sheathed with wood, but differ from ordinary iron ships, of course, at the bow and stern. These ships are very bold experiments, and the efficient adaptation of their long and fine sterns to receive the powerful action of their screws without setting up galvanic action, will tax all the ingenuity of Mr. Reed and his staff. Such ships are great and valuable experiments, and the Admiralty deserve credit for such bold endeavours to combine the structural strength of iron with the advantages of a coppered bottom in our fleet vessels of war.

The Admiralty work of the year also includes the production of the most important fleet of passenger steamships ever produced. The new Indian steam transports, which are now in the full swing of their work, have proved successful in the highest degree and in every respect. These ships presented many unusual difficulties in their design, and Mr. Reed may certainly claim credit for having overcome them completely. But few vessels of note have been added to our large mercantile steam fleets during the past year, but the "Sumatra," built by Mr. Denny, of Dumbarton, for the Peninsular and Oriental Company, deserves mention as a good, commodious, and economical steamer.

In the coming year, we fear, the shipbuilding trade must not be looked to for any great advances. So far as its probable extent is concerned, there is reason to apprehend depression, and in times of commercial and trade depression it would be vain to look for extraordinary enterprise. It appears likely that the scheme for transporting railway trains across Lake, Lucerne upon which Mr. Scott Russell is engaged, will be carried out, but we fear that little or no progress will be made with the similar scheme contemplated for the Straits of Dover. Nor do we find any ground for hoping that the wretched little steamers which now constitute our sole means of reaching the Continent will be replaced by better vessels, owing mainly, no doubt, to the harbour difficulties on the French side. In the Royal Navy, for which ships are continually being built, there is always room for progress, and there never was greater inducement to move forward than at present. What we hope to see during the coming year is the commencement, at least, of a combined broadside and turret ship of high speed, plated with at least 12-in. armour, and armed with the heaviest obtainable guns. Nothing short of this ought to satisfy the nation at a time like the present.

ORDNANCE.

WE find nothing very striking to record in gunnery matters during the past year. The guns have maintained their superiority over the targets, but this only by the aid of Major Palliser's chilled shot. The exception, perhaps, would be the American 15-inch cast-iron gun, which has been experimented with, and has put spherical shot through a considerable thickness of plating. But the vast superiority of this gun over our own remains yet to be developed. It is true that it has fired 100lb. of powder, but not many times yet. And upon this point, Admiral Farragut is reported to have said, "Ah! you may fire 100lb. of powder if you like—*we don't.*" It is satisfactory, however, to have tried this gun, but we have yet to learn its great practical value. The Fraser gun has been perfected, and is now being turned out at Woolwich, a very perfect piece. Major Palliser, too, has not been idle with his system of converting old cast-iron guns into useful rifled ordnance. The major is now engaged in some experiments with a converted gun, which, so far as they have gone, have given very good results. When these experiments are completed, we hope to place them before our readers. Mr. Parsons also is engaged in converting a cast-iron smooth bore into a rifled piece. This gentleman's system is in the main similar to that of Major Palliser; the details of the process of conversion, however, differ. From the success which attended the trials of a French gun converted on Mr. Parsons' plan, as well as from the soundness of the system itself, we anticipate good results.

As there is a great similarity between the systems of Mr. Parsons and Major Palliser, we suggest they should amalgamate and work out their ideas to perfection conjointly for the benefit of the country—taking care, of course, that they were benefited in return, But in the year before us, we think a fair opportunity should be given to each of those gentlemen to prove the value of his system of conversion. Let two guns of equal weight and calibre be converted upon the two systems under conditions as nearly equal as possible, each to the satisfaction of the inventor. Then let these guns be fairly tested, and the question as to which is the superior method of conversion would be set at rest, and one or other of the inventors need not trouble himself farther—in England, at least. But a still more important question, which should be pursued to a satisfactory conclusion during the coming year, is whether we want converted guns at all. They are like the converted rifles, very useful until we have a perfect weapon produced. They answer a certain purpose very well, but, at the most, are but a stopgap, and a makeshift. The converted guns, like the rifles, will always be found useful in one direction or other, but for general service we must have a sound reliable gun. The economy of the Fraser gun, and the simplicity and soundness of its construction, point it out at present as the gun of the future. The Mackay gun has been doing good work at Crosby, and although only roughly mounted on balks of timber, its performances were of a very high character. Mr. Mackay's gun should not be neglected; the Government ought to lend a helping hand to develope a system which evidently possesses great merit. We hope attention will be given to this gun by the authorities in the year before us.

ARMOUR.

THE great event of the year in the matter of defences has been the production of the largest armour plate ever rolled. Four years since the production of a 6-inch armour-plate was regarded as a great achievement. Four months since, however, an armour-plate 15in. thick, 20ft. long, 4ft. broad, and weighing 20 tons, was successfully rolled by John Brown & Co., of Sheffield. The production of this plate has had the effect of stopping the progress of the iron-clad fort system as at present designed with its 5-in. armour plating and two layers of 5-in. iron bars. This system of construction is of course far inferior to the solid, inasmuch as 8in. of built-up plates are not equal in resistance to 4½in. of solid. But such a system was necessary when no solid plate of the required thickness could be had. Now, however, there is no excuse for Government not using the best means of defence. Sir John Brown has met all the requirements of substance, and as the plate is now under test we shall no doubt soon hear that he has met those of quality as he always has done. The price will not be materially increased when large quantities are required, so that if the quality turn out well, there will be no reason why these plates should not be adopted in the fortifications of the future. At the same time we should not stop here, but carefully pursue the investigation of the principles which govern the resistance offered by armour-plates to projectiles. At the present time, Major Palliser's chilled shot and shell have turned the tide of victory in favour of the guns. To reverse this condition of things we must improve our armour-plates, not so much, however, by increasing their thickness; for however thick we can make a plate, we can always make a gun powerful enough to penetrate it with a proper projectile. We must bring science to bear upon the question, and try whether by a new combination of the component parts of the target, or by a peculiar arrangement of the fibres of the iron in the plate, we cannot stop out shot and shell without resorting to a thickness of metal which would virtually prohibit its application as a means of defence.

SMALL ARMS.

IN small arms we have to congratulate ourselves upon satisfactory progress in the armament of our troops with the Snider converted rifle. Although but a temporary step, this is one which enables us to keep pace somewhat with the times, and prepares our soldiers for a more perfect weapon. What this weapon is, or will be, the future alone

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can decide. We have had a grand trial of breech-loaders during the past year, which ended in the selection of nine rifles out of 112 sent in for competition. These nine are now undergoing further trial, and some day we shall know the results. It is by no means certain that any one of the nine will be adopted. If one is accepted, we shall hardly expect to see it adopted in its entirety. We want a light small-bore arm not less than half an inch, and to produce a simple and effective weapon, with a cartridge to correspond, should be work for the year before us to see done. During the past year the Spencer repeating rifle has been improved to meet the views of those who complain that it cannot be used as a breech-loader. By a simple stop the magazine can be shut off, and the rifle loaded at the breech. It thus combines double advantages, and is now a really useful and efficient weapon, and one we should much wish to see introduced as a cavalry arm. By doing this, and by giving the troops an insight into infantry drill, a splendid body of men would be at command. This was done in the American war, and great signal successes were the frequent results. But while we have been working on, perfecting our quick-firing arms, the master mind, whose invention set the whole of Europe on the alert to arm its troops efficiently, has ceased to conceive and execute. Herr von Dreyse, the inventor of the needle gun, has passed away. Among his later inventions, which promise to add fresh lustre to his name, is a grenade rifle, with which some Prussian fusileer regiments are shortly to be armed. The bullet, which is elongated, is filled with a charge of powder, which, on striking, explodes, and scatters the fragments several feet around. The physical and moral effects of this shell upon the enemy are expected to exceed all that has hitherto been achieved in this direction.

GAS ENGINEERING.

NUMEROUS details in gas apparatus have been improved during the past year, and various processes have been modified. Amongst the most recent and most useful introductions, we have to note the ingenious machine made by Messrs. Handyside, of Derby, for drawing and charging gas retorts. The object is to dispense with the laborious duty of charging and drawing gas retorts by manual labour. It consists of an iron carriage running on rails; three iron rakes and three long scoops are carried by frames made to traverse the main carriage in the direction of the retorts. The apparatus is fitted with a pair of vertical high pressure engines, and a boiler by which it is worked. When in operation the scoops are filled with coal through a hopper, and are then propelled to the extremities of the retort, when they are inverted, and the contents deposited in regular order within the retort. The rakes are also introduced in a similar manner, the flaps or rakers being horizontal until required for use, when they are lowered to a vertical position, the rakes being withdrawn and bringing with them the contents of the retorts. The scoops are then introduced with a fresh charge of coal, and the rakes are passed on to another group of retorts. The whole operation of drawing and charging a bench of nine retorts only occupies nine minutes, whilst by the ordinary system about three-quarters of an hour are required. This apparatus has been applied at the Chartered Gas Works with great success; it has also been adopted in Paris. Another practical improvement is Mr. Reid's revolving gas washer, which has been in use at the Leith Gas Works for more than two years. In this apparatus the gas passes through a horizontal instead of a vertical passage while being submitted to a copious shower of water. The principle, which works well, will be found described in detail in the MECHANICS' MAGAZINE for the 20th December last. There yet remain many points open to improvement, and there is a wide field open for the gas engineer in making good his gas holders and pipe joints against leakage. The production of gas is on the increase, and gas engineering becomes daily of greater importance. This may well be so when we reflect that between four and five million tons of coal are annually consumed in the production of gas. Attention therefore should undoubtedly be given to the utilization of other substances than coal for gas-producing purposes, so as to economize our coal supply as much as possible. We know that there are plenty of materials ready to hand for this purpose: they only await careful investigation and experiment to fit them for practical application.

ELECTRO-METALLURGY.

THIS comparatively new art is being gradually perfected, though slowly, as is usually the case with new applications of science to the arts. The year that has just passed cannot be said to have seen many new discoveries in it, but good progress has been made in perfecting old processes. The Paris Exhibition has shown some good specimens both of electro-casting and electro-coating, though we cannot say the best specimens that could have been shown. We think that Messrs. Elkington's warehouse in Birmingham can produce specimens of electro-cast bronzes surpassing anything that was shown in the Paris Exhibition, and also of electro-coating both in silver and gold. In electro-coppering of iron there have been two new processes published, or rather modifications of old processes; these have been noticed in the MECHANICS' MAGAZINE. Dr. Grazer's and M. Bernabe's are the processes here referred to, the former for their coatings only by immersion, and the latter for thin or thick at pleasure by electrolysis; of the latter we hear favourable reports: it is being extensively tested in France, in coating armour plates, and so far with the best results. Last year there was a process patented here for coating iron and steel with silver by Mr. J. Baines Thompson. His process was to coat the article first with a film of iron, by that means getting a pure surface to which the silver would easily adhere; but we understand that within the last six months he has superseded that process, and he now dispenses with the deposition of iron, and for iron substitutes other metals as preparatory coatings that have not before been so electro-deposited. Many difficulties also have been avoided by the improvement in the mechanical appliances. We cannot at present give details on account of space; but we purpose at some future time to give a full account of the processes and apparatus, with their various applications.

It is barely thirty years since the art of electro-metallurgy came into existence, and less than that since the Sheffield close plater described Elkington's then new process of silvering as "no'but a wesh" that "'u'd never do." He challenged the late Mr. Elkington to a test with his "silver wesh" spoons against the Sheffield close plated spoons, which Mr. Elkington readily accepted. Half a dozen of each were put on an iron tray, and subjected to a dull red heat. Of course the Sheffield spoons came out perfectly stripped, but the electro-plate spoons were in no way altered. On seeing this the Yorkshireman exclaimed, "I's bet," and straightway took a licence to work the new process. Since then, a bare quarter of a century, the progress of this art has been truly wonderful. Less than twenty-five years ago electrotyping was little more than an amusement when the most that was attempted was to copy a seal or a plaster medallion. Then the coating of a plaster statue was attempted; but the surface so produced was rough, and the thin coating of copper did not admit of polishing. Lastly, the deposition from within on a mould taken of a statue was accomplished, which produced a surface as fine as that of the statue, and the metal could be deposited of any thickness required.

In France cast-iron statues, fountains, and lamp-posts, have been electro-coppered; these things certainly look very well when coated, but we do not think that the process quite deserves to be classed with electro-metallurgy proper, the copper not being deposited directly on the metal castings, but the castings are first covered with a sort of cement or paint, the surface of which being made to conduct electricity.

These are but a few uses to which electro-metallurgy has been applied. Electro-gilding is extensively practised, and was used for gilding buttons in Birmingham before electro-plating was used, though both were discovered at the same time. Electrolysis is now also used for the reduction of copper ores.

It was proposed long ago by Mr. Weekes to reduce ores by dry electrolysis, but we believe it was never brought into actual practice. At present, we understand that Elkington and Mason have a process by wet electrolysis which they work in their smelting works in Wales, first roasting the ore, then dissolving the calx, and reducing it by a strong current of electricity. In electro-metallurgy we have now in use four branches—electro-gilding, plating, casting, and smelting, or reduction. In plating, there are silvering, coppering, and brassing; in casting, only silver and copper casting; and in smelting, or reduction of ores, only copper. The difficulties of depositing other metals have hitherto precluded their introduction into the arts, but we are year by year progressing, and difficulties are being constantly overcome, and new uses are being found for this art.

CHEMISTRY.

ON looking back over the records of chemistry for the past twelve months we do not find the period distinguished by any of those grand discoveries which have at times set a special mark on a year. No new element has been added to the already sufficiently long list of sixty-four, of which, so far as we know, the material world is made up. One, fluorine, which had probably never before been isolated, has, it is said, been obtained free from all combination; and another, vanadium, which Berzelius was supposed to have isolated, is now said to have been only seen in the form of an oxide. In both these cases, however, it may be said that further investigation is necessary to satisfactorily establish the results published. That fluorine should be a nearly colourless gas, possessing an irritating odour, and having the power of decomposing water and hydrochloric acid, and to appropriate the hydrogen, is in itself highly probable; and, before long, no doubt other chemists will confirm these statements. So likewise we may provisionally accept the statements of Dr. Roscoe as regards vanadium and its compounds, waiting, in the meantime, for the results of other investigators.

But although there is little to be said of advance in our knowledge of the elements themselves, much might be written of the progress made in our knowledge respecting the compounds which these elements are capable of forming. Modern research restricts itself mainly to an investigation of the compounds made up of only four elements—carbon, hydrogen, oxygen, and nitrogen; and too much praise cannot be given to those ingenious chemists who, by adroitly withdrawing an atom or molecule of an element, or a group of atoms from a compound, and introducing a different atom or group, produce new compounds, the number of which is already a source of perplexity to the chemist who wishes to keep pace with the times. On this subject we need not say more, but refer our readers to the researches of Berthelot on the Hydrocarbons, of MM. Caro and Griess on a Series of Bodies in which Hydrogen is replaced by Nitrogen, and of the recent papers of Mr. Perkin on the Artificial

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Formation of Coumarine, and of Dr. Hofman on Homologues of Prussic Acid, as marking a large advance in our knowledge of what is called organic chemistry.

In applied chemistry it can hardly be said that any strikingly grand discovery has been made. The researches of Mr. Abel on gun cotton have indeed brought that apparently unmanageable body under complete subjection, and we know now all its weaknesses as well as all its strength. It now only remains to determine how the force it is capable of developing can be best utilized for ballistic purposes; and of this also much has been learnt during the past year. The dreadful accident with nitro-glycerine at Newcastle excuses our reminding our readers that a means of rendering that body inexplosive was discovered in the past year. It consists in merely diluting the fluid with wood spirit; and how it came that so able a chemist as the late Mr. Mawson did not resort to this expedient before he attempted to get rid of the store at Newcastle must ever remain a mystery. His fate, however, will serve to impress the fact on any who may in future have the handling of such a dangerous compound.

For any and every technical application of chemistry that has appeared to us of value or interest we may confidently refer our readers to our pages, in which they will find them duly chronicled as soon as made known.

We cannot conclude this notice without a brief reference to the losses chemistry has sustained. First in the list of these must stand the name of the immortal Faraday. Although of late years he has been apt to say with a sigh that he knew nothing of chemistry, the science may fairly claim him for his early devotion to it. The discoveries, however, which constitute his chief fame have been made in another branch of science, to which reference is made in another paragraph; and only a fortunate technical application of benzole, which he discovered, reminds us of Faraday's early researches on coal tar. Dr. Thomas Richardson was better known as a writer on technical chemistry than as a worker in the science. He was, however, a very able practical chemist, and leaves behind a well-earned reputation. In Mr. R. Warington the science has lost another devoted follower, whose name will always be associated with the foundation of the Chemical Society, of which he may be said to have been the projector. Mr. Walter Crum and Mr. Mercer also will be long remembered for various discoveries in connection with the chemical treatment of textile fabrics.

We mentioned just now the general direction of chemical research in these days, one great result of which is the occasional discovery of means of forming artificially bodies which had hitherto been the production of living organisms alone. In this department we may look for still greater discoveries; and whether there be any difference in "vital force" and ordinary "physical force" or not, we do seem to gain daily a deeper and deeper insight into the mysterious operations of nature. It is the special office of chemistry to investigate and unfold these; and with the army of diligent experimenters now devoted to the science we may confidently expect that the year now opening will not close without adding yet grander conquests to the domain of Truth.

PHOTOGRAPHY.

DURING the past year prominent attention has been called to the fact, made known by the Paris Exhibition, that in portraiture English photographers have been in many instances excelled by foreigners. The photographs of M. Salomons, of Paris, created great excitement, his pictures exhibited at Paris and at the recent photographic display in Conduit-street, Regent-street, being superior to those shown by any other competitors. At the photographic societies the merits and demerits of his pictures have been rigidly canvassed. Some of them are not true photographs, but so "touched up," that half their beauties may be washed away by the application of a wet sponge. Others, of great beauty, have not been touched at all, and an examination of the negatives shows that nothing in the finished pictures did not exist in plates from which they were taken. The excellence of these remarkable portraits seems to be due to good lighting, good manipulation, tasteful accessories, and to great care in printing, parts of the negative being partially shaded from the action of light, to increase pictorial effect. The accessories, especially a large piece of velvet which comes out well in the camera, and is judiciously introduced in connection with many of the sitters, are carefully chosen, and the prints, when finished and mounted, are waxed, which increases their brilliancy. Perhaps minute attention to little details of this kind has much to do with the production of the beautiful results. At all events, a standard has been attained, which English photographers have yet to reach. In landscape photography at the exhibition, the English surpassed most nations, and were excelled by none.

The depression in trade, common to all branches of business, has been felt by photographers, and a portion of the decline has been attributed to the knowledge gradually spreading among the general public, that all the ordinary photographs on paper are not permanent. Nevertheless, although carbon pictures by Swan's process are now turned out in great numbers, and are supposed to be as permanent as the writings of the monks of old, who used carbon as the basis of many of their inks, the advantages of pictures so taken seem still to be little known beyond photographic circles. The Government of India recently spent much money in photographing the ancient temples of that empire, since these monuments are fast disappearing under the influences of climate, tropical vegetation, and the destructive agency of man. Little did the projectors of the work know that the records thus taken will probably all fade from view, quicker than the original temples themselves, although, undoubtedly, silver photographs of considerable permanence may be taken by scientific men who carefully conduct all the manipulations upon true chemical principles.

The carbon process has been brought to more perfection during the year. Some little improvement has also been made in processes for reproducing photographic pictures in the printing press by means of gelatine inks, and a new style of picture, called the "cabinet portrait," has to some extent been brought into fashion. With these exceptions, 1867 has witnessed little progress in photography. The principles of the science have, however, undergone rigid examination, and have been brought more into harmony with the discoveries of modern philosophers, in the field of molecular physics. After a photographic plate has been exposed in the camera no change in the collodionized film is visible, neither can the chemist detect any by analysis, yet on applying a developer out comes the picture. The mass of evidence resulting from the discoveries of Mayer, Tyndall, Thomson, Stewart, and others, that the atoms of all solid bodies are in a state of constant motion, has drawn much attention to the theory that the impact of waves of light upon a film of iodide of silver causes a motion of separation between the atom of iodine and the atom of silver, a result which accounts for many photographic phenomena hitherto inexplicable. Another discovery made this year is the true method of producing good films of chloride of silver in collodion, by the wet-plate photographic process. This salt in collodion requires such enormously strong baths and long immersion, that the right way to use it has naturally been long in discovery. The bath should contain one hundred grains of nitrate of silver to the ounce, and the plate must be immersed for about forty minutes to get a good film, suitable for exposure in the camera. A bath containing one hundred and fifty grains to the ounce is still better, and renders a shorter immersion necessary; but whatever the strength of the first bath, the plate must afterwards be placed a short time in a weak one to get covered with solution fit for the application of a developer. These chloride of silver plates are very slow, and in using them much care in cleaning the glass plates is unnecessary. Little else is at present known about them, as their properties are now undergoing investigation. During the year a few new lenses have been introduced, also a little new apparatus, but in photographic appliances there have been few novelties calling for special notice. The pantoscopic camera, a cleverly-designed piece of apparatus, constructed upon highly scientific principles, has not made such progress among photographers as it deserves.

In the coming year attention will probably be directed to the best method of generally supplying the public with permanent pictures. As a kind of forlorn hope, the plan of coating the present pictures with a varnish or transparent film, to protect them to some extent from the action of the atmosphere, has been tried, but excites little confidence, and time only can show the value of these improvements. The most delicate and beautiful pictures producible by photography are transparencies upon glass. These pictures, when carefully taken and cemented between two plates of glass with Canadian balsam, in the same manner that the lenses forming the object-glass of a telescope are united, are believed to be so permanent that they will last for centuries. The fragility of glass is one hindrance to the permanency of these pictures, but the smaller the photograph the less will it be liable to accidental breakage. Many of the public, if they can get great beauty and permanence in small photographs, will not object to extra expense, and it is possible that little gems of transparencies on glass, if introduced, would get a successful reception during the coming year.

METEOROLOGY.

THE history of meteorology during the past year is not without its interest. Notwithstanding the abolition of weather forecasts and of storm warnings, which constituted the immediate practical and useful duties of the Meteorological Office under its late chief, Admiral Fitzroy, the House of Commons voted a sum of £10,500, nearly three times the amount ever before voted in one year, to enable the committee of the Royal Society, under whose direction the office was placed in February, to commence their operations, without making any stipulation as to the resumption of storm warnings. These warnings have now been suspended more than a year; and it seems significant of the impolicy of this retrograde step that the list of wrecks and casualties in the British seas has nearly reached a total of 3,000 for the year just past, a number greatly exceeding that of any previous year. The weather has not been remarkably stormy in these latitudes; and, if the absence of the storm-warnings does not in some measure account for this serious and excessive waste of property and life, we should like to know what does. Shipowners, underwriters, officers, seamen, and fisher men have been clamorous for a renewal of the warnings. The press, eminent scientific men, learned societies, and an influential party in Parliament, have advocated the same measure. Nevertheless, the seafaring community are still without them. They are, however, promised, as has been officially announced by the Board of Trade, but we regret that the new warnings will not be nearly so complete as those previously given. One signal only, that of the "drum," is to be used, which will signify bad weather probable during the next thirty-six hours, for

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which time the signal is to be kept hoisted unless direction is given for a longer period. Places on the coast, accessible by telegraph, from which requisitions may be made for the warnings, will be supplied with the necessary signal shape and staff without charge, if the community is too poor to pay for them. For an object so decidedly national, because all are interested in the saving of life and property, the Government surely might undertake the entire cost, keeping a vigilant check on the officers responsible for the issue of the warnings, so as to improve the system and confine it to within bounds. Admiral Fitzroy's plan was thus national. In fact, it was at once simple and comprehensive, framed to effect indeed more than was needful, thus providing for greater success. We would have been content had his signals for polar and equatorial gales, the north and south "cones," been readopted. The drum, by which the direction of the coming gale cannot be announced, will thus give foreknowledge of only partial value.

That there are principles truly scientific from which the coming wind can be foreseen not only in strength but in direction also, and, consequently by which weather forecasts may be made, has been demonstrated by Mr. R. Strachan in a valuable investigation lately published. This is not the only scientific contribution to meteorology made during the past year. The Rev. C. Clouston has published a scientific explanation of the weather prognostics common to Scotland. These are hopeful indications of the future advance of meteorology in the direction of practical daily utility. The Meteorological Society of Scotland maintains its characteristic vigour. Not content with the success which has attended its efforts to elucidate the meteorology of Scotland, it is now pushing experiments and investigations abroad, and medical climatology is made an important feature. It has established stations in Palestine, Cyprus, Iceland, Feroe Islands, &c. Its quarterly journal also contains papers of much interest; and we should not omit from our record, that its secretary, Mr. A. Buchan, has this year given to the public a "Handy Book of Meteorology," in the right sense of the word. The British Meteorological Society cannot expect the same measure of praise. Its proceedings lack both in research and in interest. Indeed, we hardly know what it would do but for the labours of its present president, Mr. J. Glaisher, F.R.S., the veteran meteorologist. Mr. Symons, who has identified himself with the subject of rainfall, continues to do good service in rendering his statistics available for the use of hydraulic engineers, and for working out the problem of water supply, which must more and more engage the attention of the public, especially for our largest towns. The vast accumulation of statistics of rain renders the subject appalling. It is a most unpracticable one to investigate with a view to the induction of laws which will serve for future guidance and foresight. Such laws we believe will have to be sought for from very different data to that afforded by the amounts and durations of rain itself; and, at any rate, the Newton for the purpose is not yet apparent.

There can be no doubt that the future has much in store for meteorological progress. Much has yet to be done for the meteorology of the oceans, and of distant semi-civilized and uncivilized countries. This work must be looked for from our Meteorological Office, which we trust the House of Commons will be wise enough to continue to provide for as liberally as it has done this year. We presume the office, at the end of the first year of its new management, will report progress in a straightforward and truthful way.

CONCLUSION.

WE might greatly extend our already lengthy notice by reference to the progress of many other branches of the arts and manufactures. But we have taken those—indeed, we have been obliged to defer our remarks upon electricity and telegraphy until next week—which chiefly interest our readers, and have shown them what has been done, and, to a certain extent, have indicated what remains to be done in the future. One concluding suggestion, however, it occurs to us to offer, and that is, that the question of using petroleum as a fuel for generating steam under marine boilers should be practically solved. We have had several attempts to do this during the past year, but no very great successes. Field's principle, as applied to Cornish boilers, is perfection, and we believe it would prove equally successful if adapted to marine boilers. And this, notwithstanding the circumstance that the Americans have virtually given its application up as a bad job. The Secretary of the American Navy reports that after an elaborate series of experiments, the conclusion arrived at is that the convenience, comfort, health, and safety are against the use of petroleum in steam vessels. All we can say is, that they have not gone the right way to work to use it. Barff's petroleum furnace was recently tried in a small yacht, but under conditions that hindered its successful working. Richardson's petroleum furnace has been extinguished for some time past, and we doubt whether it will ever be relit in its present shape. Looking around us, we see progress slowly but surely going on in every direction, and although it may be retarded and hindered, it never can be stopped. In the year upon which we are now entering, the beauties and mysteries of science will be further developed and unfolded, and their practical application to the wants and requirements of the age further extended. Let us hope for better times, that the high aim of science—usefulness—may be freely developed, and that science itself may be advantageously applied to the practical arts and manufactures, for the advancement of knowledge and the benefit of mankind.

COMPETITIVE GUN CARRIAGE TRIALS.

THE return of the "Minotaur" to Portsmouth from her lengthened cruise offers a favourable opportunity for noticing the experimental trials that have been made on board with gun training gear. That other than the ordinary mechanical appliances for working guns were required to control the movements of modern heavy broadside guns was soon discovered when 6¼ and 12-ton guns were mounted on the broadside, and the question arose as to the best method of applying improved mechanical power for this purpose. Two gentlemen, Mr. Cunningham (of patent topsail fame) and Captain R. Scott, R.N., with the sanction of the Admiralty, entered the lists in friendly rivalry to attain this object, and the plans of both have since been fully and fairly tested. Mr. Cunningham appears to have been the first who went thoroughly into the matter, as 1862 in he carried out a series of experiments on board the gunnery ship "Excellent" with a compressor, in which he introduced the principle of large friction surfaces to check the gun's recoil, in lieu of the the old-fashioned claw and riband arrangement, and this compressor was worked for some time very successfully with the breech-loading 110-pounder Armstrong. In the same year he took out a patent for sundry methods for working heavy guns, including an endless chain for running guns in and out, the chain revolving on the slide and connected with four compressors or nippers on the carriage. Captain Scott, too, soon afterwards brought out a somewhat similar plan. The four 12-ton guns mounted on the main deck of the "Minotaur" may be looked upon as competitive guns during the last cruise of the ship, they have been fitted experimentally with different descriptions of training gear, &c.

The after 12-ton gun on the port side of the deck is fitted with Mr. Cunningham's combined running in and out and traversing gear. The plan is very simple and works the gun most efficiently. Upon the rear end of the slide is fixed a winch furnished with chain and clutch wheels. Upon the traversing bolt on the slide are blocks, with single traversing chains leading through them. When the gun has to be run in the chains are put on the clutch wheels, which being turned round by the winch handle and back and pinion wheels, draws the gun and its carriage up the slide. To change again to traversing gear, the running-in chains are thrown off and the traversing chains put into the clutch wheels. Nothing can apparently exceed the extreme simplicity of this plan, and together with that is the important advantage that it can be fitted on board a ship, thus avoiding the expense and delay of sending the carriage and slide ashore to a factory. This gun was fitted by Mr. Cunningham when the "Minotaur" was lying at Spithead, previous to sailing on her cruise last spring, in less than an hour's time. When Admiral Farragut visited the "Minotaur" at Lisbon, he greatly admired this plan for traversing and running in and out heavy ordnance when mounted on a ship's broadside.

The other 12-ton gun on the port side of the "Minotaur's" deck is also fitted with gear designed by Mr. Cunningham---a detached traversing gear; that is, with the motive power detached and separate from the carriage, a form of traverse held by many experienced gunners to be best of all, as it leaves the gun quite clear. The men in using this gear are kept quite away from the gun, and are, in a great measure, out of harm's way when a shot chances to enter the port. The crew of this gun speak very highly of its traversing gear, and profess to have beaten all the other guns with it in point of time in traversing. Mr. Cunningham fitted this gear to the gun nearly three years since, and it remains now in perfect working order. The running in and out provisions of the gun are on the endless chain principle, as applied by Captain Scott, and are of a very efficient character. The traversing arrangements of the two 12-ton guns on the starboard side of the ship's deck is on Captain Scott's plan, and is markedly different from the plan followed by Mr. Cunningham.

Captain Scott traverses his two guns by means of massive toothed and curved metal castings fixed to the deck, on which a bevil wheel upon a spindle on the slide works. On the foremost of the two guns the crank handle which turns the spindle is at the rear of the slide. With the aftermost gun the crank handle is fixed at the side, the motion being conveyed by an endless screw. Both these guns are run in and out by endless chains fitted on Captain Scott's plan. It will be at once seen that Captain Scott's arrangements for traversing his guns are much more perfect as pieces of machinery than those of Mr. Cunningham. There is, perhaps, a trifle too much of engineering skill bestowed upon them. Mr. Cunningham appears to have based all his arrangements upon simplicity and the use of the smallest possible number of working parts. In this he has been eminently successful. There is nothing in any part of the fittings but what can be applied, changed, or repaired by an ordinary ship's smith or armourer and at once understood by the seaman. In addition to the evident superiority of the Cunningham over the Scott method of traversing and running in and out of the guns in point of simplicity, it has also the advantage in point of cost; the Cunningham gear, it being understood, can be fitted to a gun for £30, whereas the Scott gear would cost between £200, and £300. According to the "Times," from which paper we take the foregoing particulars, the tests to which the gear of all four guns have been submitted on board the "Minotaur" have been of a very severe character, a large number of rounds having been fired from each with heavy service charges, and under all conditions of sea and weather.

SOCIETY OF ENGINEERS.

AT a meeting of the Society of Engineers, held December 16, 1867, W. H. Le Feuvre, Esq., in the chair, the following paper on "The most Recent Improvements on the Injector," by Mr. James Gresham, was read. The growing importance and increased application of the injector, render it unnecessary to apologize for reintroducing the subject before this Society. The complete and admirable paper of Mr. Lewis Olrick, read at a meeting here some two years ago, pointed out with clearness and force the action of the apparatus, and gave a succinct account of the modus operandi of the instrument. The value of Mr. Olrick's paper was considerably enhanced by a series of elaborate and precise mathematical formulæ. The treatment of the injector in this paper will be from an eminently practical point of view, and such knowledge and information as the writer has gained from long and active experience in working the injector, as well as a thorough knowledge of the experiments that have, from time to time, been found necessary for its further improvement, will now be laid before this Society, and the writer may be considered fortunate if, after a description of, and reference to, the models and drawings, he shall have removed a little of the prejudice which is inseparable from a new invention. Since the introduction of the injector into England, it has been the object of those interested in its success to obviate and overcome, step by step, the difficulties that were originally found attendant upon its working, by watching its performance over thousands of miles of railway, under every variety of circumstance, and by careful observance of its working, and numerous

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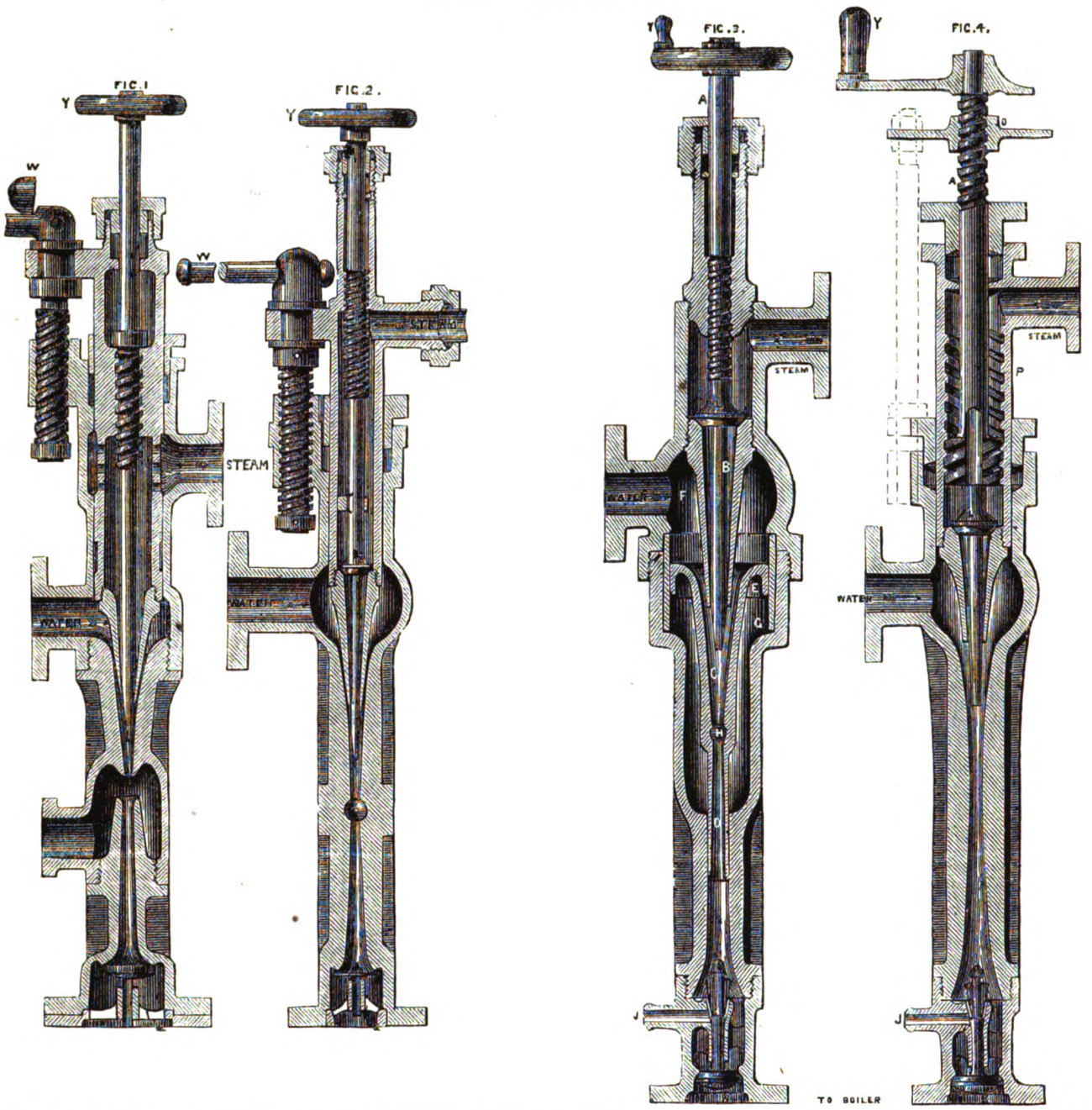
SOCIETY OF ENGINEERS.



experiments on stationary as well as locomotive boilers, many improvements have been made, resulting in its present advanced state. The great objection raised by a driver to the use of the injector, when first applied to his engine, after his long use of the pumps, is the number of handles he has to manipulate at starting the injector, all of which must be open and closed in their proper order to secure the efficient working of the instrument; and though the increased labour may at first seem but a trivial objection, those experienced upon the "foot-plate" will admit that it is a valid one, remembering the number of claims already on the driver's attention, which, by the original form of Giffard's injector, is increased by at least four necessary and distinct operations to be performed, as well as a no less important caution to be noted, as will be seen from the "method of working" issued by the makers.

The method of working, as taken from the printed instructions, is as follows:—First, turn the wheel or handle W to the position suited to the steam pressure in the boiler, the higher the pressure of steam requiring the greater opening. Second, open the cock on the steam pipe. Third, turn slightly the wheel or handle V, which will admit a small quantity of steam to the apparatus, until water is seen to issue from the overflow pipe. Fourth, as soon as this happens, continue to turn upwards the wheel or handle V until the overflow ceases, and thus give full liberty to the steam to act upon the water, and drive it into the boiler through the delivery pipe. If, however, after having turned the wheel or handle V to the extent of its range, the overflow still continues, it should be stopped by reducing the quantity of water by the wheel or handle W. The injector is working properly when there is no discharge from the overflow pipe, and no more steam is admitted than is absolutely necessary to pre ent that discharge. N.B.—The jamming down of the wheel or handles V and W should be avoided. The instrument is purposely neither made steam nor water tight, and when stopped the steam and water must both be shut off by the cocks.

This is certainly formidable, and one of the objects sought by the improvement about to be described is to remove the greater part of this manipulation at starting, while at the same time securing a more efficient and durable instrument, with nothing in the constructive detail that can fail, except through actual wear or tear. It has been found that more failures in the working of the injector have been traced to the burning or wearing away of the packing than to all other sources combined; and in the late improvements it has been determined to remove all the internal packing that cannot be reached from the outside. The adjusting of the injector to the various steam pressures has been reduced to one operation, or rather, the adjusting of the exact proportion of water to steam, for the various pressures, hitherto accomplished by two separate and distinct handles, has been arranged to be accomplished by one handle alone.

Fig. 1 in our engraving shows an injector as constructed by the original inventor, M. Giffard, with a separate adjustment for both water ans steam, to which applies the instructions for working previously quoted. It will be apparent that some considerable experience, only to be obtained by practice in the working of the injector, mud be needed before an ordinary fireman would be able to turn the handle W to the position suited to the steam pressure in the boiler, seeing that no further instructions can be given than "the higher the pressure of steam requiring the greater opening." It has been attempted to index these injectors for the various pressures, but without success, as the position of the water regulator not only varies for every different steam pressure, but also varies considerably for the same pressure, owing to the change of temperature of the water supply, and the height it may have to be lifted. It is to be attributed entirely to the amount of manipulation and attention required to adjust the injector to work properly at the different steam pressures, that on boilers with irregular work to perform, and having only small steam and water space, as compared with the heating surface, we see the injector constantly losing hot water at the overflow pipe, or, as some drivers call it, "working sick." This frequently occurs, and is a great objection as well as loss. Another disadvantage in the original form of injectors is the "whip-cord" packing on the ram X.

The objections to this internal packing are fatal, especially when an injector has to lift its supply-water from a considerable depth; for it will be

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seen, on reference to the drawing, that it is by the fit of the ram in the body of the apparatus, and this packing alone, that the steam is prevented passing direct from the steam-pipe to the water-chamber, where the vacuum is formed to lift the supply-water for starting the injector; and it will be apparent that unless this packing is perfectly steam-tight, no such vacuum can be created. The frequent failures of this injector, when used for stationary boilers, where the supply water has been considerably below the level of the boiler-house, has long ago led to its abandonment, and the adoption of another form of injector, with a fixed partition between the steam and water cones, designed by the writer and Mr. Robinson. The original injector also fails upon locomotives from the same cause producing a different effect—that is, when the packing on the ram gets worn, which is soon the case if the driver only adjusts his injector as often as he should do. The steam passes direct into the water-chamber, and mixes with the supply-water before it enters the combining cone; and supposing the water in the tender to have been heated some 130 deg., say, whilst waiting at the station, the steam leaking past the packing on the ram will soon raise the temperature of the water enough to make the injector uncertain in its working, or stop altogether. Many drivers, finding out this, have given up adjusting their injectors, to save the trouble of frequent packing, and let the ram get fast in its place, preferring the lesser evil, viz., the occasional loss of hot water at the overflow pipe, from non-adjustment to the various pressures, rather than have the uncertainty of the injector working at all when the packing becomes inefficient.

Fig. 2 is intended to show one of the ways in which the difficulty of packing the ram has been overcome with the least possible alteration of the original form of the injector: for, notwithstanding all that has been adduced against this arrangement, a vast number are in use. The dispensing with packing is accomplished after this manner:—In attaching the injector to the boiler, care is taken to have the steam pipe sufficiently long; that it shall have the requisite elasticity to admit of its moving at the end attached to the injector—say in the case of a locomotive 1½in.; this requires the pipe only to move ¾in. up or down from a straight line—and those conversant with the bending of brass and copper pipes, will know that pipes of any considerable length are seldom bent nearer than ¾in. to their required positions when fixed, and that their elasticity readily admits of bringing them home to the desired place. Advantage has been taken of this to attach the steam pipe direct upon the moving ram itself, placing it beyond all possibility for the steam to pass into the injector at any but the right point. Experience has proved that the steam pipes for injectors at present in use on locomotive and other engines, are considerably larger in diameter than is requisite for the efficient working of the apparatus; and several large firms and railway companies are now fitting their injectors with steam pipes in the proportion of ⅛in. to the millimetre, equal to 1in. pipe for a No. 8 injector; in fact, some No. 8 injectors are working at the present time with ¾in. steam pipes, or about 1-5th the area given by M. Giffard. This may seem strange at first, but we may be helped to believe it when a locomotive engine on one of the principal lines can be pointed out in which all the steam for the cylinders was made to pass through a 1in. pipe about 1-20th of the usual area. When the steam pipe is of necessity very short, a coil is made in it, after the manner of Allen's patent tender-pipe coupling. Another improvement claimed for this injector, is the impossibility of steam blowing through it when not at work—a circumstance which happens under the original form of injector at nearly every station where a locomotive engine stands any length of time. This blowing of steam is prevented by the conical valve L on the steam spindle shutting down firmly on its seating at the base of the steam cone, and by the removal of the packing from the ram.

Figs. 3 and 4 show two different methods of reducing the adjustment of the injector to the various conditions under which it may have to start working to one single operation. Fig. 3 represents an injector with the water supply self-regulating, the inventions of Mr. William Sellers, of Philadelphia, U.S., and is certainly the most elegant improvement that has been made upon the injector since it left the hands of the original inventor. The arrangements to enable this apparatus to dispense with internal packing, and to be started by means of one operation, are the invention of the writer. One handle, marked V, regulates the steam supply, any increase or decrease of which will cause a corresponding increase or decrease in the water delivery. This self-regulation of the water supply is obtained by the alternate action of a pressure or vacuum, as the case may be, upon a piston attached to the water or combining cone, and working in a cylinder formed by the body of the injector. Referring to fig. 3, A is the steam regulating spindle, B is the steam cone, C is the water or combining cone, D is the receiving cone, E is the piston attached to the water or combining cone C, and separating the water chamber F from the air-tight chamber G; H is a hole forming a space between the combining cone C, and the receiving cone D, and communicating with the air-tight chamber G; J is a valve for allowing the steam and water to pass into the atmosphere at starting; K is the foot valve to prevent the return of water from the boiler when the injector is not working.

In starting the injector—supposing it to be in communication with both steam and water—it simply requires the spindle A opening, say, a quarter turn, until water is seen to issue through the waste valve J, then to continue opening up the spindle until this valve closes, which will take place immediately the relative proportion between the water and steam has been established. This regulation is obtained by the rising or falling of the piston E, thus increasing or diminishing the annular space between the steam cone B, and the water or combining cone C. Supposing more water is admitted between the annular space than is requisite for the proper formation of the jet, part of the surplus escapes through the hole H into the air-tight chamber G, and raises the piston E, reducing the quantity of water admitted until it is in the right proportion to the volume of steam. The piston will then remain stationary until some change takes place in the pressure of the steam, or pressure of the supply-water. If the pressure of the steam diminishes, more water will be driven into the air-tight chamber, and the piston will continue to rise so long as the pressure of the steam continues to diminish; if, on the contrary, the steam pressure increases, it will require more water to condense it, and the increased velocity of the jet will carry along with it a portion of the water from the air-tight chamber, creating a vacuum therein; then the pressure of the atmosphere on the water in the supply tank will cause the piston to fall, and admit more water around the steam cone, until the exact proportion of steam and water be again established. The action of this injector is shown very clearly by the sectional model.

It will be seen that the lower end of the steam spindle A is made hollow. This arrangement enables the injector to lift its supply water with certainty from depths below that at which it is convenient to place the apparatus itself. By giving the steam spindle a quarter turn, it elevates the conical valve T a short distance from its seat, and the steam is allowed to pass down the centre of the spindle in the requisite volume, and at a high velocity, carrying along with it the air existing in the water chamber G, and cones C and D, passing out into the atmosphere at the waste valve J, creating a much greater vacuum than can be produced by allowing the steam to pass round the end of the spindle, as is the case when the injector commenced to work. There may be a slight disadvantage in using the self-adjuster where the temperature of the supply-water is high, owing to there being no overflow pipe to allow of any surplus water escaping after the jet has been established. This is felt when the supply water has reached a temperature at which it requires more water to condense the steam than can be carried along with the jet into the boiler. Under these circumstances the injector would be difficult to start, and when started liable to stop, owing to the surplus water finding its way into the air-tight chamber, thereby forcing up the piston and shutting off the supply-water altogether. This drawback is overcome by one of the modifications about to be described.

Fig. 4 shows an injector in which the relative proportions of water and steam are regulated, or adjusted, by means of one and the same handle. The double adjustment is accomplished by means of two screws of different pitch upon the steam spindle A, one screw working in a fixed nut O, and the other working in a movable nut cut upon the sliding ram P, thus producing a differential motion, causing the spindle to rise, and the steam cone to fall. The manipulation in starting this injector to work is exactly the same as for starting the "self-adjuster," previously described, viz.: Open the steam spindle A one quarter of a turn, wait until water is seen to flow from the waste valve, then continue to open the steam spindle until this valve closes, which will take place immediately the relative proportions of water to steam have been established. Its action may be thus described:—By giving the spindle the requisite part of a turn, the supply is lifted in precisely the same manner as by the self-adjuster; then, by continuing to turn up the steam spindle, the free volume of steam for working the injector is allowed to pass. At the moment this occurs there will be more supply of water than is required for condensing the steam, the surplus passing out at the water valve J, but the continued upward movement of the spindle causes the steam cone to approach the water cone, reducing the supply water to the extent required to condense the steam. This point is indicated by the instant closing of the waste valve J, showing that the jet is established, and passing into the boiler through the foot-valve K, it being impossible for the waste valve to close until the foot-valve is opened by the passing of the jet into the boiler; therefore it will be seen that these two valves are combined, the action of the one being dependent upon the action of the other.

When the injector is stopped working the positive action of the foot-valve K is secured, by making it act like a piston as well as a valve. This is accomplished by causing it to lift some distance from its seat before there is space for the fluid to pass; then in closing to shut off the passage for the fluid some distance before reaching its seat, the action changing into that of a piston in a cylinder. By this means the requisite amount of power is obtained for lifting the waste valve from its seat, and thereby giving the required opening to the atmosphere for again starting the injector. The area of the waste valve J must not be more than 1·4 times the receiving cone D, otherwise the pressure exerted by the injector would be reduced to such an extent that it would not be able to open the foot valve into the boiler. The advantages claimed for this injector over that of the "self-adjuster" are due to its being able to work with an open overflow or waste pipe. This empowers it to take its supply water some considerable number of degrees hotter than can be taken by the "self-adjuster." Another advantage of the open overflow is the peculiar singing noise made by the jet passing through the atmosphere, telling by the sound when the apparatus is working properly. Many drivers look upon this as a great desideratum. The open overflow arrangement is shown by the sectional model. The conical valve L on the steam spindle is considered a better way for shutting off the steam than allowing the spindle to fit in the apex of the steam cone, and might be applied advantageously to every form of injector, preventing the possibility of bursting the cones by jamming down the spindle. The injectors shown in Figs. 3 and 4 give an increased delivery in gallons per hour of 35 to 40 per cent. over Giffard's original calculations. This is owing undoubtedly to the improved proportions and the entire exclusion of the atmosphere attained by the use of the self-acting valve.

SURGICAL PNEUMATICS.

THE importance of preventing atmospheric air from being in contact with sores and wounds is now generally recognized, and the ingenuity of surgeons is now directed towards contriving means for effecting this desirable end. Dr. Guerin has communicated to the Academy of Medicine the description of an apparatus by means of which pneumatic occlusion, as it is called, may be extended simultaneously to all the patients confined in the same surgical ward. We read in "Galignani" that it consists of a hemispherical balloon provided with three tubulatures; the central one, which is larger than the rest, is fitted with a manometer, consisting of a barometrical tube ending in an india-rubber bag, and filled with mercury. The bag is enclosed in the balloon, so that in proportion to the vacuum effected in the latter, the former is dilated, in consequence of which the mercury in the tube falls, a scale showing the amount of the fall, and hence also the degree of rarefaction in the balloon. The second tubulature receives a tube communicating with the receiver of an air-pump, and by the third a communication is effected between the balloon and each bed by means of india-rubber tubes so arranged that the secretions from the sore or wound of each patient are kept separate for further examination. There are stop-cocks for regulating the degree of vacuum in the central vessel, and the part under treatment in the case of each patient is covered with a sort of india-rubber hood, which effectually protects it in each case from the action of the external air.

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APPARATUS FOR BURNING HYDROCARBON OILS.

FIG. 1.

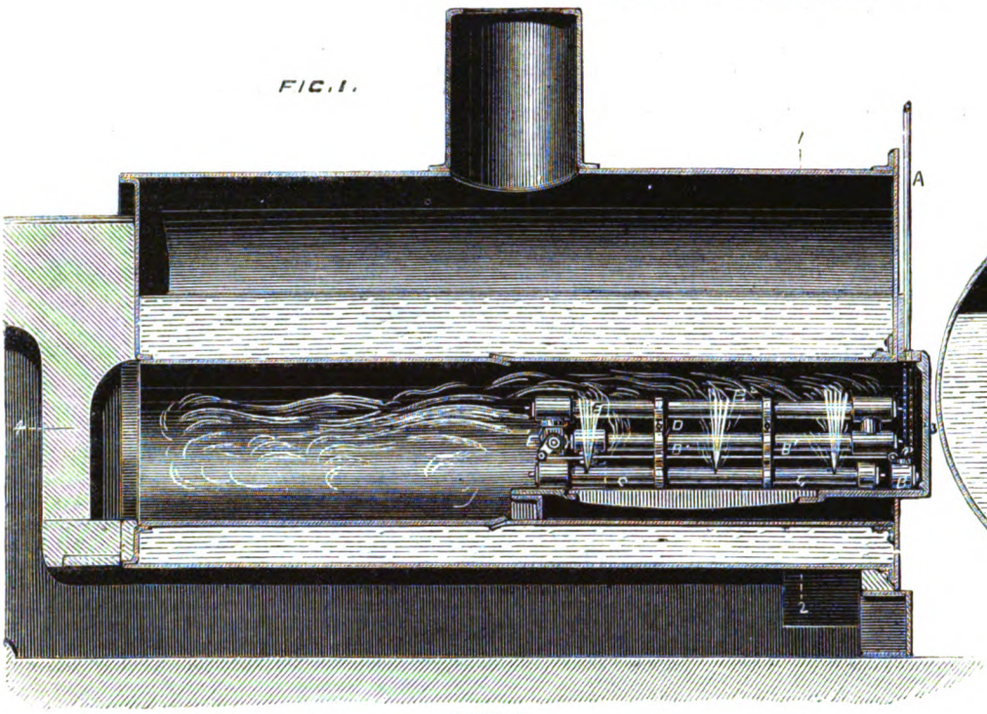


FIG. 2.

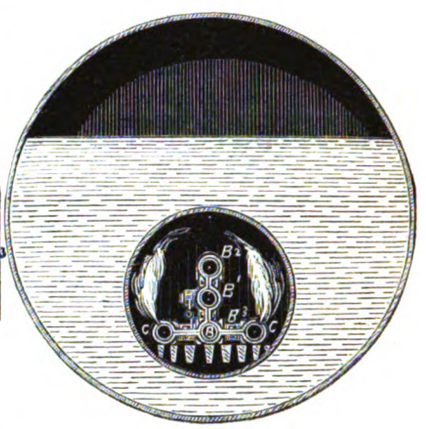


FIG. 3.

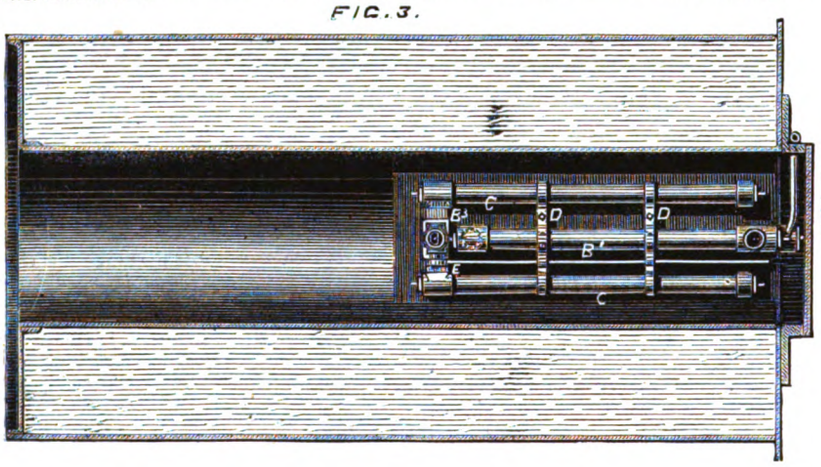
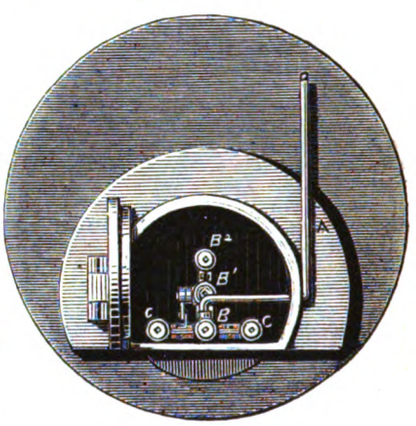


FIG. 4.



APPARATUS FOR BURNING HYDROCARBON OILS.

THE desirability of using petroleum and kindred oils as a fuel for steam purposes is evidenced by the many attempts to utilize them for that purpose. Amongst the most recent inventions in this direction is that of Mr. Thomas Crow, of West Ham, who has patented an apparatus for economically burning hydrocarbon oils. This apparatus consists of a vaporizer and burner in which a constant but regulated supply of hydrocarbon oil is maintained for the purpose of being converted into vapour and superheated, and in its superheated state consumed at the burner. The form of the apparatus varies according to its application, whether used for heating or lighting, but the principle of construction and action are the same. The supply of oil is continuous, and at a pressure due to the elevation of the oil reservoir. The passages for the escape of the vapour to or its discharge from the burner are so proportioned as to produce a back pressure in the vaporizer, and the heating surface and capacity of the vaporizer and burner are such as to admit of the whole of the vapour generated being superheated before it passes off to be consumed.

In our engraving we have shown the invention as applied to the fireplace of a horizontal cylindrical boiler. Fig. 1 is a longitudinal section taken through the centre of the boiler, and showing the apparatus in side elevation; fig. 2 is a cross section taken in the line 1 2 of fig. 1; fig. 3 is a sectional plan taken in the line 3 4 of fig. 1; and fig. 4 is a front view of the boiler with the fire-door open, showing the apparatus in front elevation. The fire-bars are used to receive the apparatus, which consists of a number of metal pipes coupled together, and so arranged as to require no further support. In this instance, as the fireplace is long and contracted laterally, the apparatus is elongated, and takes a kind of pyramidal form in end elevation, but in a fireplace circular in plan the apparatus takes the form of concentric rings or coils, the flame from the burner being so directed as to heat the pipes forming the vaporizer without impinging upon them, and thereby effect the generation and superheating of the vapour.

A is a pipe leading from an oil reservoir, and used to conduct down a supply of oil to a horizontal pipe B, with one end of which it is connected by a union joint. The opposite end of this pipe B is connected by a union joint with a second pipe B^1, which overlies the pipe B, and in like manner this pipe at its opposite end is connected to a third pipe B^2 placed above it and parallel thereto. From this pipe B^2 depends a junction which connects with a short transverse pipe B^3; this pipe is formed with sockets to receive the ends of two horizontal pipes C C, which are pierced with a row of fine holes, and constitute the gas burner. These pipes are braced together by means of clips D D, which are held fast by bolts and nuts, as shown at figs. 1 and 2, and to facilitate the cleaning of the pipes their ends are fitted with removable plugs. For cutting off the supply of gas to the burner a stop-cock E is provided. The apparatus requires in starting to be heated externally by the application of fuel. The oil is introduced by bringing the apparatus through the opening of a tap in the pipe A into communication with the supply cistern. The oil will then immediately upon its entrance be converted into vapour by the heat. The vapour so formed completes its circulation under pressure through the apparatus. As the vapour thus passes through the apparatus it is brought to a very high temperature, and is converted into permanent gas. The generation of the vapour is continuous, and the escape of the vapour at the entrance for admitting the oil from the supply pipe of the oil vessel is prevented by the pressure of the oil, and the escape of the vapour at its exit openings is partially obstructed by the smallness of the apertures through which it is discharged. An accumulation of vapour is thus kept up within the apparatus, whereby the pressure and the circulation is produced. The gas thus formed passes out from the burners C C, which are so placed in relation to the generator that the flame of the burners will supply the requisite heat to the vapour generating apparatus, while at the same time the heat for raising the required steam pressure will be imparted to the boiler. In order to steady the flame and diminish to any extent desired the intensity of the blast which the pressure imparts to the flame, a perforated disc or plug of iron is fixed in the end of the generator, as at F, fig. 1, which will act as a throttle or pressure check, or the cock E may be used for the same purpose.

This furnace has been used to do the regular work of Mr. Crow's factory, to the exclusion of coals, for the last eight months, and is also in regular use in several other establishments. Some experiments of the evaporating power of tar oil (creosote), made under Mr. Crow's direction, show 18·91lb. of water evaporated for 1lb. of oil burnt. One firm, who have had the furnace in use for the last five months, state that "the cost of the fuel is little more than one-third that of coal." An estimate of quantity, made by this firm, give results:—85 gallons of oil (10·5lb. to the gallon), *i.e.*, 8 cwts. of oil, did the work of 1 ton 2 cwt. 3 qrs. coal. Mr. Goddard, of Ipswich, says, speaking of Mr. Crow's furnace in a recent lecture on "Coal and its Products," "My experience with it shows that one ton of creosote will do the work of three tons of coal, as fuel." We may add that the flame from creosote burned in this apparatus is perfectly smokeless. The oil is difficult to light instantly, extinguishing a lighted match, when dipped into it, even if the temperature of the oil is raised to 140 deg. Fah., or in some qualities to a still higher temperature. The boiling point of the oil is about 500 deg. to 700 deg. The economy is apparent from the fact that the present price of the oil is almost *nil*—say 10s. per ton, when bought in large quantities. Shale oil, petroleum, paraffin, or any other hydrocarbon, would be equally available, but no other oil has yielded the same amount of heat in this furnace, or can be bought at so low a price.

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THE NEW RAILWAYS AT BATTERSEA*.

By Mr. C. D. Fox, M. Inst., C.E.

THE system of railways, designed by Sir Charles Fox, M. Inst. C.E., in the year 1862, for the purpose of improving the access to the Victoria Station, by providing additional lines, and avoiding the sharp curves and steep gradients of the then existing railways, comprised:—the widening of the Victoria Station and Pimlico Railway, and of the Victoria-bridge over the Thames; the high level line from the south end of the Victoria-bridge to near Clapham Junction, with a branch to the Wandsworth-road; the diversion and raising of the West End and Crystal Palace, and West London Extension Railways, the Longhedge Junction, and the two low level lines from the Victoria-bridge to Stewart's-lane; and the connecting link between the London and South Western, and the London, Chatham and Dover systems at Clapham Junction. In widening the Victoria Station and Pimlico Railway, the chief work was the removal of the retaining wall from one side of the existing line,—an operation of some difficulty, from the excellent character of the concrete and brickwork originally used, as on account of trains so frequently passing, blasting could not be employed. A girder bridge was successfully substituted in place of an arch over the line, by cutting away a narrow strip of the arch, and inserting one girder at a time.

It was originally intended to construct an independent bridge over the river Thames, to carry three lines of way for the London, Chatham and Dover traffic; but it having been determined to add, at the same time, a third line for the London, Brighton and South Coast Railway Company, it became necessary to make arrangements for joining up the new work with the Victoria-bridge. The new bridge, in common with the original one, consisted of four river spans, of 175ft. each, having arched ribs, with a rise of 17ft. 6in., and of two land openings, carried by plate girders, one of 70ft., the other of 65ft. span. Its width, from the outside of the original bridge to the parapet, was 100ft., giving, with the old work, one structure 132ft. 6in. wide between the parapets. The total length of the piers and abutments just below the springing was 158ft. The excavations of the abutments were got out by means of coffer-dams, the enclosed area being afterwards covered with cement concrete, 3ft. in thickness, then with brickwork in cement, also 3ft. in thickness, surmounted by outside and cross walls of brick in cement, the pockets being filled with lime concrete. In consequence of the proximity of the original bridge, it was impossible to drive the coffer-dams so as to include the whole of the work, and a portion of the face was therefore carried on strong cast-iron girders, put in at low-water mark, resting at one end on the old, and at the other on the new work. By the use of cement, and the care taken to keep the joints thin, the abutments, though bonded up with the old work, had not shown the least sign of movement. The foundations of each pier were carried down by means of four cast-iron cylinders, each 21ft. internal diameter; temporary wrought-iron cylinders, 19ft. in diameter, being used for the top. About 100 tons of kentledge were used in sinking them; this was laid upon stages slung within the cylinders, as being less liable to tilt them than when placed outside, and more easily thrown off when the requisite depth was reached. The cylinders were all sunk to an average depth of 45ft. below Trinity high-water mark, of which 13ft. were into the London clay, the total time occupied in sinking being on an average eight days. The cylinders were filled with cement concrete for a depth of 12ft., and then with brick in cement up to low-water mark. The brickwork was then tested, and afterwards the masonry was commenced. The stonework face, between the cylinders and forming the connection between the old and the new work, was carried on strong cast-iron framework.

The superstructure of each of the river spans was precisely the same, and consisted of eight main ribs, with provision for a ninth. Of these, the rib nearest the existing bridge was only one-half the strength of the others, which were each calculated to carry a single line of way. These arched ribs were of wrought iron, 3ft. 4in. deep, and the flanges were 18in. wide; but for 38ft. in the centre of the span they merged into one with the horizontal girders, thus giving a total depth at the centre of 4ft. 6in. The flanges of the ribs gradually diminished from a thickness of 3in. at the centre to 1½in. at the springing, the webs being of plates three-quarters of an inch thick throughout. The sectional area of the rib at the centre was 166·9 square inches, or deducting rivets, 142·5 square inches; the sectional area of the rib at the springing was 102·4 and 86·5 square inches respectively. The horizontal girder was 4ft. 6in. deep with flanges 18in. wide, and was continuous throughout, the whole bridge being riveted up for a length of 913ft. It was firmly connected with the cast-iron standards at the piers and abutments, in order to obtain the full advantage of continuity for the land spans, and was anchored by a plate running from the top flange down to the cast-iron skew back. The main ribs were braced by transverse girders and by vertical diagonal bracing; the four middle ribs being further cross-braced horizontally.

The calculations of the strains, from which the superstructure was designed, led the author to the conclusion that, whilst cast iron was the best material for arched bridges of single spans, similar bridges of several spans, having piers whose perfect stability under horizontal stress could not be relied on, were, under certain circumstances, exposed to tensile strains which rendered the use of wrought iron most desirable. The bridge was severely tested on several occasions by Major Rich, R.E., on behalf of the Board of Trade. Each rib, where practicable, with the exception of those adjoining the original bridge, was tested with eight of the heaviest locomotives and tenders, weighing 360 tons, or thereabouts, which were allowed to stand on, and also to run over at speed; and the whole structure was then tested with twelve locomotives and tenders, weighing 530 tons or thereabouts. The ribs deflected uniformly, when fully loaded, to the extent of seven-eighths of an inch at the centre; the corresponding ribs in the adjacent spans at the same time showing a rise of one-eighth of an inch at the centre. The girders over the land spans, when fully loaded, showed a deflection in the centre of half an inch. The cross-girders, when a pair of driving wheels rested exactly upon them, showed a deflection in the centre of three-eighths of an inch. The permanent set in each case was scarcely appreciable. Careful observations had been made for nine months as to the effect of changes of temperature upon the structure. This effect was limited to a rise and fall of the crown of the arches, amounting to a maximum of 1½in., and a movement at the free ends of the land arch girders of eleven-sixteenths of an inch. The total cost of the bridge, including the land spans, had been £245,000, which was equal to about £2 13s. per superficial foot of space covered, or about £38 per lineal foot of single line. The bridge was completed in seventeen months; the whole of the ironwork having been supplied and fixed by Messrs. Ormerod and Grierson, the sub-contractors.

The high level line of the London, Brighton, and South Coast Railway Company, with a branch line from the Wandsworth-road, consisted mainly of a viaduct of brickwork, which was described. The bridges were of a heavy character, comprising eighteen spans in wrought iron, ranging from 26ft. to 150ft., three spans in cast iron of from 60ft. to 70ft., and nine spans of brick in cement. The bridge over the London and South Western Railway had a central span of 149ft. and two side spans of 47ft. each, and had two main girders of lattice construction, continuous throughout. The centre-span was erected without the use of scaffolding, by putting together the bottom flange and lifting it into its place, supporting it by temporary truss-rods, and then, erecting the remainder of the girder upon it, inserting the tension bars from either end till they met in the middle. An adjoining bridge, of 120ft. span, was of similar construction. The main girders, weighing 106 tons each, were built on the viaduct, and, when put together complete, were each rolled over into their places during the night, an operation occupying but four hours.

The other lines of this system were afterwards described, and it was stated that these works, which were three years in progress, comprised a length equal to nine miles of double line, of which five miles were on viaduct, and had cost for works only, including the bridge over the Thames, the sum of £910,000. The high level line of the Brighton Company, which was entirely on viaduct, had cost, including permanent way, stations, and signals, and the numerous heavy bridges, £45 per lineal yard of double line. The whole of the works had been executed from the designs and under the superintendence of Sir Charles Fox, M. Inst. C.E., and the author, Mr. Edmund Wragge, being the resident engineer. The contractors were Messrs. Peto, Betts and Crampton, Messrs. Lucas Brothers, and Messrs. W. and J. Pickering, Mr. J. Heywood, jun., executing the ironwork for the Brighton Company.

* Read before the Institution of Civil Engineers.

ARCTIC EXPEDITION.

CAPTAIN SHERARD OSBORN, mourning the present inactivity of the Navy, proposes an expedition of some sort. He thinks that geographical exploration and discovery in the Arctic seas, in Central Africa, in New Guinea, or Western China, in surveying the storm-swept channels of Cape Horn, or exploring the depths and currents of the great ocean, and such like pursuits, are the true school for our naval officers and seamen. The gallant captain, however, is specially in favour of an Arctic Expedition, which he advocates upon the strength of two remarkable feats which have recently been accomplished. It appears that in Baffin's Bay, Captain Richard Wells, of the steamship Arctic, of Dundee, has been further north in his ship in open water than any navigator had previously reached. Captain Osborn thus narrates the circumstances:—"As early as the 20th of June last, the 'Arctic' proceeded up Baffin's Bay, crossed the face of the glacier of Melville Bay, steamed away past Cary Isles and Hakluyt Island, visited Whale Sound of Baffin, and the subsequent scene of Dr. Kane's adventures. Captain Wells then, finding open water to the north, crossed to the west side of Smith's Sound, and still, tempted by a fine open sea, went on till he sighted Kane's Glacier of Humboldt, and must, he says, have then been in the 79th north parallel—considerably north of where I reached in 1850 in the 'Pioneer'—beyond Inglefield in the 'Prince Albert,' and beyond Kane in the 'Advance.' The bold Dundee whaler was still in open water, and adds, 'I should have continued my course northwards had I seen a fish. There was no indication of ice to the northward, the sky blue and watery, and only a few small streams of light ice to be seen.' Of course, Captain Wells did right in not being tempted to risk his owner's property into the unknown straits before him, but I am sure all living Arctic officers will feel with me. Would that one of us, with a well-found discovery ship, could that day have been where the 'Arctic' was, only 660 miles from the Pole, and I fell pretty sure from Kane's report that we know what to expect for at least another 120 miles, or within 540 miles of the axis of the globe."

The other remarkable voyage has been made from the Pacific Ocean by a whaler called the "Nile." She has rediscovered an extensive land, which will be found recorded on all our Admiralty charts since 1850. The Russian Admiral Wrangel first mentioned it in the account of his remarkable survey of the Siberian shores of the Arctic Ocean. The Tchukties now wandering near Cape Chelagskoi aver that a tribe called the Onkillon fled before them across the frozen sea to a land lying north of Siberia, and occasionally seen from Cape Jakan. Wrangel questioned its existence, but Admiral (then Captain) Kellett, in Her Majesty's ship "Herald," in 1850 sighted this land some 30 miles distant, and although he would not name it, as he could not land upon it, he said, as far as eye-sight could be trusted, it was land of a bold character, extending from about 175 deg. to 180 deg. W. long., and in lat. 71 deg. N. It is a verification of this discovery which the whaler "Nile" brings us this year. An American paper states, that the sea within Behring's Straits was so clear of ice this last summer that the "Nile" reached considerably closer to, but it does not appear that any one landed on, Kellett's Land. Her captain traced the land to the 73rd deg. north latitude, and saw it still reaching away to the northward in all the magnificence of snow-capped cliffs and mountain peaks. The gallant captain observes that these two voyages of the "Arctic", and the "Nile" are cheering proofs of the reduced risk attending ice-navigation in steamers instead of the old fashion of whaling with sailing vessels, and he doubts not that we are on the eve of a considerable extension of our geographical knowledge of the North, owing to the keenness of our whale hunters, and the desire of the poor fish to escape from seas ploughed by the keels of our Arctic steamers. Now, we are quite willing to see our Navy legitimately employed, and are ever desirous for the advancement of science. But the employment of the Navy and the advancement of science should have some practically useful end in view, and we are by no means sure that such would be attained by an Arctic Expedition. Suppose we leave the matter to the "keenness of our whale hunters," and allow the reticence of their prey to allure the catchers on to geographical distinction.

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RETURN-ACTING SCREW ENGINES OF H.M.S. "DRYAD."

OUR double page illustration with this week's impression shows a pair of return-acting engines of 300-horse power nominal, by Messrs. R. Napier and Sons, of Glasgow, and which were fitted by them in H.M.S. "Dryad." The cylinders, each 62in. in diameter, are steam jacketed around and at both ends. The slide valves are of the equilibrium type, with double ports on each side of the exhaust opening. The packing at the back is the ordinary metallic rings and spiral springs, with outside set screws for adjustment. The expansion valve is the ordinary multiple ported sliding valve. The maximum grade of expansion is 2 from the commencement of the piston's stroke, 6 being the minimum. The side elevation of the engines show the expansion gear, which is the eccentric and slot-lever, the latter being for the alteration of the cut off.

The stroke is 2ft. 6in.; the piston rods, each 5¾in. in diameter, are prolonged to the opposite side of the crank-shaft, the latter being 12⅜in. in diameter. The length of each bearing is 1ft. 10in., and the crank-pin is 12in. long and of the same diameter as the shaft; the cranks are weighted with counterbalances of cast iron, secured by wrought-iron hoops or bands. For greater facility in forging, turning, and fitting, the shaft is flanged at the centre, and secured by bolts and nuts. The piston rods are secured, at the condenser end, into the crosshead by nuts, and the crosshead is placed at the back of the guide block. The connecting rod is 5ft. 6in. in length between centres; the pin is 8in. in diameter, and 12in. long in the block. The lower surface of the latter is 30in. long and 16in. wide, the adjustment being made by the usual slipper and set studs seen in the longitudinal section. The slide-valve motion is on the link principle, with the starting wheel at the side of the main frame, near to which are the steam valve handles, blow through, and injection levers, &c. The brasses in the main bearings for the crank shaft are laterally adjusted by vertical set bolts and nuts.

The condenser is the main feature in these engines, being arranged to suit the particular requirements for the return action of the connecting rod. The tubes, 3,923 in number, are packed in one cluster above and between the guide channels. Each tube is 6ft. 3in. long between plates, the outside diameter being ¾in. and the inside ⅝in. full. The water circulates through three sets of tubes consecutively. The divisional plates are of cast at one end, and wrought-iron boiler plate at the other. The packing is of india-rubber and metal, as patented by Mr. Davidson, on whose principle the condenser was arranged. The air and circulating pumps are situated below the tube compartment, each being 16in. diameter, and receiving motion from the steam pistons. The valves are rectangular, 28in. by 13in. of india-rubber, with gun metal seating and guards. This condenser has an injection valve and stop sliding valves to convert the circulating pump into an air pump when desirable. The injection pipe is 5½in. in diameter, and is placed at the front of the condenser at the side of the main exhaust steam pipe, the diameter of which is 20in., and that of the discharge water pipe 16in.

The feed and bilge pumps, each 3¾in. diameter, are worked from the piston rod crosshead. The snifting valve is 2½in. in diameter, the cylinder relief valve 5⅜in., and the bilge injection pipes 2½in. in diameter, and the blow through valves have each an area of 10·5 square inches to each engine. The screw propeller is a Griffith's, 15ft. diameter, having a mean pitch of 14ft. 6in. The boilers are the ordinary marine tubular, four in, number. Length of tubes in each shell, 6ft. 6in., and the number 272. Length of each firegrate 5ft. 6in. by 3ft. 4in. wide, three in each boiler. The funnel is 3ft. 9in. by 7ft. 9in. The "Dryad" has attained a speed of 13 knots, and her engines indicated 1,600-horse power.

COLOUR OF THE MOON DURING ECLIPSES.*

BY MR. A. BROTHERS, F.R.A.S.

ON the night of October 4, 1865, there was a partial eclipse of the moon, when about one-third of the disc was obscured. My time and attention on this occasion were chiefly directed to some photographic experiments, and it will be remembered I then obtained pictures of the eclipse at short intervals, from the commencement to the end. At about the greatest phase I looked at the moon through the telescope with an eye-piece of low power, for the purpose of noticing whether the eclipsed portion showed colour, and at once saw that the part of the moon most deeply within the shadow was of a decided copper colour, such as I had seen some years previously during a total eclipse of the moon.

The eclipse which occurred on the night of September 13 last was rather more favourable for detecting the presence of colour, as seven-tenths of the moon were covered by the earth's shadow; the weather being clear, many persons have recorded their observations, and as the colour of the moon is one of the chief features of a lunar eclipse, this point attracted considerable attention.

Mr. Browning says, in a letter which appeared in the "Astronomical Register":—"I looked most carefully for colour both with the 10½ silvered glass reflector, furnished with an achromatic eye-piece of very low power, and also with a five-feet refractor; with neither could I detect a trace."

Mr. Slack, who was also observing with a silvered glass reflector, and in the same locality as Mr. Browning, says:—"After twelve, the eclipsed limb grew noticeably redder; the red coppery tint chiefly affected the lower parts of the obscured limb, but was visible further in, gradually blending with the inky tints presented by the umbra at its advancing edge."

Mr. Weston, observing at Landsdown, near Bath, says:—"The prevailing colours were red-bluish and grey, and grey; the redness increased towards the darkened edge of the moon."

Many other observers speak of the presence of colour, but, on the other hand, a few say they did not notice any, the eclipsed portion of the moon merely having a darkened appearance. On this occasion I did not make any photographs, as I could not expect results materially differing from the last, and I gave my whole attention to observing the progress of the eclipse through the telescope, which is a refractor of 5in. aperture. As to the question of the presence of colour, I can most distinctly say that colour gave the moon a very beautiful appearance, and it seemed to me the most interesting feature of the eclipse. The beauty of the moon's surface appeared to increase as the penumbral shadow stole over its surface, and until the shadow itself was considerably advanced, all the details of the lunar surface could be distinctly made out, and during the whole period of the eclipse some of the brighter points of light within the shadow continued visible, as did also the entire disc with many of the details of light and shade. The colour of the eclipsed limb was of a coppery hue, much brighter towards the part most deeply within the shadow. The part of the moon not eclipsed was of a beautiful bluish-grey colour.

That the appearance of colour cannot be caused by the telescope, or by peculiarities in the eyes of the observers, is, I think, proved by the fact, that the same colours are seen whether refractors or reflectors, either of metal or silvered glass, be used; and, as the majority of observers see colour, the eyes of those who remark the absence of it are, perhaps, temporarily afflicted with colour blindness;—the bright light from the uneclipsed portion of the moon may be sufficient to produce this in some persons. If an observer, after looking at the moon through the telescope, attempts to look at objects while the other eye remains closed, it will be found that until the retina has recovered from the excess of light everything will appear misty—in fact, the eye is partially blinded, and it may be that some eyes are sufficiently sensitive to be affected by the diminished lustre of the moon, and may thus be prevented seeing colour, which there can be no doubt the lunar surface presents during an eclipse.

Some observers have remarked on the difficulty of detecting the first appearance of the shadow, and although the exact time is known, the real shadow is not seen until many seconds, or, perhaps, minutes, after the predicted time. In the present instance, I watched very carefully for the first appearance of the shadow, and, having previously ascertained the error of my watch, I took my position at the telescope; at the same time I requested a friend to take particular notice of the time at the moment I saw the shadow. The result thus obtained was within twenty seconds of the time given in the "Nautical Almanac," clearly showing that under favourable conditions, and, if the attention be given carefully to the subject, the real shadow may be detected very near the predicted time.

* Read before the Literary and Philosophical Society.

ROYAL MICROSCOPICAL SOCIETY.

AT the ordinary meeting, held at King's College, December 11, James Glaisher, Esq., F.R.S., president, in the chair, twenty-seven gentlemen were elected fellows of the society. A number of presents in the library were announced, and the following papers were read:—"On the Pedilceliariæ of the Echinidea," by Mr. Charles Stewart; "On a microscopical ferment found in red French wine," by Mr. H. J. Slack; and "On a new species of marine animalculæ," by Mr. Tatham, communicated by Mr. Jabez Hogg. Dr. Maddox exhibited and explained a valuable and interesting collection of photo-micrographs of scales of poduræ and other minute objects, which had been taken with the highest power objectives of various makers, by the Army Medical Department of the United States. A new form of microscope lamp, with parabolic reflector and condenser, designed by Mr. Bocket, and manufactured by Mr. C. Collins, was also shown and described by Mr. H. J. Slack.

BREAK POWER.

IN the fifth series of official reports upon railway accidents recently published, three casualties are recorded which were wholly or partially caused by a want of break power in the trains. One of these accidents happened to the limited mail train on the London and North-Western Railway last July, when the vans and carriages broke from the engine and tender and afterwards came into collision with them, resulting in injuries to both guards and to fourteen passengers. From evidence collected by Colonel Yolland, R.E., inspector to the Board of Trade, it appears that "the ordinary west coast rolling stock was under repair at Wolverton, so that the guards had only single breaks to depend on, instead of continuous breaks connected with the next carriage," and "that it took nearly half a minute to put on one of these breaks." The other accidents referred to took place on the North-Eastern Railway, in one of which a collision occurred between an express train of the Great Northern and a goods train of the North-Eastern Railway Company; and in the other a collision took place between a mail train and an empty coal train between York and Scarborough. The inspector remarks as to the former that "it is a most dangerous practice to despatch heavy express trains without very much more break power than was available in the present instance;" and as to the latter, that "some portion of blame rests with the person who is responsible for the trains being despatched with the amount of break power prescribed by the rule of the company," the rule in this instance having been disregarded.

STATISTICS OF MATCHES.

THE following curious particulars concerning matches occur in a paper lately read to the Société des Ingénieurs-Civils by M. Peligot. It has been calculated that the number of matches consumed in France is about six per head; it is eight in England, and nine in Belgium. Taking the French average as a basis, the number of matches consumed all over Europe in a day is about 2,000 millions, representing upwards of 600lb. of wood. The kinds of wood chiefly employed in manufacturing them, viz., aspen and poplar, are sold by the cubic metre (35 cubic feet); allowing for waste, this quantity does not weigh more than 500lb., so that in Europe alone the number of cubic metres of wood thus burnt amounts to 400,000, being equivalent to 14 millions of cubic feet English measure. To this quantity should be added that of the stearine matches, commonly called vestas, the consumption of which has of late increased very considerably. The weight varies between 3,200 and 4,000 per lb. in France. The quantity of phosphorus used in the manufacture of matches is about 420,000lb., exclusive of chlorate of potash, sulphur, minium, sulphuret of antimony, gum, and glue. There are in Austria manufactories employing 5,000 hands, and the aggregate value of matches produced is 250 million francs. The invention of friction matches only dates from 1832. In 1835, chlorate of potash was partially replaced by minium and peroxide of manganese, and phosphorus by sulphuret of antimony. In 1837 chlorate of potash was completely abandoned for bi-oxide of lead, and then for the nitrate of that metal, and also by nitrate of potash. In France, chlorate of potash continued to be in use till 1847; at present it is only used for vestas. It is a very dangerous substance, since it will explode by mere friction in the mortar.

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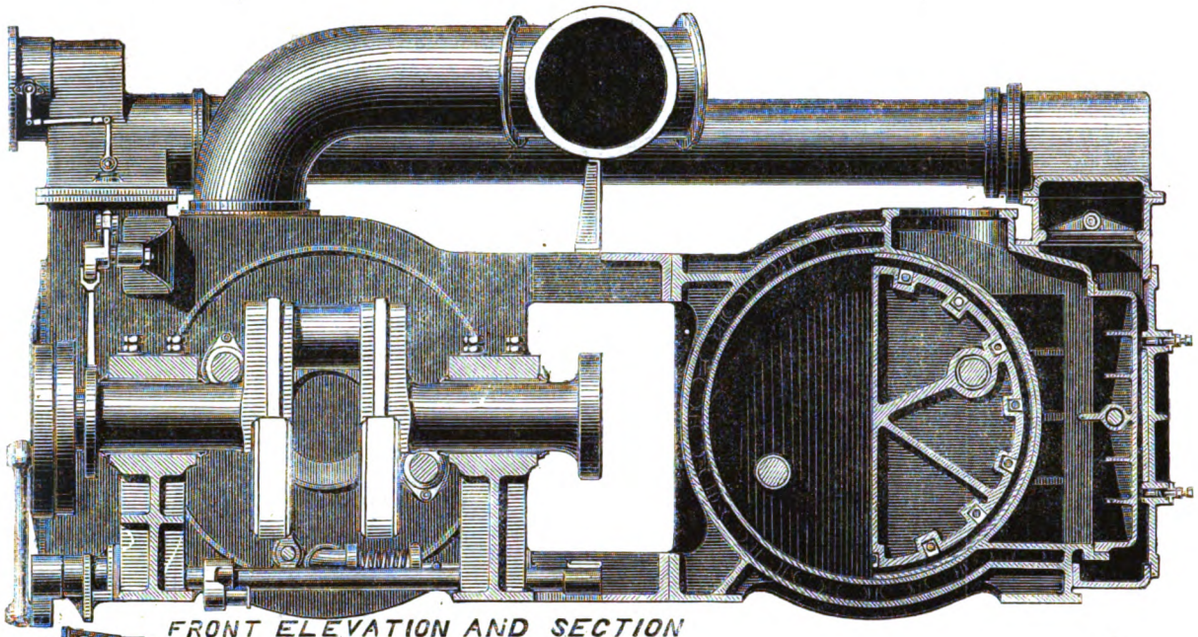
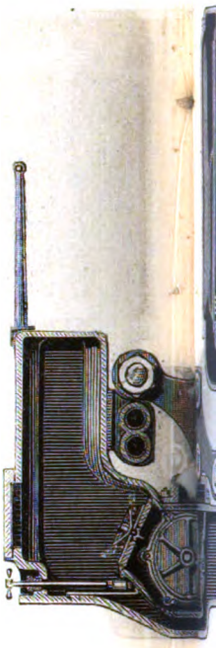
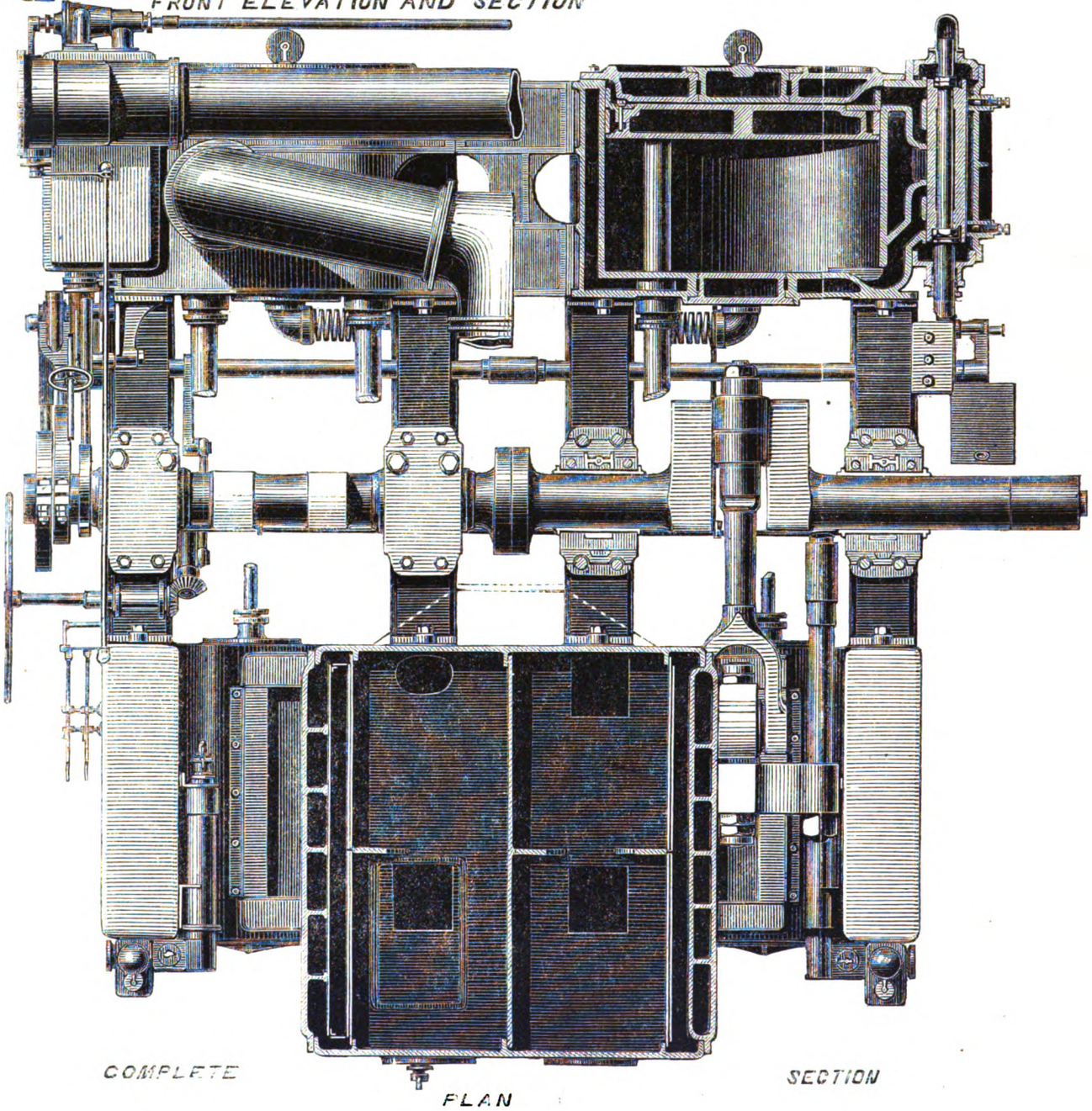


FRONT ELEVATION AND SECTION





COMPLETE

SECTION

PLAN

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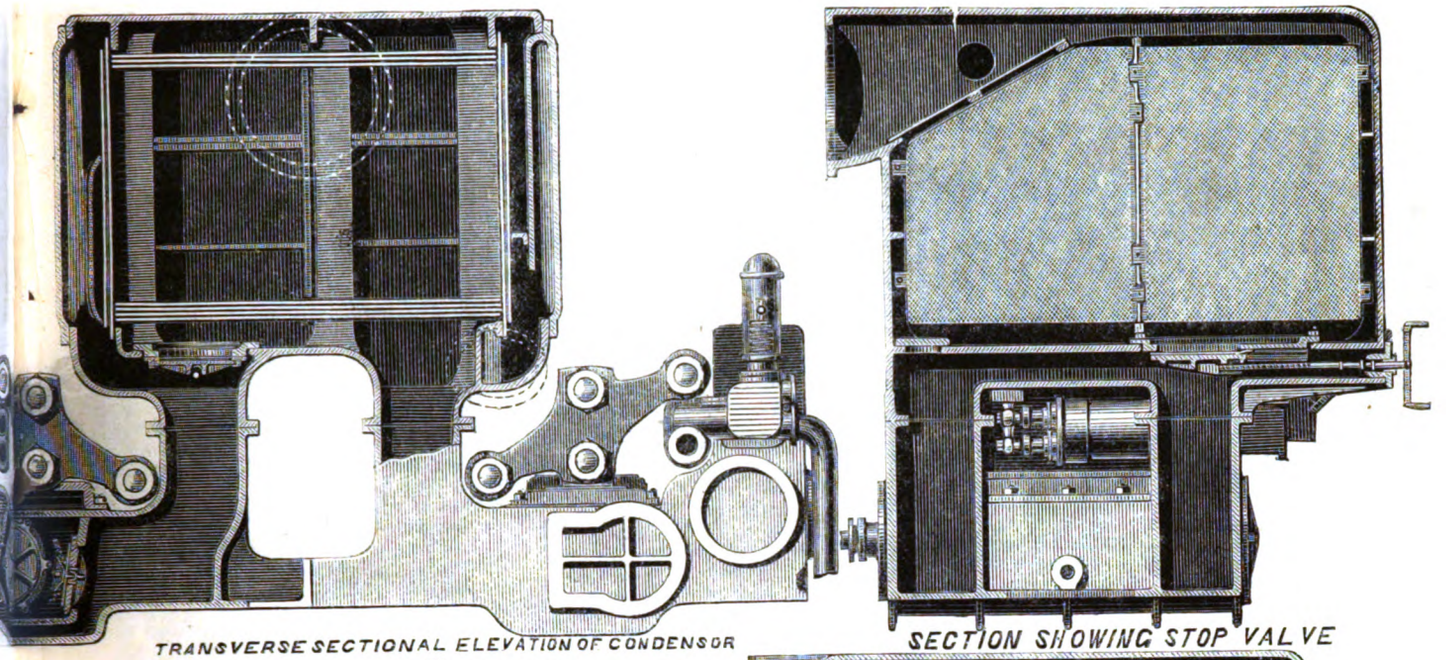
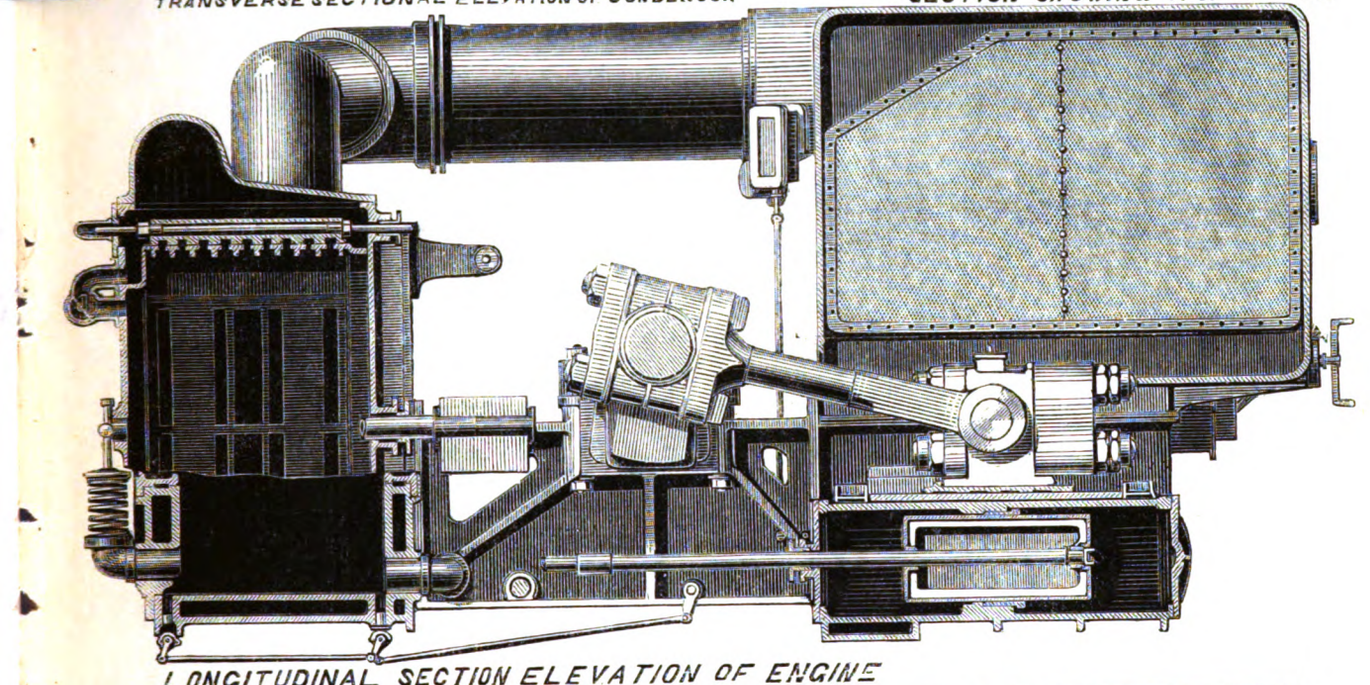
INES OF H.M.S. "DRYAD."

ER AND SONS.

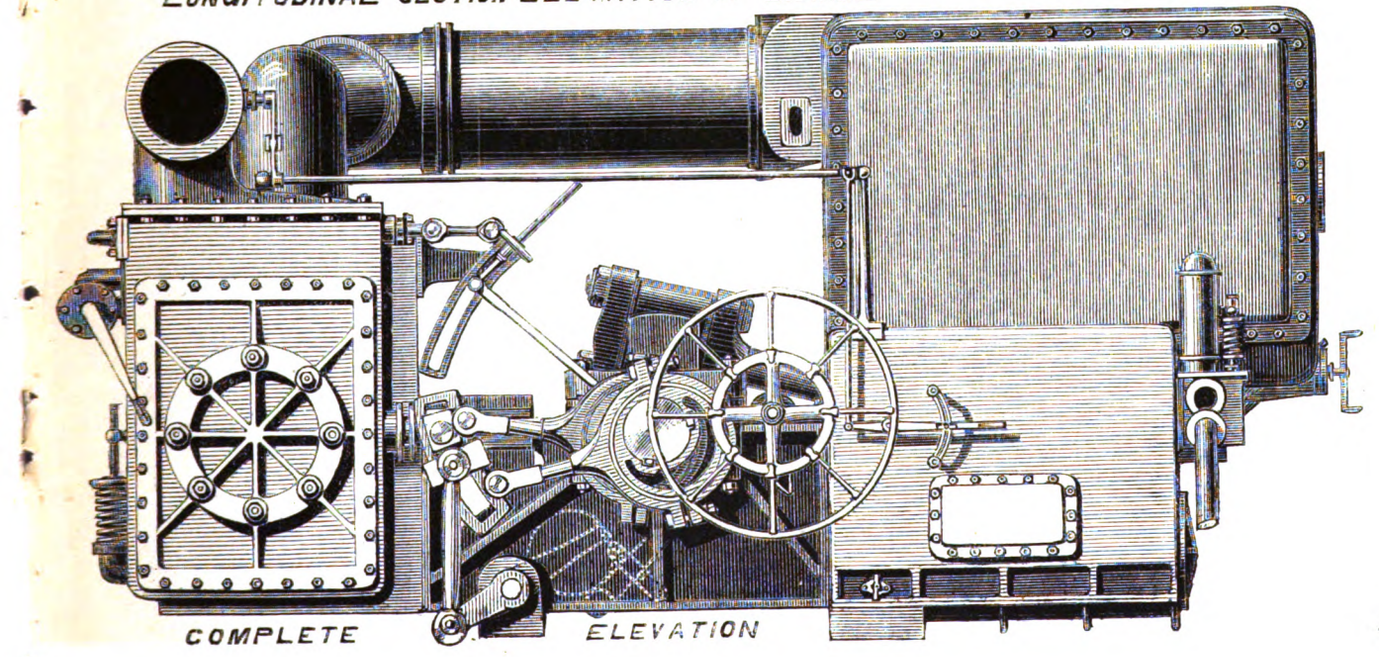


TRANSVERSE SECTIONAL ELEVATION OF CONDENSOR

SECTION SHOWING STOP VALVE



LONGITUDINAL SECTION ELEVATION OF ENGINE



COMPLETE ELEVATION

AYLOR.

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AGE OF THE HÆMATITE IRON DEPOSITS OF FURNESS.*

By E. W. BINNEY, F.G.S.

THE great value of the vast deposits of hæmatite iron ore found in the carboniferous limestone of North Lancashire, and in a similar position near Whitehaven, in Cumberland, renders any information as to the date of their formation of considerable importance. There is no doubt that the carboniferous limestone was first formed in most instances. Hollows were then made by some agency, whether by aqueous or atmospheric, or both agencies, it is not necessary here to inquire; but most of the cavities bear evidence of some erosive action, their sides being more like old valleys or watercourses than simple fissures. The next question to be considered is when were these hollows filled with the iron ore? No one who has investigated the subject would estimate their age so late as the date of the magnesian limestone, but some eminent geologists have supposed them to have been formed during the lower Permian period, whilst others have adduced reasons for believing that they had been formed during the Carboniferous epoch. There is very little doubt but that large deposits of iron have been met with in both these formations, some of Carboniferous and others of Permian age, but our present enquiry is the geological age of the hæmatite iron ores of Furness.

In two previous memoirs the author has described deposits of hæmatite iron ore, and given his reasons for believing that they had their origin during the Carboniferous epoch, and were deposited in erosions of the mountain limestone in some instances, or in others interstratified in regular beds in the lower coal measures like seams of coal. Long after his papers had been printed, Sir R. I. Murchison, and Professor Harkness, in a memoir on the Permian rocks of the north-west of England, printed in volume XX. of "The Quarterly Journal of the Geological Society," at page 152, says:—"The mode in which that valuable ore of iron hæmatite is found deposited in pre-existing cavities of the carboniferous formation, and sealed up by crab rock (Permian breccia) is a matter of great geological interest. Joints, fissures, and caverns were doubtless formed in the older rocks antecedent to the deposition of the Permian strata, and in these the ores of iron, so widely diffused throughout the Permian rocks, have in this portion of the north-western region assumed the character of hæmatite. This circumstance justifies the inference that these hæmatite ores are the result of an agency which ushered in the Permian epoch. The earlier rocks of both England and Scotland are strongly impregnated with iron, their composition consisting principally of silica and an oxide of this metal. This latter substance originated from the same source which, during the commencement of the deposition of the Penrith sandstones, filled up the fissures in the carboniferous limestone. This conclusion is applicable not only to the Ulverstone district but also to that of Cleator, south-east of Whitehaven, where valuable deposits of hæmatite are also obtained from the cavities and fissures in the carboniferous limestone, which at one time was here covered over by an extension of those Permian breccias and sandstones, now forming an escarpment a short distance west of Cleator Moor. This inference concerning the Permian age of the hæmatite had been arrived at by Professor Phillips, who, in a communication to the British Association, illustrated his opinions by maps and drawings."

The authors of the paper illustrated their views in a section from Park to Furness Abbey, shown in a woodcut, exhibiting two vertical fissures in the limestone rock, filled with hæmatite, and covered up with breccia or crab rock. Now, this undoubtedly shows that the limestone rock was first formed, then that the fissures or erosions were made, and subsequently filled with hæmatite. But at what time the latter process took place, whether during the Carboniferous or Permian epoch, no evidence is adduced by the authors further than that the beds of hæmatite are there covered up by Permian breccia, and some of the latter has been introduced into the fissures. It has been generally supposed by geologists that at the close of the Carboniferous epoch great convulsions took place in the earth's crust, and large quantities of iron were ejected from its interior. Now, the three authors previously named are recognized authorities on the age of hæmatite iron ores, and their opinions deserve great attention. When his papers were written, conclusive evidence could only be given of the age of the hæmatite iron of Ipstones, in Staffordshire, which was clearly interstratified in the Lower Coal Measures between the Rough Rock or Upper Millstone of Professor Phillips, and the Geological Survey, and the Gannister coal. Some years since, Mr. Bolton, of Swarthmoor, near Ulverstone, showed him, amongst other fossils, a beautiful specimen of Sigillaria vascularis, exhibiting both its external characters and internal structure, quite as perfect in every respect as the specimens found in the Gannister or hard coal at Halifax, or the Bullion seam of Burnley, all converted into hæmatite iron. At that time no doubt existed in his mind of its having come from one of the Furness iron mines, but Mr. Bolton could give him no proof of the exact locality where it was found. At a meeting of the Manchester Geological Society, held on May 30, 1866, he gave his opinion of the value of this fossil as indicating the carboniferous age of the hæmatite iron ores of Furness. These specimens have been kindly lent him by Mr. Swainson, of Newland, their present owner, and were exhibited on the table for examination. With them were some other interesting specimens from the cabinet of Miss E. Hodgson, of Ulverstone, a lady well known for her acquaintance with the geology of Furness, and who procured the specimens now exhibited from the Water Blain Mines, west of the Duddon. They do not exhibit their external characters so well as Mr. Swainson's specimens do; but one is a Stigmaria, the root of Sigillaria, and another a Lepidodendron, two common coal plants, which indicate the carboniferous age of the deposit in which they were found as clearly as any fossil organic remains can do. There is no doubt about the locality of Miss Hodgson's specimens. They came from the Water Blain Mines, and plenty more may be obtained from the same place. They are all converted into good hæmatite iron, that substance having metallized them in a similar way, as we find plants in the Coal Measures converted into the carbonate of the protoxide, or the bisulphide of iron, or carbonate of lime.

It was not the author's intention to attempt to give any explanation of the process by which the original ligneous structure of the plant has been removed and replaced by per oxide of iron: that was a subject better fitted for the chemist than the geologist. Now, the discovery of common coal plants not only embedded in but actually formed of hæmatite iron, surely indicates the carboniferous age of the deposits in which they are now found as clearly as it well can be, for the plants must have been floated in with the water which brought the iron, or else they must have fallen into the cavities when such were open at the top, and the iron was in a soft state. Of course, the occurrence of such fossil plants as Sigillaria, Lepidodendron and Calamitis occurring as they do in beds, from the lowest to the highest carboniferous strata, would give little evidence of any particular part of that epoch, but the Sigillaria vascularis, so far as yet known, is confined to the lower coal-field, not far in geological position from the Ipstones hæmatite previously alluded to, and the valuable clay band ironstones now wrought at Hazlehead, west of Penistone. The deposits of hæmatite in Furness and Cumberland, found in hollows of the carboniferous limestone, and covered up by Till, or "Pinel," as it is locally termed, or more rarely by Permian breccia, are so much alike in all their characters, that if the origin and age of one of them are clearly proved, those of the rest must follow almost as a necessary consequence.

* Read before the Literary and Philosophical Society.

ON THE MANUFACTURE OF STEEL FROM CAST IRON, BY THE USE OF NITRATES AND OTHER OXIDIZING SALTS. *

By MR. J. HARGREAVES.

THE object of the invention which I submit to the consideration of the Polytechnic Society, is to effect the acieration of cast iron by a direct process, and thus dispense with the many permutations which it is at present made to undergo before the condition of steel is attained. I effect this by the agency of oxidizing salts and oxides of iron and manganese. The oxidizing salts which are most suitable for the purpose are the nitrates, and especially the nitrate of soda, on account of its lower cost, higher percentage of oxygen, and the highly electro-positive character of its base, which renders it a most effective agent in removing the metalloids, silicium, sulphur, and phosphorus, and the semi-metal arsenic from iron, by forming with them compounds of sodium, thus enabling inferior qualities of cast iron to be used in the manufacture of steel, and also to improve the qualities of malleable iron by depriving it of those objectionable substances. This is effected by placing the converting materials below the fused cast iron, and allowing the products of their decomposition to rise through the fluid metal, exerting while passing through it their chemical energies in separating from the cast iron the excess of carbon above that which is required to constitute steel, and in removing the metalloids which, even in the smallest proportions, deteriorate the value of the product.

The necessary use of fossil coal in Great Britain, in consequence of the scarcity of wood from which charcoal can be obtained, tends, while lowering the cost of production, also to deteriorate the value of the iron produced, by communicating to it some of its own impurities, which, added to those existing in the ore, render the iron very impure. A great proportion of silicium and sulphur are separated by the lime used as a flux in the form of slag. But the last traces of these elements are very difficult to remove under the circumstances; while, with the exception of a slight trace, the whole of the phosphorus originally present in the ore remains in combination with the metal.

En passant, I beg to direct the attention of the chemical members of this Society to a chemical and industrial problem, the solution of which is of great importance to society, viz., the separation of phosphoric acid from the iron ores in such a manner that it may be effected on a large scale, and at a cost sufficiently low to yield a profit upon the phosphoric acid extracted, and yet leave the ores in a suitable condition for obtaining the metal therefrom. The agriculturists of Great Britain have to resort to imported phosphates to restore and maintain the fertility of their lands; and the islands of the Pacific, South America, Australia, and other distant countries are put under contribution to supply them; while beneath our feet and among the minerals which pass through our blast furnaces lie phosphates which, if extracted, would render us independent of those supplies, but which at present depreciate the value of the labour and skill of our iron workers. To know this must give us all a strong sense of our ignorance and weakness, in spite of the repeated and complacent boast of our powers to control the forces of nature. I hope that the attention of chemists will be drawn to this important subject, and that some of us may be able to pronounce the "open sesame" which shall throw open this storehouse of phosphatic treasures.

In 1861 my attention was first seriously attracted to the subject of the acieration of iron by the communications of the researches of MM. Caron and Fremy to the French Academy of Sciences. These communications show that, to form steel with such qualities as will compete with that produced from Swedish and Russian iron, by cementation, it is necessary that the iron should be pure or approximately so; and that to effect cementation, nitrogen must be present in combination with carbon, or in contact with some gaseous compound of carbon. M. Caron disputes the hypothesis that nitrogen is an essential element in steel; but he admits that it acts as an inter-porter or carrier of carbon between the charcoal in the cementing pots and the iron, acting in fact as a kind of chemical shuttle, carrying carbon to the iron, and depositing it within the substance of the metal; and after delivering the carbon to the iron, it returns, and again picks up another charge or load of carbon, which it again delivers to the iron. A very small quantity of nitrogen is by this means made the agent for carrying a comparatively large quantity of carbon; and he proposes cyanide of ammonium as a gaseous cementing agent. M. Fremy, on the contrary, asserts that nitrogen is absolutely essential to acieration, and that in the absence of this element cast iron and not steel is the result of operating upon iron with pure carbon, unless the iron itself contains nitrogen. That iron can be made to combine with nitrogen has been placed beyond doubt by M. Despretz, whom M. Fremy quotes and whose experiments he repeats, a ferrammonium (N. Fe, 4), having in fact been produced; *i.e.*, a compound analagous to the quasi-metal ammonium in which the hydrogen is replaced by iron. M. Fremy proposes to effect the cementation of iron by the use of ammoniacal and hydrocarbon gases, to supply nitrogen and carbon. I was then, and am still, disposed to take the view of M. Fremy as the correct one. But the thought suggested to me by the discussion between these eminent *savants*, was—"Why not obtain and use some material which shall effect the removal of the excess of carbon, with all other objectionable elements, and at the same time add nitrogen, which being chemically very inert, must be in the nascent state to effect its combination

* Read before the Polytechnic Society of Liverpool.

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with iron, instead of removing the whole of the carbon, and then by a very expensive, laborious, and inconstant process restore a portion of the carbon extracted and a very small portion of nitrogen?"

The great difficulty was to find an agent capable of fulfilling the requisite conditions, which are—1. That it shall remove any desired quantity of carbon, this being varied with the varying proportion of carbon contained in the cast iron, and leave in it just sufficient carbon to effect its acieration. 2. That it shall remove all the silicium, sulphur, and phosphorus, or at least leave only traces of these elements. 3. That it shall supply nitrogen in the nascent state.

I occasionally took up and studied the subject, but with no satisfactory result—as I could not see clearly how to have a practical process, which could compete with those then in operation—till in 1864, when considering the theory of the action of the alkaline nitrates upon the elements composing cast iron, I found that these salts possessed all the properties necessary to accomplish the object I then had in view. 1. The quantity of carbon to be removed could be regulated at will by the quantity of nitrate used. 2. The alkali would in all cases be in excess of the quantity required to form chemical compounds with silicium, sulphur, and phosphorus, and give rise to the formation of silicate of soda, sulphide of sodium, and phosphide of sodium. 3. Nascent nitrogen would be formed in the presence of iron, in consequence of the formation of cyanides, by the reaction of the sodium or potassium and nitrogen of the nitrate upon the carbon in the cast iron, and would also be liberated upon the decomposition of the oxides of nitrogen. 4. The reaction of the nitrate upon fused iron could be easily effected by placing the nitrate at the bottom of a suitable vessel, and allowing the products of its decomposition to rise through the metal.

The writer, after briefly adverting to the great difficulties he encountered in endeavouring to secure some benefit to himself, for the labour he had undergone and the great discovery he had made, and stating that ultimately he had the mortification to find a friend in sole possession of a patent which should have been in their joint names, but which really prevented him from using his own invention, said—I then applied for provisional protection for the use of other nitrates than those of soda and potash, and also for the use of chlorates, manganates, chronates, and stannates. Mr. Robinson, of the Widnes Foundry, giving me facilities in that establishment for conducting the preliminary experiments, I set to work to find some cheaper method of making or obtaining some of the most suitable oxidizing salts, or some more effective method of putting them in operation, so as to economize them. I found that nitrate of iron, and the chlorates of potash and soda, acted with explosive violence, the evolution of oxygen being so rapid that it was extremely dangerous to pour the melted iron upon them. This necessitated the use of some agent which would retard the rapid and violent action of these salts. The first thing that suggested itself was clay, or other inert substance. The use of clay suggested the feasibility of making the whole of the oxidizing materials into a solid hard and dry mass at the bottom of the vessel used as a converter. This again, together with the fact that I had to compete with a lower priced, and in other respects more suitable material, suggested that the clay might be replaced by hæmatite or other oxide of iron, ground into a plastic condition. I should thus get a cheap additional supply of oxygen, and also an increased yield of metal. The advisability of adding manganese to form an alloy with steel, suggested that, where it was desirable, oxide of manganese might replace oxide of iron.

By this succession of thoughts, I got matters into a shape that promised at least a chance of success, and secured these improvements by a second patent, which received provisional protection in May last. Shortly after this I discovered that I was not the first, by many, who had proposed to use nitrates for the purpose of converting iron into steel, and to assist in removing objectionable impurities from it. Neither was I the first to propose placing the salt below the surface of the metal, that the products of its decomposition might rise through and act on it. I also found that the claims advanced by my friend did not exclude me from their use. Under these circumstances my first patent was not worth holding, and I allowed it to terminate, without proceeding to the Great Seal. I therefore congratulate myself on the fact that my invention has been, to some extent, anticipated, and that circumstances impelled me to put the mechanical part of my first crude conceptions into a practical form. The chemical properties of the nitrates and chlorates have frequently been appreciated by other inventors and patentees, but they do not seem to have attempted to get over the difficulty occasioned by their rising too rapidly to the surface of the fused iron, when it is poured upon these salts. Their action has in consequence not been controlled or regulated, but left to chance, and the decomposition of the salt has been so rapid as to render the process a perilous one; and it had to be given up, if for no other reason, because workmen would not willingly imperil their lives and limbs in carrying it into operation, as the explosive violence with which the gases are evolved, often accompanied with showers of incandescent fused metal, thrown about in all directions, involve more dangers than many workmen are willing to encounter.

Before describing the details involved in treating iron by the process for which I obtained the second patent referred to in the foregoing, I beg to point out the general principles upon which it is based. You will have before observed, that to effect the removal of a given quantity of carbon from cast iron, a given quantity of oxygen must be supplied, to convert this carbon into carbonic acid, or carbonic oxide. To convert six parts of carbon into carbonic acid, sixteen parts of oxygen are required, and to form carbonic oxide, eight parts of oxygen combine with six parts of carbon, and in one or both of these forms the carbon is eliminated from the iron. The weight of oxygen contained in the acid of the nitrate of soda, and which will be eliminated from it, is equal to 47 per cent., binoxide of manganese yields about 36¼ per cent., and sesquioxide of iron 30 per cent. It thus becomes tolerably easy to ascertain, especially after a few practical trials, the proportion of oxidizing materials necessary to remove a given quantity of carbon. This is, however, complicated by some conditions, each of which requires a trial or two to obtain exact results. For instance, when the operation is carried on in a deep vessel, the oxidizing materials act more effectively than when a shallow vessel is used, because the products of their decomposition have more time to become saturated with the impurities which it is desirable to remove from the iron. The rate of evolution of the gases from the oxidizing material is regulated by the proportion of oxide of iron or oxide of manganese mixed with the nitrates. The oxides, though themselves evolving oxygen, especially in the presence of carbon, do so tardily; and they restrain the otherwise uncontrollably rapid action of the nitrates alone. By this means the action of the nitrate can be so retarded as to cause only a comparatively slight ebullition.

The nitrate of soda is mixed with a proper proportion of oxide of iron, the most suitable form of which is hæmatite, and when in a slightly moist condition, pressed or tamped into the bottom of a vessel lined with fire brick, the whole is then dried into a solid block. If the vessel has been used immediately before, its heat will be sufficient to dry the mass, but if not heated by a previous operation, it is heated by other suitable means. The nitrate of soda of commerce is generally sufficiently moist, without the addition of more water. When the mass is dry, the fused iron is poured upon it; successive layers being then removed, the materials by their levity are carried through the body of the metal, and the reactions occur, to which I have before referred; and as each layer is removed, the part immediately below is exposed to the heat of the melted metal. A boiling appearance accompanies this action, and a frothy slag containing some oxide of iron, and compounds of soda, with the impurities extracted from the iron, rises to the top. After the action has ceased, in consequence of the converting materials being expended, the steel is tapped out, and made use of in any suitable way. Refined iron, for the manufacture of malleable iron in the puddling furnace, may be made by the use of about 3 per cent. of nitrate and 6 per cent. of peroxide of iron. Steel by 8 to 10 per cent. of nitrate and an equal weight of binoxide of manganese. Malleable iron by 8 per cent. of nitrate and 20 per cent. of peroxide of iron. In each case iron with 5 per cent. of carbon being used.

But it was often suggested to me that the use of separate and special apparatus is objectionable, on account of its expense, as manufacturers are generally averse to any large outlay upon new processes; and that some mode of applying it to the ordinary puddling furnace would be very useful. But there was this difficulty to contend with, the puddling furnace is too hot for the introduction of the converting materials, and fixing them at the bottom, and could this be done they would be decomposed before the fusion of the iron could be commenced, to say nothing of their remaining till it could be melted, so as to allow the gases evolved to rise and act through the fluid metal. I get over this difficulty as follows:—I make the converting materials into blocks or balls, and fix them on the ends of iron rods. These balls being made hard by drying, are ready for use. When the iron is fused in the puddling furnace, and the boil has commenced, one of these balls is pushed to the bottom of the metal in the furnace—the products of its decomposition rise through the metal, causing rapid agitation, which is much more effectual than that produced by the puddler with his tools. After the ebullition has ceased, the rod is withdrawn and another put in its place. The time occupied in puddling is thus very much shortened, the labour very much reduced, fuel saved, and a better yield of metal obtained, in consequence of the soda forming a base which readily combines with the silicic and phosphoric acids eliminated from the iron. In the ordinary puddling operations the silicium and phosphorus are extracted, the previous formation of oxide of iron, with which those acids, which are also products of oxidation, combine. But when silicium and phosphorus are reduced to a somewhat small proportion of the whole, the last traces of them are removed with difficulty, still the powerfully basic character of the soda intensifies the disposition of these substances to separate from the iron, and to enter into combination with itself.

The malleable iron produced from cast iron which has been treated with nitrates is of a very superior quality, having great range of temper. The same metal which by gradual cooling is fit for purposes requiring great toughness and powers of endurance of bending and torsion, may by rapid cooling be made sufficiently hard for wood-cutting tools; and its freedom from impurities is shown by the remarkably thin scale formed when the iron is worked by the smith, and the consequently small amount of loss in working. In this respect it very much resembles the best charcoal iron, and contrasts very remarkably with the iron made from the same "pig," but which has not been previously treated with nitrates. The presence of silicium causes a large amount of waste when malleable iron is exposed to the atmosphere at high temperatures, causing a thick, heavy scale, which must contain at least 70 per cent. of iron.

THE CHASSEPOT-RIFLE.

AN officer of Northern Germany, who visited the camp at Chalons, publishes in the "North German Gazette" the following observations on the Chassepot: "It is now idle to ask if this weapon is superior to the Prussian gun; the question at present is, to what extent that superiority could be injurious to us in case of a war with France. That depends on the precision with which the arm may be used; but the natural vivacity of the French, and their deficiency in the patience which the Germans possess, will be a great obstacle to the acquisition of that perfection. During my stay in the camp I observed that the troops who, with the exception of the Chasseurs, were all armed with the new musket, showed in its use a want of certainty, which is besides easily understood. However, it would be madness to attempt to conceal the superiority of this firearm. In facility of loading the Chassepot is superior to any other system at present known. The number of rounds which can be fired in a minute is—on the Dreyse system, 5; Snider and Joslyn, 6; Milbank, Remington, Richler, and Chabot, 7; and for the Chassepot, 8. The other qualities of this musket are: Its weight is not great (8½lb. the small bore), and, which is more important, the flight of the projectile forms a low trajectory. The latter quality, conjointly with the facility of loading, is especially important in firing by command and at will; in one word, in every case wherh the mass of balls is the essential and where the musket which fires most is the best. The Chassepot is lighter, and its work is much more elegant than that of the needle gun; that is why it is in complete accord with the views of the French soldiers; but it affords less resistance than others to long use in rainy weather."

The officer who wrote the above letter is rather at fault in some of his figures, as the following table of results of firing at the trials of breechloaders at Woolwich last summer show:—

Joslyn	12	shots in 47	seconds.
Martini	12	„ 48	„
Fosbery	12	„ 50	„
Remington	12	„ 50	„
Burton No. 1	12	„ 57	„
Henry	12	„ 57	„
Albini and Braendlin	12	„ 61	„
Burton No. 2	12	„ 62	„
Peabody	12	„ 63	„

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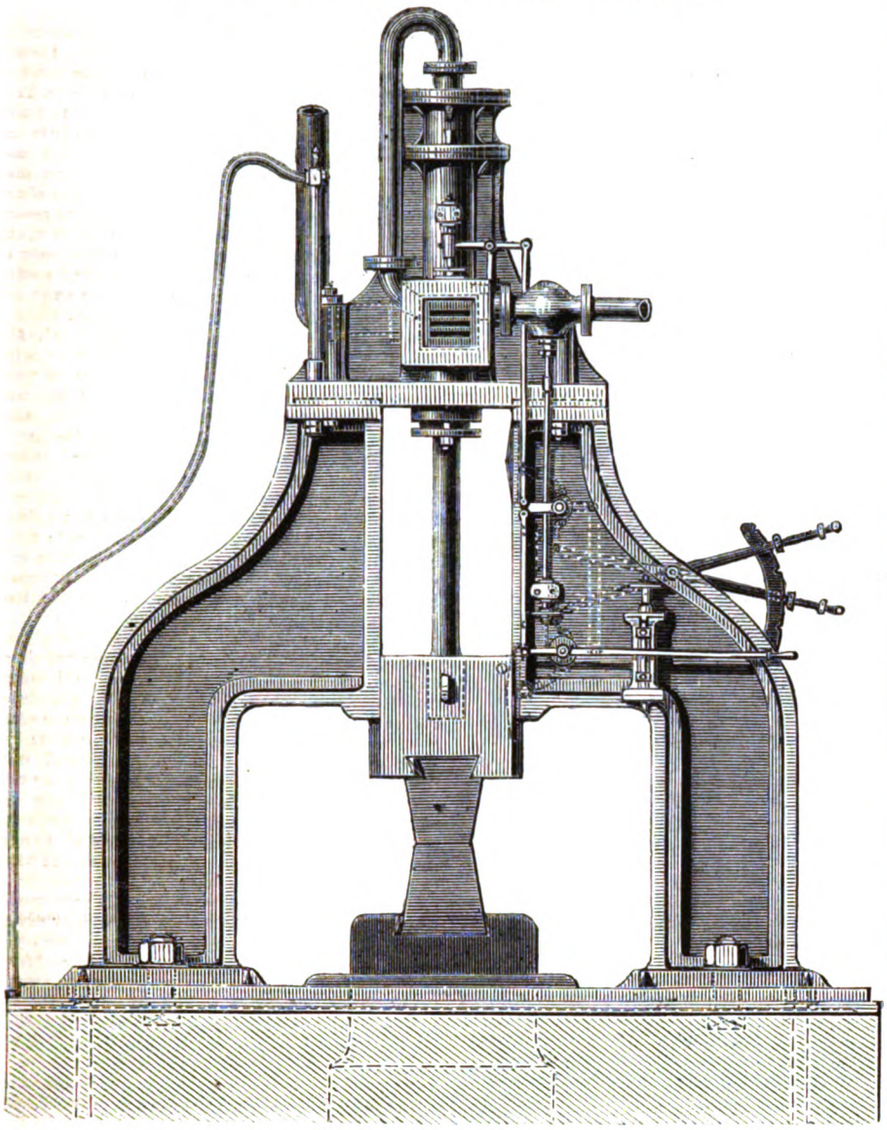
DOUBLE-ACTION SELF-ACTING STEAM HAMMER.



DOUBLE-ACTION SELF-ACTING STEAM HAMMER.

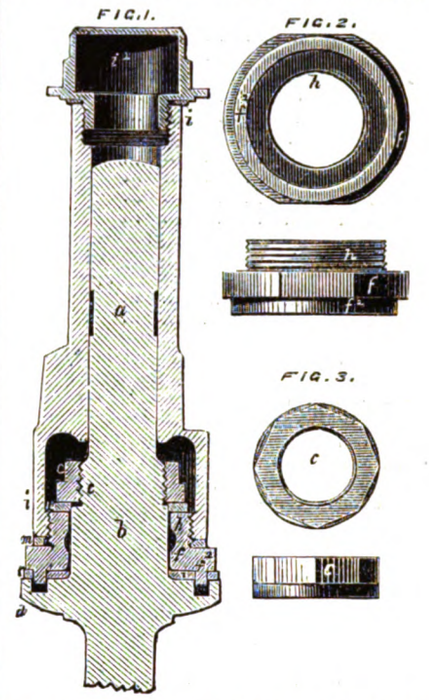
WE illustrate above a neatly finished one-ton steam hammer, exhibited in Paris by Messrs. Vanderelst and Co., a Belgian firm of good standing. The casing shown on top of the cylinder contains a loose piston with a short stud projecting downwards to meet the centre of the working piston at the end of its up-stroke. This "floating piston," as it is called, has its upper surface in constant communication with the steam, and thus serves as a cushion against which the hammer piston strikes when working full stroke. This is an arrangement not uncommon abroad, but can only be considered as a makeshift to save the necessity of good valve gear. The general design of the hammer and the hand and self-acting gear, which are at opposite sides of the frame, will be seen from our engraving. The price quoted for it was £300.

ARTILLERY EXPERIMENTS AT FORTRESS MONROE.

OUR readers doubtless remember the artillery experiments which were carried out by the United States Government about a year since at Fortress Monroe, and particulars of which were published by us. We have now to hand details of another series of experiments much more extensive than the last. In those, plates of wrought iron were fastened in front of a section of a fort, and 12-in. and 15-in. rifled Rodman guns were fired at them. Nearly every shot penetrated, and some went entirely through the protecting plates of iron four inches thick, and only a few shots were fired before the granite wall behind them, varying from 8ft. to 12ft. in thickness, and strengthened with stout iron girders and bolts, became a crumbling ruin. At this point the experiments of 1866 ended, but from the extensive preparations made more definite results are expected from the new experiments, which are probably being carried out at the present time. Sections of three forts, which are fac-similes of casemates of Fortress Monroe and two other works near the mouth of Chesapeake Bay, Fort Carroll, and Wool have been erected. These three works are regarded as the strongest American fortifications, and the same varieties of stone and cement have been used, and their forms exactly imitated. The walls are strengthened with iron bolts and girders, and vary from 7ft. to 12ft. in thickness; the average width and height of the surfaces fronting the guns are about 24ft. each. Plates of wrought iron similar to those used in the last experiments are being placed on these surfaces. Targets for getting the range of the guns, and an electric telegraph for ascertaining the initial velocities of the shots, have been erected. In addition to the casemates, there has been built a heavy cemented stone wall, 2ft. thick and 10ft. high, with sand packed in front for a distance of 18ft., the object being to ascertain the resisting power of this species of fortifications against the same guns and projectiles that are to be fired at the casemates. Three shots from a 15-in. smooth-bore Rodman gun have been fired at this wall. These shots were fired with a solid round shot weighing 640lb., and charges of 100lb. of powder. The gun was 200 yards from the front of the sand bank, and the initial velocities of the three shots varied from 1,500 to 1,600 feet a second. None of the shots penetrated the wall, but they showed a very sensible effect upon it. The first shot put it three-fourths of an inch out of a plumb-line, but did not crack it in the least; the second shot moved it an inch and a quarter further out of plumb; and the third shot an inch further, the three combined causing three inches deviation in the wall, though at the end of the third shot it was still without any crack. A new projectile, called "Taylor's projectile," is to be tried with others in the experiments. This is a compound of steel and chilled cast iron, and its form varies as it is made either with a square, a cup-shaped, or a conical face. It is described as a sub-calibre steel bolt shot encased in an iron jacket, and the advantage claimed is its greater power as a penetrative shot.

WATKINS' CARRIAGE AXLE.

THE annexed engraving illustrates an improved carriage axle, patented by Mr. John Watkins, of Balsall Heath, Worcester. Fig. 1 represents in longitudinal section a portion of a carriage axle constructed according to this invention, figs. 2 and 3 being parts of the same. *a* is the arm of the axle; *b* is the cone or front collar; and *d* is the ordinary or back collar; *c* is a flanged nut screwed internally, this nut being screwed upon the screw *e* made on the arm *a* of the axle. Upon the cone or front collar *b*, and between the flanged nut *c* and back collar *d*, is a revolving collar. This collar is provided with an internal flange f^2 which works in an annular groove *g* in the back collar *d*, as seen in the section fig. 1. The revolving collar *f* has an external screw *h*, upon which the wide open end of the screw box *i* is screwed. The flanged nut and revolving collar have left-handed threads for the left-hand arm of the axle, and right-handed threads for the right-hand arm of the axle. The revolving collar *f* is represented separately in side and front elevation respectively in fig. 2, and the flanged nut *c* is represented separately in side and front elevation in fig. 3. Leather washers *k l* are interposed between the flanged side of the revolving collar *f* and inner side of the back collar *d*, and a leather washer *m* is also interposed between the end of the axle box *i* and the revolving collar *f*. A leather washer *n* is also placed between the flanged nut *c* and outer end of the revolving collar *f*.



In arranging the parts on the arm *a* of the axle, the revolving collar *f* with its washers *k l* is first placed upon the cone or front collar *b* of the axle, its flange f^2 being engaged with the annular groove or channel *g* in the ordinary or back collar *d*. The flanged nut *c* is next screwed upon the screwed part *e* of the arm *a*, and the flange of the nut is made to bear firmly against the revolving collar *f*, the washer *n* being placed between the parts. The revolving collar *f* is thus securely fixed to the arm of the axle, the collar on revolving working or bearing between the flanged nut *c* and the ordinary or back collar *d*, and also working upon the cone or front collar *b*. The axle box *i* is finally screwed upon the screw *h* of the revolving collar, and thereby secured to the collar and to the arm of the axle, the axle box *i* on revolving carrying with it the revolving collar. The outer end of the axle box *i* is closed by an ordinary screw cap i^2. In addition to the flanged nut *c*, a collet or a screw, or lock nut, or a cross pin or cotter may be used to secure the flanged nut in its place.

THE earthquake at St. Thomas has raised the expectations of several other islands as being more suitable stations for the mail packets. Among others, Grenada and Port of Spain have preferred their claims.

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ON THE COMPOSITION AND GAS-PRODUCING QUALITY OF TRINIDAD PETROLEUM.

By Dr. Anderson.

I HAVE carefully examined and analysed a sample of bituminous substance, sent to the Laboratory by H. P. Stephenson, Esq., for the purpose of determining its composition and applicability to the improvement of gas obtained from ordinary coal. The substance in question has a brown colour and somewhat bituminous smell. When heated it quickly catches fire, and burns with a smoky flame, leaving a bulky ash. As received it was very moist, and contained 23·65 per cent. of water. It was chiefly found in small hollows, varying from the size of a minute seed to that of a grain of wheat distributed through the mass. When at 202 deg. it was found to contain:—

Carbon	48·66
Hydrogen	6·03
Oxygen	3·59
Sulphur...	3·96
Nitrogen	0·67
Ash...	37·9
	100·00
Coke	49·69
Fixed carbon	12·60

Its composition as imported is:—

Moisture	23·05
Carbon...	37·44
Hydrogen	4·63
Oxygen	2·77
Sulphur...	3·05
Nitrogen	0·52
Ash	28·54
	100·00
Coke	38·24
Fixed carbon	9·70

When distilled at a high temperature for the production of gas, the yield and quality were found to vary with the heat, the quantity being largest when the temperature of the retort was highest, but the quality proportionately diminished.

The two following experiments, in the first of which a red heat was used, and in the second a temperature approaching a white heat, will serve to illustrate this:—

	Red heat.	Higher heat.
Cubic feet of gas per ton	6570	8736
Illuminating power when turned on the standard burner, consuming five cubic feet per hour ...	34 cndls.	26 candles.
Specific gravity	0·65	0·63
Quantity absorbed by bromine		14·7 per cent.
Grains of sulphur in 100 cubic feet of gas	6·58	

For the purpose of testing the effect of this bituminous substance in improving the quality of coal gas, I send a specimen of North Pelton (Newcastle) gas coal, which gives, when distilled alone:—

Cubic feet of gas per ton	10,752
Illuminating power	11 candles.
Specific gravity of gas	0·352
Absorption by bromine	4·07 per cent.
Grains of sulphur per 100 cubic feet of gas	0·704

This coal having been reduced to a coarse powder was mixed with the bituminous matter in the proportion of 4 to 1, and gas was made from the mixture. The results were as follows:—

Cubic feet of gas per ton... ...	10,080
Illuminating power	16·5 candles.
Specific gravity...	0·374
Absorption by bromine	5·66 per cent.
Grains of sulphur per 100 cubic feet of gas	1·43

I have also examined the effect of the bituminous substance on the gas produced from an ordinary Scotch household coal. I used for this purpose Lord Belhaven's Main coal, which was selected because a similar coal had been employed in experiments on Mackenzie's patent for improvement in the manufacture of coal gas. This coal, when distilled alone, gives:—

Cubic feet of gas per ton... ...	10,864
Illuminating power	6·5 candles.
Specific gravity of gas	0·389
Absorption by bromine	3·85 per cent.

Mixtures of this coal in the 20 and 10 per cent. of the bituminous substance were distilled for gas with the following results:—

Mixture containing 20 per cent. of bituminous substance.	Red heat.	Higher heat.	Ditto 10 p. c. Ditto.
Cubic feet of gas per ton.	9072	10,528	10,880
Illuminating power (candles)	14	10·5	7·5
Specific gravity of gas...	0·497	3·43	0·38
Absorption by bromine	6·6	5·3	3·3

In considering these results and the conclusions to be drawn from them, several matters merit attention. 1st. The bituminous substance, as imported, contains 23·05 per cent. of moisture and 28·54 of ash, amounting together to 51·59 per cent., so that less than half its weight consists of matter capable of yielding gas. A good Cannel coal contains about 90 per cent. of gas-producing matter, and gives in round numbers 10,000 cubic feet, having an illuminating power of from 25 to 30 candles. Had the bituminous substance contained no more than 10 per cent. of impurity, it would have yielded on the average upwards 14,600 cubic feet of gas with an illuminating power of 30 candles. It must, therefore, be considered an excellent source of gas; but, in importing it, it is very desirable that the purest and oiliest parts should be selected, so as to avoid as much as possible the expenditure incurred in transporting useless matter. 2nd. The substance contains a large quantity of sulphur, and it is, therefore, important that the best methods of purifying the gas obtained from it should be resorted to. In my experiments on the gas obtained from the bituminous matter used alone, the sulphur was reduced, by careful purification, to 6·586 grains per 100 cubic feet, but I believe that if the purifying apparatus be insufficient, it is probable that it may greatly exceed that quantity. 3rd. When used as a mixture with a Newcastle gas coal, it adds very materially to its illuminating power, raising it from 11 to 16·5 candles. A similar increase is produced in the illuminating power from an ordinary household coal, but in this case the quality of the mixed gas was not sufficiently high to admit of its being used with advantage. 4th. The quality of the gas obtained from the bituminous substance being affected by the temperature of distillation it will probably be found in practice that the best result will be obtained by distilling at a temperature not greatly exceeding a red heat. Looking at the whole of these results, I have no hesitation in saying that this substance may be advantageously employed for the purpose of improving the quality of gas, provided it can be imported at a sufficiently moderate price.

The only difficulty which is likely at any time to arise in the use of this bitumen, depends on the sulphur it contains, and the risk of a quantity of that substance remaining in the gas produced from it. This can only arise, however, from imperfect purification, my experiments having shown that the gas can have the sulphur very effectually removed from it.

I have examined also the quality of this substance in an oil-yielding material, but the results were not such as to encourage me to pursue the investigation into details. It yields, when distilled at the lowest possible temperature, a thick mixed and tarry-looking oil, having exactly the specific gravity of water, from which it cannot be separated in a satisfactory manner. It is well known that the value of oils obtained by distilling bituminous matters depends on their specific gravity being low. I am clearly of opinion that the produce of this substance could not compete with the oils obtained from shale and other similar minerals.

University of Glasgow, 19th November.

We have been favoured with the above interesting report by Mr. H. P. Stephenson, C.E., who enclosed with it the following copy of letter to the Directors of the Trinidad Petroleum Company, for whom the analyses were made, and which embodies the practical conclusions upon the subject:—Gentlemen,—In handing you reports on the gas-producing power of Trinidad bitumen from the Pitch Lake, made at my suggestion by Dr. Letheby and T. M. Keats, Esq., of London, and Dr. Anderson, of Glasgow University, I would draw your attention to the following practical conclusions to be derived therefrom.

1st. As to the high illuminating power of the gas. If the yield per ton of Boghead Cannel be taken at 130,000 feet of 35 standard sperm candles, that of Wigan Cannel at 10,000 feet of 22 candles, and that of Newcastle ordinary coal at 9,300 feet of 13 candles, then a mixture of 20 per cent. of Boghead with 80 per cent. of Newcastle ordinary coal would yield per ton 10,040 feet of 18·7 candle gas, and a mixture of 20 per cent. of Wigan Cannel with 80 per cent. of Newcastle ordinary coal would yield 9,440 feet of 14·9 candle gas. You will observe from the reports before you that with a mixture of the same proportions of Trinidad bitumen and ordinary Newcastle coal, according to Drs. Letheby and Keats, the yield of gas per ton was at the rate of 10,600 feet of 17·6 candle gas, and according to Dr. Anderson it was 10,080 feet of 16·5 candles, the difference between the two being accounted for probably by the use of West Leverson coal in the first instance, and North Pelton coal in the second. It will, therefore, be seen that the bitumen, as a gas-producing agent, is very superior to Wigan Cannel; in fact, to produce the same result, it would be necessary to increase the quantity of Wigan Cannel to nearly 50 per cent. The result also approaches and very nearly equals that obtained from Boghead.

2nd. According to Dr. Anderson's report, the effect produced by a mixture of the bitumen with coal-producing gas of low illumination is very marked. A mixture of 20 per cent. of bitumen with 80 per cent. of Lord Belhaven's Main coal distilled at a red heat, producing 9,072 feet of 14 candle gas, thus rendering useful for the production of gas coal which, carbonized alone, is at present unfit for that purpose.

3rd. As regards the sulphur in the gas, it is to be observed that the purification on a large scale of working will be much more perfect (particularly where scrubbers are used, and the gas is washed with ammoniacal liquor), and it is probable that the quantity found by Dr. Letheby may be considerably reduced.

4th. The price of Boghead being at present about 55s. and Wigan Cannel 27s. per ton in London, looking at the above results the bitumen ought to meet with a ready sale for gas purposes at from 45s. to 50s. per ton, particularly when it is remembered that it may be carbonized with ordinary coal without any deterioration to the coke, and there is no refuse to cart away, as is the case with Boghead. This price would of course be increased if the material could be imported, as suggested by Dr. Anderson, with less moisture than 23·05 per cent.

Under these circumstances I should recommend you to import a carefully selected carp as dry as possible from the Pitch Lake, in order that you may be in a position to supply quantities of from 25 to 50 tons, which will enable any gas company to give the material a good trial on a fair scale, and to satisfy themselves as to the beneficial result to be obtained.—I am, Gentlemen, your obedient servant, (Signed) H. P. Stephenson,

Mem. Inst. Civil Engineer.

15, Abingdon-street, Westminster, Nov. 23.

THE PARIS OBSERVATORY.

THE question of the expediency of removing this important establishment to some more eligible place is now engrossing the attention of the Academy of Sciences. At last week's sitting, M. Yvon-Villarceau read a long paper on the subject, in which he showed that the present building did not even contain decent accommodation for the astronomers who inhabited it, independently of which the murky atmosphere of the capital, and the constant oscillation of the ground, owing to the increasing circulation, rendered all delicate observations impossible. Of these, one of the most difficult is the determination of the exact vertical line, that passing through the zenith and nadir. This is effected by means of a bath of pure mercury, which receives the reflection of the thread required for the purpose. The slightest motion evidently causes the mercury to vibrate but so long as the vibrations are not strong enough to cause the image to get confused, they are not of much importance. It was at first attempted to place the mercury bath on one of the piers supporting the mural circles; but it was soon found that there it oscillated much more than it did on the floor. In order to prevent the vibrations caused by the passing of vehicles, al the streets adjoining the ground belonging to the Observatory were macadamized; but it then became apparent that these vibrations were much less owing to the circulation of vehicles in the immediate vicinity than to that going in the more distant quarters; so that at present it is impossible to observe the nadir before one o'clock after midnight. The noise of the city is another unfavourable circumstance, causing vibrations in the atmosphere, which, coupled with the effects of the gas lamps, render every image so indistinct that the astronomers are precluded from using any magnifying power exceeding 500. Having thus

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stated the inconveniences resulting from the present situation of the Observatory, M. Yvon-Villarceau proceeds to examine whether the establishment ought to be removed, and concludes by recommending the place now occupied by the windmills at Fontenay-aux-Roses, situated south-west of Paris. The sale of the present ground of the Observatory would produce between four and five millions of francs, which would be quite sufficient to defray all the expenses, and even leave a surplus.

RAILWAY CARRIAGE LOCK.

THIS lock is intended for the better protection and quicker facility of fastening doors; and more particulary carriage doors, and prevents any wear and dithering so often met with in the locks now in use. In our engraving, fig. 1 is a front view, fig. 2 a side elevation, and fig. 3 a plan of this lock. The tongue 1 is kept in its position by the spring 2 after entering the slot 3 in the striking plate 6, the catch 4 keeping the tongue in its place by the spring 5. In the event of either of the springs 2 and 5 breaking, or even

FIG. 1.

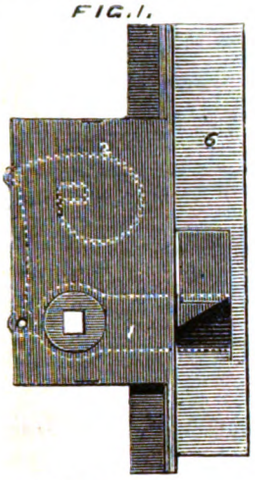


FIG. 2.

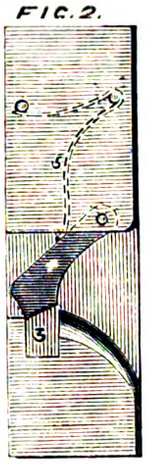
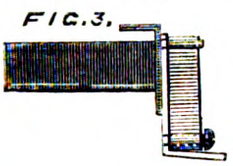


FIG. 3.



both becoming damaged, the door will be secured by the tongue being kept in the slot. The lock latch has this advantage over the present carriage door locks—the person inside can fasten the door by pulling it to, without the trouble or danger of putting his hand outside to turn the handle. It is also more durable than the locks now in use, having the tongue kept fast by the catch, so that there is no friction on the striking plate nor on the tongue. This lock is the invention of Mr. S. J. Campling, carriage foreman, of the Great Northern Railway (King's-cross Station), on which line the lock is being successfully used.

RAMSBOTTOM AND PEARCE'S IMPROVED TURBINES.

MR. JOHN RAMSBOTTOM, of Leeds, the well-known hydraulic engineer, has lately patented, in conjunction with Mr. T. M. Pearce, of Bradford, some improvements in turbines. These improvements comprise two arrangements, one intended to work water-tight and under the influence of pressure, and the other as an improved turbine or turbine meter working by the velocity of flow. The water engine is best adapted for pressures of 100ft. upwards, and the other for pressures from 100ft. downwards, the object being to adapt the machinery to he circumstances so as to enable the use of water te t more widely extended with advantage for purposes of motive power. The distinguishing character of this turbine consists in the more complete manner in which the principle of opposite action and reaction are obtained, so that the yield of mechanical effect will be the greatest obtainable from velocity of flow.

The inventors construct a circular vessel, inside which they place a hollow girdle with slotted apertures or jets tapering towards its inner circumference; into the cavity of this girdle the water first passes from the supply pipe, and is intended by means of the jets or slots to dispose the fluid to strike upon

RAMSBOTTOM AND PEARCE'S IMPROVED TURBINES.

FIG. 1.

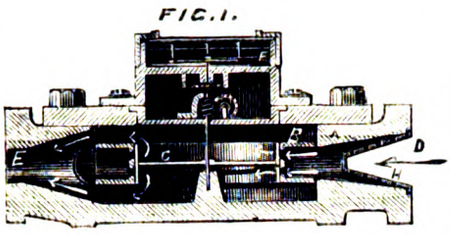


FIG. 2.

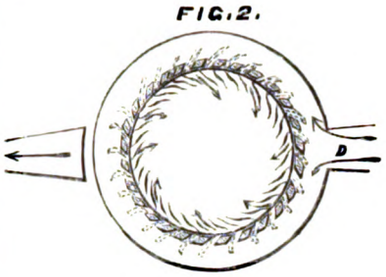


FIG. 3.

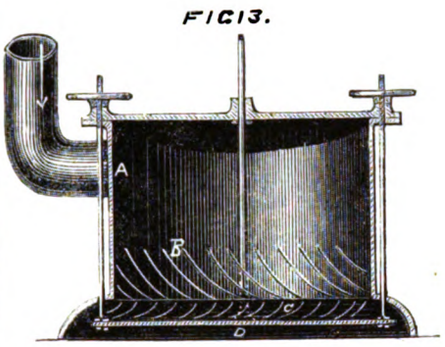


FIG. 4.

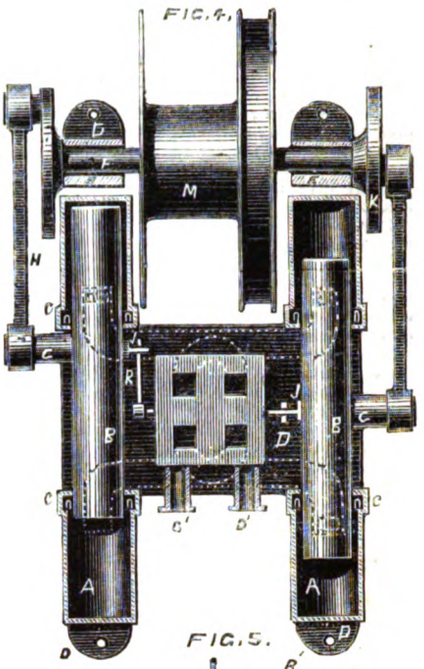


FIG. 5.

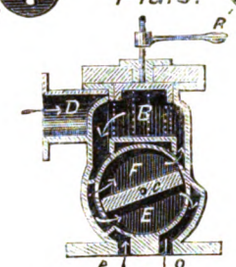


FIG. 6.

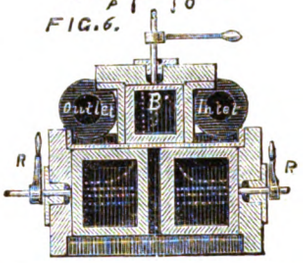


FIG. 7.

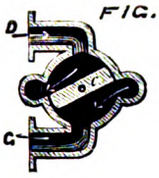
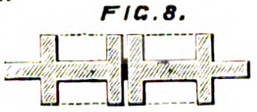


FIG. 8.



vanes constructed near to the periphery of a wheel arranged to work within the girdle without being in contact with the same. The vanes of this wheel or turbine are of such a form, relatively to that of the jets of the girdle, that the fluid in issuing therefrom upon these vanes shall be diverted in a direction almost directly backwards, and by the forces of action and reaction operative in the fluid, the wheel is thus caused to be driven round on its shaft with greater effect than if less diversion of the current were obtained.

In our engraving, fig. 1 is a vertical section of the turbine as applied mainly for measuring water, showing the inlet orifice D and the outlet orifice E. The casing A is circular and turned out to receive the girdle B, which is also turned on its inner circumference to receive the turbine wheel C, the shaft of which passes upwards to work the indicating mechanism in the box or case situated on the cover of the meter. Fig. 2 is a diagram of the girdle jets and turbine vanes, showing the direction and manner in which the water operates in passing through the instrument. The indicating apparatus is of the usual construction, the fluid enters the turbine in the direction of the arrow D, and passing first through the dirt protector H, and then through the taper jets or slots shown by dotted lines, impinges on the vanes affixed to the turbine disc, giving motion thereto as well as to the shaft and recording apparatus of the meter. The water enters the interior of the turbine wheel on both sides of the disc (as shown by the arrows) and escapes by two orifices leading to the outlet E; this property is important, as it tends to preserve an equilibrium of pressure on the turbine, thus enabling it to perform its duty with greater sensitiveness and freedom from friction.

Fig. 3 is a turbine arranged exclusively for purposes of motive power, and more particularly for low falls or pressures. The novelty here is in the arrangement rather than in the form of this turbine, and more especially in the construction and application of the regulating disc D, which is placed beneath the instrument and arranged to be raised or lowered by rods connected therewith and proceeding to the upper framing of the turbine case, and therg worked or adjusted by screws and wheels actuated either by hand or by an ordinary governor. The outlet or discharge is restricted when this disc is brought nearer to the outlet vanes of the turbine, and its reactive direction is also improved thereby. The object of the regulating disc is to restrict the quantity of water flowing from the turbine when the supply falls short of its maximum amount, instead of restricting the quantity leading to the turbine, as is usually done. And this method of diminishing the outlet orifices utilizes more thoroughly the full effective pressure with varying quantities of water, as well as regulates the speed of the turbine. The fluid enters the casing A and is caused to take a circular direction by the guide vanes B previous to impinging on the turbine vanes C, from whence it issues in an horizontal direction across the edges of the disc D and outwards.

In constructing the hydraulic engine to be worked by pressure, four cylinders are cast on a bed-plate, two at each end, parallel with each other, and in a line with the two opposite cylinders. In each pair of cylinders a ram is placed of sufficient length to extend from one cylinder to the other so as to work within these cylinders. These rams are made water-tight by means of packing rings placed in recesses near to the cylinder covers, and on the rams betwixt these covers are fixed stud pins, to which connecting rods are attached, to give motion to a pair of cranks on a shaft at the extremity of the bed-plate, as well as to work the valvular apparatus. The cranks are constructed at right angles to each other, and the valve box is placed in the middle of the bed-plate betwixt the four cylinders. This valve box is cylindrical, and contains two valves worked from each end of the box by rocking levers driven from projections fixed on the rams. In this valve box at each end are four passages, these passages lead downwards through four corresponding holes in the bed plate, and communicate with each end of the four cylinders respectively

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The valves are somewhat similar in appearance to an ordinary plug tap, being cylindrical, with a divisional midfeather to separate the feed from the exit side. Fig. 4 is a plan of the engine showing the four cylinders A with rams B contained therein. The glands C contain cupped leathers or the usual hydraulic rings to form the water-tight connexion at those points. The bed-plate D extends lengthwise beneath the cylinders to the journals E, carrying the shaft in one direction, and in the other to the opposite extremity of the cylinders. G, are the stud pins; H, the connecting rods; K, the cranks, and H, the rocking lever for the valves. M is a view of a winding drum and break pulley, as used for colliery and other purposes.

In the centre of the bed-plate is shown a square surface containing four orifices; upon this surface the valve box is fixed, and it will be seen from the dotted lines that the passages leading to the respective cylinders cross each other, causing the valves situate at one side of the valve box to communicate only with the cylinders situate on the opposite side; two of these cross passages being constructed on the upper surface of the bed-plate leading to the rams, and the other two cross passages being constructed beneath the same so as not to intersect each other. By these means the ram which is for the time being passing its centres has its valve worked by the opposite ram, which at this time is in full effect. D and G are the inlet and outlet passages to the valve box. For the purpose of a winding engine and for various other uses it is very important that the motion should be readily reversed; and this engine as constructed admits of the accomplishment of this object, without the link motion or other eccentric valve gear as usually applied by an additional reversing valve which is arranged to change the direction of the fluid leading to and from the working valves or those immediately communicating with the rams by means of a reversing lever to be worked by the attendant.

Fig. 5 shows an end section of the valve box; figs. 6 and 7 are views of the valvular arrangement. B, a longitudinal section of the reversing valve; C, an end section of one of the working valves, of which fig. 8 shows a transverse section. On the supply of water through the inlet pipe D (figs. 5, 6, and 7), it passes through the reversing valve in the direction of the arrows downwards, and through the chamber E; fig. 5 of the working valve to the port O leading to the cylinders and giving motion to the rams communicating therewith, the fluid leaving the opposite ends of which returns through P upwards and across the chamber F and thence through the reversing valve to the outlet pipe G. The reversing and working valves are similar in construction, and it will be seen that if a rocking motion be imparted to them, by bringing the midfeather C of these valves over the opposite portways, it will change the direction of the fluid thereby from one end of the rams to the other end, or from one side of the working valve to the other side thereof, as the motion is changed in either the reversing or the working valve to effect these objects.

SOUTH KENSINGTON MUSEUM.

IN addition to the attractions offered to visitors during the Christmas holidays by the collections at the South Kensington Museum, the Committee of Council on Education have, says the "Society of Arts' Journal," pushed forward the arrangements for the exhibition of the purchases made at the Paris Exhibition, which have recently arrived in England. These latter, as well as some valuable loans, have been temporarily placed in glass cases, and opportunities during the holidays will be thus afforded to the public to view these treasures. The loans acquired from the gallery of the "Histoire du Travail" at the Paris Exhibition, although not numerous, are of a highly interesting character, not only from their being extremely curious and rare as works of art, but chiefly from the fact that they are the property of foreign governments. A most admirable system of international intercourse with foreign powers in relation to works of art may be thus said to have commenced. In the Loan Court are to be found the Crystals lent by the Austrian Government. They consist of five pieces; one piece, standing about 3ft. high, is handsomely carved, and for size is the most important. The enamelled gold work which surmounts the crystal is a delicate piece of execution; and the vase with two handles, richly cut, is a marvel of skilful and dexterous workmanship. Without the evidence of the presence of this vase it would be hard to conceive that any workman could have, out of a simple rock crystal, produced so charming a result. In the case next to the crystals are shown curious specimens of very ancient gold work, discovered at Petrossa, in 1837, and lent to the museum by the Roumanian Government. The date assigned to their origin is about 450 A.D. The work is considered as probably that of Gothic tribes, and the style of the design is called Byzantine. The shapes of the objects, the setting of the stones, and the remarkable pierced work, should be carefully inspected. The largest piece is a salver, about 2ft. 3in. in diameter, with a somewhat rudely stamped ornament round the circumference. A patera is in a good state of conservation, and is, apparently, a capital illustration of the style of art employed at that period for gold work. Adjoining the Loan Court is a portion of the museum assigned to purchases, and here, under glass cases, at the north end of the court, may be found the purchases made from the Paris Exhibition. Of the principal purchase, exquisitely carved and inlaid with precious stones, the spinette by Anniballi de Roxis, Milan, 1577, standing by itself. As a work of art it is unrivalled in the museum. Next to it, but of a totally different genre and date, is the famous inlaid and sculptured wooden cabinet by M Fourdinois, which elicited so much admiration from visitors to the Paris Exhibition. The Italian peasant jewellery, bought from Signor Castellani (through whose means the spinette referred to was likewise acquired), occupies four cases, and has much interest forour jewellers, who would do well to adopt many of the elegant designs to be found in this collection. There is a small assemblage of musical instruments of foreign countries. This, however, is but a part of what was purchased at Paris. The instruments from Japan and China are very eccentric. Beyond this case are specimens of Turkish popular jewellery, and a Norwegian marriage crown. The form of the Danish silver parcel-gilt drinking-vessel is curious, but seems awkward. It is of modern execution but of ancient design. The artistic fans, from the atelier of M. Alexandre, are well represented by eight elegant examples, of which the more noticeable ones are by Messrs. Alexandre, Froment, Frossoy, and Regina. Opposite the inlaid cabinets from Copenhagen stands a very fine vase, of French manufacture, in modern enamelled earthenware, of Persian design, by M. Collinot. The style of this piece of pottery is excellent. A collection, comprising chiefly modern French porcelain, German glass, Austrian ormolu, and French bronzes, complete the artistic purchases from the Paris Exhibition. In the north great court some very accurately working models of mechanical contrivances, cog-wheels, pistons, &c., &c., by Von Schröeder, of Darmstadt, are exhibited temporarily.

Correspondence.

THE SQUARE OF THE CIRCLE, AND "THE GREAT PYRAMID OF GIZEH."

LETTER VII.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—It is only necessary for me to say in reply to the letter of your correspondent, Mr. Wm. Hayden, in your issue of 6th current, that if he will persevere he can divide geometrically, and put together mechanically, the four spandrils, or right-angled triangles E, and the square F I G H in diagrams 7 in my letter No. III. in your columns of October 18th last, as two squares each exactly equal to F I G H. When he has accomplished this, if he then doubts the conclusiveness of the truth that the square contents of a circle is 4-5ths of its tangent square, I shall be glad to hear his reasons.

To resume the thread of my letter No. VI., on the subjects which head this letter, I will now give the measurements and angles from Colonel Howard Vyse's work on the "Pyramids of Egypt," which bear reference to and contain indubitable proof of the geometrical and astronomical objects of the origin and structure of the oldest type of them all, the Great Pyramid at Gizeh of Suphis I.

This Pyramid has four sides facing directly the true four cardinal points of North, South, East, and West. Each side at the base of the Pyramid, including the casing stones, had a length of 764 British feet from corner to corner. Two of the casing stones which originally covered with a smooth polished surface the whole four exterior faces of the Pyramid from a pointed apex at the summit of the Pyramid to the base of each of the four faces fronting the four cardinal points as already stated, were on May 12th, 1837, discovered *in situ* by Colonel Howard Vyse. His journal runs as follows:—(Vol. I. page 261.) "After having gone round the several works, I was sent for about two o'clock to the great Pyramid, as the casing stones at the base had been discovered. The size and angle of the building could therefore be exactly determined, and all doubts were removed respecting a revetment. Two of the blocks were in their original position, nearly in the centre of the Pyramid. Their dimensions were taken by Mr. Brattel, and the angle was 51 deg. 50min. They were quite perfect, and had been hewed into the required angle before they were built in, and had then been polished down to one uniform surface; the joints were scarcely perceptible, and not wider than the thickness of silver paper; and such is the tenacity of the cement with which they are held together, that a fragment of one that has been destroyed remained firmly fixed in its original alignment, notwithstanding the lapse of time, and the violence to which it had been exposed. The pavement beyond the line of the building was well laid, and beautifully finished; but beneath the edifice it was worked with even greater exactness, and to the most perfect level, in order probably to obtain a lasting foundation for the magnificent structure to be built upon it. I consider that the workmanship displayed in the king's chamber in this pavement, and in the casing stones, is perfectly unrivalled; and there is no reason to doubt that the whole exterior of this vast structure was covered with the same excellent masonry."

I have made this rather long quotation, to bring distinctly before the minds of your readers the great and unaltered accuracy of the work in the Pyramid, and the careful description of its exact position by Colonel Vyse. The next measurement given by Colonel Vyse is the perpendicular height of the Pyramid by the combined elements of a square base of 764ft. on each side, and the casing stones of an angle with the horizon of 51 deg. 50 min. This height he gives as distinctly as possible as 480ft. 9in. I need scarcely tell your readers that with such elements of base and angle, the height of the Pyramid was and could be nothing else than 480ft. 9in. At all events, let them project these measurements in 30ths of an inch on elephant drawing paper, and they will soon satisfy themselves.

It is not easy to understand, under the stated circumstances, that the three gentlemen, Messrs. Taylor, Smyth, and James, whom I referred to in my last, should err so egregiously—if it be error—as they do. Mr. Taylor writes as follows:—(Page 19, paragraph 17.) "The angle of the casing stones being 51 deg. 50 min., and the base 764ft., would give for the perpendicular height, supposing the Pyramid ended in a point 486ft.;" and this, after having in the previous paragraph quoted Colonel Howard Vyse's height as 480½ft. What do your readers suppose this wresting of hard fact is for? We have it in paragraph 20, page 22, as follows:—"And this proportion, if our theory be true, would be half that of the diameter of a circle to its circumference, which is stated in the table of constants to be that of 1 to 3.1415927. We may reasonably expect that the Great Pyramid, in its actual measure, as it is now here recorded, would exhibit some approach to this proportion." So far Mr. Taylor. Now for Mr. Smyth. In page 322, Vol. II., under the guise of fair dealing and candour, he writes as follows of Colonel Howard Vyse and Mr. Perring:—"We have, indeed, been obliged to point out in more than one instance, such as that of the height of the present Pyramid, that their numbers are by no means always so correct as they might be;" and in page 323, Vol. II., Mr. Smyth absolutely gives as Colonel Howard Vyse's measurement of the angle of the casing stones, what is not in all Colonel Howard Vyse's work, viz., "angle of casing stones 51 deg. 52 min. × ∞ seconds."

Next, Colonel James, in the "Athenæum" of November 16, 1867, page 650, writes as follows:—"I find that a pyramid having a square base, and a rise at the four corners of 9 parts in 10, has the exact proportions of the Great Pyramid. The side of the square being 764ft., the diagonal is 1,080ft., the half of which is 540ft., from which, deducting 1-10th = 54, we have 486ft. for the height of the Great Pyramid; and this is the exact height given by Vyse. In the Great Pyramid these dimensions are 486 × 2 × 3.1416 = 3053.6ft. 4 × 764 = 3056ft."

Is it not lamentable to see men like these, it would seem, deceiving themselves, and trying to deceive others. At all events, misquoting and wresting the plain straightforward statements of undeviating truth in the pages of Colonel Howard Vyse's work; and for what? That they may continue to ride the miserable jaded Hypophthegm, that the ratio of the diameter of a circle to its circumference is 1 to 3.14159, &c.

I will here condense the data in Colonel Howard Vyse's work, from which I shall in my next elucidate and describe by diagram the beautiful geometrico-astronomical truths they enable the mind to grasp, in the consideration of the Great Pyramid of Gizeh. They are—

1. The base a square of 764ft. on each side.

2. The angle of the exterior face of the casing stones 51deg. 50min. with the horizon from that base.

3. The perpendicular height of the Pyramid from centre of base to apex when perfect, from elements 1 and 2, 480ft. 9in.

4. The angle of the entrance passage 26deg. 41min. with the horizon.

Other data respecting the interior of the Pyramid and its pavement will be quoted when I proceed to

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the numerical portion of my proof of 7 as the basis of the structure. Requesting your readers to test the truth of those already given in the interest of true science,—I am, Sir, yours, &c.

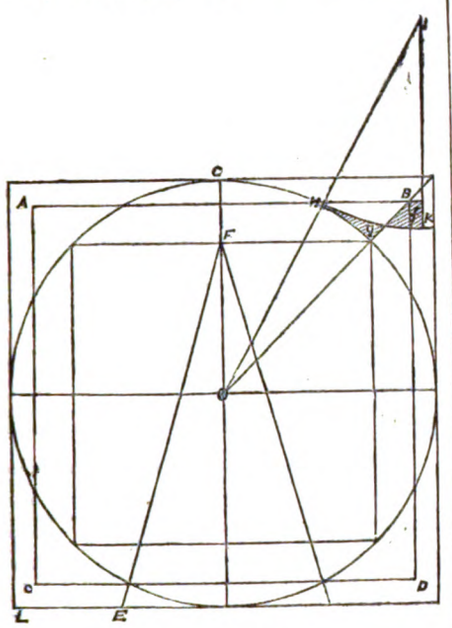
WILLIAM HARVEY.

London, December 19, 1867.

SQUARING THE CIRCLE.

SIR,—I am much surprised to see that Mr. Harvey, after having been proved to be wrong, should still persist in being right, when his error is so glaring that anyone having the slightest knowledge of geometry may easily detect it at first sight. With reference to the method of finding the circumference of the circle as mentioned in my last letter, I have no doubt your other correspondents have found it almost exact. Supposing that way to be correct, the nearest figures I can get to represent the ratio of the diameter to the circumference are—7 1-8th to 22 3-8th, or 57 to 179. I stated in my first letter that I had found the area of a circle 36 feet in diameter to be 1,014 feet and a fraction, but I have since found that the mean of four admeasurements by the way therein described gives just over 1,012¼ feet; and, supposing the side of the square of that circle to be equal to 5-4ths of the side of the inscribed square, or, what is the same thing, 5-8ths of the diagonal of the tangential square (see diagram to letter No. 2), the area of that square would be exactly 1,012½ feet. I have also put a square of the above-mentioned ratio to the same test as I did Mr. Harvey's demonstration (see diagram No. 1 in first letter), and I find it extremely difficult to tell which is the larger of the two spaces corresponding to *f* and *g* in that diagram; and it is certain that if the circle is squared those two spaces will be equal to one another.

The accompanying diagram illustrates what I



have just stated, the two shaded spaces corresponding to *f* and *g* in diagram No. 1, letter No. 1 (the letters O G H and I H K being equal). This diagram requires very careful drawing, otherwise it will be a failure. I may remark, as a somewhat curious coincidence, that if the line E L be drawn, the distance E L being one-fourth of the side of the tangential square, that line apparently crosses the circle at the point of its intersection by the side of what I will call, for the sake of illustration, the square of the circle A B C D at H. As I have not such confidence in my abilities as Mr. Harvey has in his, I do not pretend to have done that which is generally considered impossible, viz., the geometrical quadrature of the circle; but I think I have shown that the square whose side is equal to 5-4ths of the side of the inscribed square, or 5-8ths of the diagonal of the tangential square of any circle, is very nearly the square of that circle. Hoping that my humble efforts may not be uninteresting to the readers of the MECHANICS' MAGAZINE. I am, yours, &c., WM. HAYDEN.

Kent-street, Chichester, Dec. 21, 1867.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10s. half-yearly, payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later tqan 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—Messrs. M. and W.—A. R.—R. B. P.—W. P. M.—A. B.—G. E. P.—J. A.—W. H. H. P.—G. S., jun.—T. C.—J. M.—R. K.—J. R. T.—T. H.—J. T. L.—C. D.—B. K.—R. B.—S. R. B.—J. R.—T. B.—S. T. E.—G. D.—B. R. J.—A. H.—G. R. P.—S. L.—Messrs. H. R. and Co.—T. P.—R N.

Meeting for the Week.

TUES.—Royal Institution.—Professor Tyndall on "Heat and Cold" (Juvenile Lectures), 3.

Naval, Military, and Gunnery Items.

WE hear that Captain W. H. Patten Saunders, K.C.G., has submitted an invention for the unplating and destruction of armour-plated ships of war to the representative of His Majesty the Emperor of the French.

MR. BARROW, her Majesty's Consul at Kertch, has been relieved from the charge of the Crimean cemeteries, which are now placed under the superintendence of Colonel Gordon, at Constantinople.

WE are informed that the Commissioners of the International Maritime Havre Exhibition have acceded to the request received from England to extend the time for application for space until February 15, 1868.

WE are happy to state that Mr. E. J. Reed, Chief Constructor of the Navy, who recently met with a severe railway accident in France, has so far recovered as to be able to resume his duties at the Admiralty.

IN No. 4 dock, at Portsmouth, lies the mere shell of an iron vessel from deck-line to keel, stripped of everything except the engine-room bulkheads. This is all that now remains of the once beautiful iron screw-yacht "Fairy," for many years the favourite steam yacht of Her Majesty and the Royal Family.

THE Committee on Naval Affairs of the House of Representatives of America have in contemplation a reduction of the officers and men, as also the number of ships of war of the navy. This will, it is asserted, embrace a withdrawal of vessels from foreign squadrons, reducing them to the minimum number necessary to maintain the honour and dignity of the American Government.

IT appears that the American Gattling gun will be very generally introduced into European armies. According to the "Augsburg Gazette," the agents, Broadwell and Co., in Carlsruhe, have received orders for 1,000 of these engines. Of these, 400 are for France, and 200 for Russia, while Austria, Italy, Belgium, and Holland, are contented with 100 each.

THE twin screw-steamer "Ruahine," 1,503 tons register, and 350-horse power nominal, employed in the mail service across the Pacific, made one of the quickest passages ever known on her last voyage to Panama, having run from Sydney to Wellington (1,250 miles) and from Wellington to Panama (6,670 miles) without stoppage—in all 8,920 nautical miles in 31½ days.

THE greatest activity, says the "Journal du Havre," prevails in the French maritime arsenals. There are at present thirty-nine ships in course of being built, of which four are armour-plated frigates, four coast-guard iron-plated vessels, an armoured floating battery, a screw wooden frigate, six corvettes, screw and not plated, and a screw transport. The fleet really ready for sea comprises 343 steam vessels, and 116 sailing ships; with the thirty-nine in course of construction, the whole will amount to 501 vessels.

THE Marine Department of the Board of Trade has issued a notice that masters who hold certificates of competency bearing the words "of fore-and-aft-rigged vessels" only, are not deemed by the Board as holding certificates appropriate to the station of masters of brigantines, or other square-rigged vessels, and that on and after the 1st inst. superintendents of mercantile marine offices will not be satisfied with the production of these qualified certificates in any cases except in those of *bona fide* fore-and-aft rigged vessels.

THE "Laurel" is a hulk, well known to the seamen of Her Majesty's ships in dock at Portsmouth as a vessel where they can wash their clothes, and where they are also very often made the victims of experimental cooking schemes. It is a remarkable fact that no sooner does one of Her Majesty's ships find itself in dock, or alongside the dockyard, at Portsmouth, than down is sure to come an order from the Admiralty for the trial of some new scheme of cooking, to carry out which it is necessary to take the dinners of a certain number of men from the ship. In nine cases out of ten the invention utterly fails, and the men lose their dinners or eat them half cooked. Why don't the Lords of the Admiralty have a turn and get their dinners cooked there occasionally?

THE first step has been taken by the War-office in forming battalions of volunteers into brigades, by the formation of the 2nd and 4th Tower Hamlets Volunteer Corps into the 1st Tower Hamlets Volunteer Rifle Brigade, and to this amalgamation Her Majesty's consent has been obtained. The 2nd Tower Hamlets formed a battalion with the 8th, and the 4th formerly constituted a battalion with the 6th Corps of the Tower Hamlets; but having raised its strength to the requisite standard to warrant a separate staff, it was formed into an independent battalion, with Lieutenant-Colonel Thomson as its commander, and he is now commandent of the brigade. Lieutenant-Colonel Samuda, M.P., commands the 2nd Corps, while the 8th will go to constitute a brigade with the 26th Middlesex. General satisfaction has been expressed by the volunteers at this amalgamation for all military purposes.

Miscellanea.

A NUGGET weighing over 500oz. has been found near Sandhurst, Victoria.

THE Rev. Dr. Jelf has sent in his resignation of the office of Principal of King's College, London, which he has held for twenty-four years.

THE walrus, which was so recently an object of general interest at the Zoological-gardens, is dead. It was found to be in a state of extreme debility and inanition, and was afflicted with entozoa.

THE number of visitors at the Patent Office Museum, South Kensington, for the week ending December 28, was 9,292; total number since the opening of the museum, free daily (12th May, 1858), 1,222,160.

THE total quantity of gold exported from New Zealand from the years 1853 to 1866, inclusive, was 3,059,451oz.; chrome ore, 5,306 tons 3 cwt. 2 qrs.; coals, 290 tons; copper ore, 2,374 tons 8 cwt.; iron sand, 161 tons 13 cwt.; plumbago 7 tons.

ON the 1st instant the following new Acts of Parliament took effect:—County Court Act, Worship Regulation Act, Factory Act Extension, Agricultural Gangs Act, Merchant Shipping Act, and Sales of Reversion Act.
sions Act.

WE regret to announce the death of Baron Marochetti, which happened somewhat suddenly in Paris, on Saturday last. His many friends will regret in him a most amiable and kindly gentleman, an ardent admirer of art, and an artist, many of whose works are of high and undisputed merit.

AN avalanche of snow came down a few days back at Unterschachen, in the canton of Uri, Switzerland, and carried away a house and its barn. A woman and child and all the animals were swept off. One man, the brother of the proprietor, and a female servant escaped, although it is not mentioned how.

WE hear that an Augusta (Maine) gentleman has recently invented a machine for dressing and blacking boots, which is operated by foot-power. It is stated that this machine can do the work of ten men, and will save much labour in boot and shoe factories. Attached to it are an emery wheel and grindstone.

THE death on Friday last, of Mr. William H. Godson, who had for nearly twenty years occupied the position of superintendent of the London and South-Western Railway, and whose connection with that line dates from its first opening, is announced. He has been suffering from severe illness for several months, and during that time lost his wife.

SEVERAL new streets in Paris have been named after the old masters of French and foreign schools. For instance, two new streets running close to the Parc Monceaux are styled Ruu Rembrandt

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and Rue Murillo; and we have the names of Veronese, Primatrice, Ph. de Champaigne, Mignord, and Isabey, scattered in different directions of the city.

THE works for bringing the waters of the Vannes to Paris are about to be immediately commenced. The course they will have to follow will be nearly the entire department of the Yonne, and a portion of the Seine-et-Marne, in the neighbourhood of Moret, to reach the grand reservoirs of Montrouge, whence they will be distributed through the quarters of the capital on the left bank of the Seine. The cost of this undertaking is estimated at 20,000,000f.

ACCORDING to the last accounts from the island o St. Thomas, the work of the divers was progressing. A company of American divers, using Heinke's apparatus, were also in operation. The earthquakes, however, entirely unsettled the labour of the negroes, and yellow fever had interfered with the engineering hands. Messrs. Easton and Amos have lost one at work in the dock, and one of Mr. Heinke's men has also died from the effects of the climate.

ON Monday morning last, between two and three o'clock, a portion of rock, weighing several hundredweight, fell with a tremendous crash on the road leading round by the south side of Edinburgh Castle. There was no one near at the time. In the course of the day the burgh engineer made an inspection of the rock, and the attention of the War Department having been directed to the matter, he has given instructions to have any loose portions of rock that remained immediately removed.

COLLECTIONS were made on the 1st instant at all the railway stations, in aid of the accident fund of the Railway Benevolent Institution. Every railway servant contributing 1s. will, in the event of injury by accident, be assisted out of the fund raised, but no applicant is to receive more than £5; and if the sum realized is insufficient to grant them this amount, whatever is collected will be equitably divided among the sufferers. Last year, 11,000 men on 46 different railways became subscribers, and 228 persons, connected with 26 distinct lines, were assisted.

"The Optic Wonder" is the name of a scientific instrument just introduced by the London Stereoscopic Company. It is a creator of apparently solid form out of a mere line. A piece of wire or glass bent to the form of one side of a cup, vase, or anything else is made to faithfully pourtray the whole article. This is done by simple mechanical means, a quick motion gearing being the whole secret. It is really most ingenious, and will efficiently render a wine glass or a beautiful work of art in any material. It illustrates in a striking manner the persistence of vision, and can be rendered instructive as well as highly amusing.

A SPLENDID meteor passed from N.E. to S.W., about 35 deg. above the horizon, and rather slowly, about 7.30 a.m., on the morning of the 1st inst.. It appeared of the size of the full moon, and left a trail of broad, white light, over 60 deg. in length, which was visible for a long time afterwards. It disappeared in a dark mass of clouds fringing the horizon; all the rest of the sky was very clear, the air frosty, and the wind, E., calm. The peculiar form the trail of light took was most singular. From a straight broad line it assumed all the forms of a zig-zag and wave. Here and there the white light was at places, during these movements, as much (to the eye) as 2ft. broad and 6ft. long.

THE treasury building at Washington, it is said, when completed, will have cost nearly 5,000,000 dollars, and will be the finest executive edifice in the world. The greater portion of it is built of Maine granite, and it is proposed to rebuild the remainder with the same material, as the porous sandstone of which it is constructed is disintegrating rapidly. Plans have been prepared for a new War Department building, but Congress will not, probably, vote the requisite appropriations for its construction. The new building for the Department of Agriculture is rapidly approaching completion, and the museum hall will be a prominent attraction for visitors. Specimens of the animals, fruits, products of the soil, and insects of every section of the Republic, will be arranged in classes.

THE first railway for traffic in Prussia was opened in 1838. It appears from the report of Mr. Lowther, our Secretary of Legation at Berlin, that of the railways in use, 225,947 miles belong to the State, and 201,833 miles are private property under the control of the State, and 487,587 are under private administration; this includes 86,598 miles of Prussian railways in foreign territory, but it does not include 12,833 miles of foreign railway on Prussian territory. Of the single provinces the amount of railway in each is as follows: Prussia with 9.17 per cent.; Posen, 6.67; Brandenburg, 13.52; Pomerania, 6.96; Silesia, 20.101; Saxony, 12.26; Westphalia, 12.41; and the Rhine, 18.91.

THE monthly meeting of the Quekett Microscopical Club was held at University College on the 27th ult.; Mr. Arthur E. Durham, president, in the chair. Mr. Burgess read the concluding portion of his paper on the Wools of Commerce, Commercially and Microscopically considered. After reviewing the writings of the previous and present centuries, he explained by the aid of diagrams the result of his own examinations, and regarding the generally received notion that felting properties are due to the imbrications as an error, he maintained that they are entirely due to the natural curvatures of wool, which vary considerably in different growths. A large number of specimens in illustration of this view were placed under microscopes for examination. Mr. Bockett called attention to a form of live-box which he has used with considerable advantage. Eleven members were elected.

M. DOLFUS Assuet has determined to erect a chalet on the summit of Mont Blanc and establish therein a meteorological observatory, which will therefore be placed at an altitude of 4,800 metres above the ordinary level of the earth. Two guides, paid and supported by M. Assuet, will spend the summer there for the purpose of making meteorological observations. During a period of twelve months three guides were kept at the expense of this "savant" in a chalet on the Col de St. Theodule at an altitude of 3,200 metres, that is, at 2,000 or 3,000 feet above the monks of St. Bernard. The value of the meteorological observations made by these men has induced M. Assuet to make a fresh experiment.

THE total production of charcoal-made pig iron for 1867, in France, is estimated at 177,300 tons; of pig made with two combustibles, 78,700 tons; and of pig made with mineral combustible, 886,800 tons; showing a total of about 1,142,800 tons, of the value of £4,805,800. In 1866, the production of charcoal-made pig attained a total of 213,000 tons, while that of pig made with two descriptions of combustible was 89,900 tons, and that of coke-made pig 950,200 tons; showing a total of 1,235,100 tons. The decline in the production of pig in France this year is thus estimated at 110,300 tons. The French production of charcoal-made iron this year is estimated at 41,700 tons; of iron made with two combustibles, 23,400 tons; and of coke-made iron, 735,900 tons; showing a total of 801,000 tons, of the value of £7,393,880. Comparing these results with those for 1866, shows a diminution of 8,700 tons in the quantity of charcoal-made iron, a diminution of 4,700 tons in the quantity of iron made with two combustibles, and an increase of 2,500 tons in that of coke-made iron.

ON visiting the ironworks at Creuzot, Mr. Samuelson, M.P., was conducted over them by M. Schneider, the senior member of the firm. Mr. Samuelson writes:—Notwithstanding his public duties as President of the Corps Législatif, M. Schneider retains the chief direction of the works. During the Session of the Chamber the immediate management on the spot is in the hands of his son (his partner, there being also a small number of other partners with limited liability), but in the recess he resides at Creuzot. After having conducted me for several hours through these vast works, M. Schneider returned to his office to complete and despatch his correspondence, and debate the most minute economical points, items of cost and rates of carriage, with the heads of departments, showing himself, as he expressed it, "*industriel jusqu'au bout des ongles.*" He will forgive me for entering into these details. They are interesting to France and to England, where high political duties are still deemed almost incompatible with an active industrial career.

THE exports of railway iron from the United Kingdom have considerably increased during the past year, notwithstanding the competition of Belgian makers and other circumstances, the total shipments in the ten months ending October 31 having reached 513,071 tons, as compared with 430,141 tons to the corresponding date of 1866, and 361,652 in the first ten months of 1865. The exports to Russia in the ten months ending October 31 this year amounted to no less than 125,513 tons, against 55,396 tons in the corresponding period of 1866, and 37,758 tons in 1865. The United States took the large total of 145,166 tons, as compared with 79,023 tons in 1866, and 44,055 tons in the first ten months of 1865. To British India the exports reached 140,606 tons in the ten months, against 117,737 tons in 1866, and 89,900 tons in 1865. The chief market in which Great Britain has had to meet with Belgian competition has been Russia, but even with that country a much larger business than usual has been done this year by British firms. In the ten years ending 1866 the exports of railway iron from the United Kingdom were as follows: 1857, 457,680 tons; 1858, 433,250 tons; 1859, 528,927 tons; 1860, 453,445 tons; 1861, 377,565 tons; 1862, 400,765 tons; 1863, 446,440 tons; 1864, 408,215 tons; 1865, 434,300 tons; and 1866, 498,595 tons. This year's total will be the largest on record, for the ten months' exports exceed the aggregate returns for 1866.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS,

THE Abridged Specifications of patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—1401
BUILDINGS AND BUILDING MATERIALS—1393, 1407, 1426
CHEMISTRY AND PHOTOGRAPHY—1433
CULTIVATION OF THE SOIL, including agricultural implements and machines—None
ELECTRICAL APPARATUS—None
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—1403, 1405
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1386
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1394, 1406, 1440
GENERAL MACHINERY—1388, 1389, 1391, 1392, 1397, 1410, 1414, 1427, 1430, 1481, 1435, 1439, 1444
LIGHTING, HEATING, AND VENTILATING—1382, 1409
METALS, including apparatus for their manufacture—
MISCELLANEOUS—1379, 1380, 1384, 1385, 1387, 1395, 1396, 1397, 1402, 1408, 1412, 1415, 1416, 1418, 1419, 1421, 1424, 1425, 1432, 1437, 1438, 1443, 1445
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1404, 1420, 1429, 1441, 1442
SHIPS AND BOATS, including their fittings—1417, 1423, 1434
STEAM ENGINES—1422
WARFARE—1381, 1400, 1413, 1446

1379 R. ANDREW. *Improvements in communicating between passengers in railway carriages.* Dated May 2, 1867,

The specification of this invention is too voluminous to be quoted here at sufficient length for an intelligible abstract.—Patent completed.

1380 C. RITCHIE. *Improvements in casks.* Dated May 9, 1867.

In performing this invention the inventor introduces into the head of a cask, or similar vessel, a recessed socket, having at the bottom an opening into the cask or vessel, and at the top a lid or cover which may be secured by a lock. Through the opening at the bottom of the socket a tube slides in which a tap is formed. The tap is thus able to slide in and out, so that a cask can safely travel without the tap being removed, but with it pushed back into the socket and enclosed by the cover or lid. In a similar way the bung may be arranged in a socket in the side or bulge of the cask, and the bung may serve also in place of a vent peg, being made tubular for some distance up, and with a hole at the side leading into the internal hollow, so that when the bung is drawn up a short distance, air can enter freely into the cask or vessel, but when it is pushed down, the cask or vessel is closed air-tight.—Patent abandoned.

1381 G. JEFFRIES. *Improvements in apparatus for turning or closing central-fire sporting cartridges.* Dated May 9, 1867.

For this purpose the patentee employs a barrel of the size of the cartridge, and into which the cartridge case is inserted, and its end which is to be turned over against the wad which encloses the charge within it then rests against a grooved disc or end of the barrel which has a tooth within it, and is capable of being rotated by a crank handle as heretofore. In order to press the cartridge up to the grooved rotating disc or end of the barrel, he employs a hand lever jointed to the side of the barrel, and with a forked projection upon it which comes against the head of the cartridge; the two prongs of the fork come on each side of the head of the cartridge, and they are tapered and roughened at the side, so as to jam the head of the cartridge between them and hold it firmly, so as to prevent it turning round, whilst at the same time the lever forces the cartridge up against the turning or closing disc. —Patent completed.

1382 G. M'KENZIE. *Improvements in the manufacture of illuminating gas.* Dated May 10, 1867.

The patentee claims the manufacture of a gas of good illuminating powers by mixing poor gas obtained from inferior bituminous coal with gas obtained by heating mineral oil along with suitable minutely pulverized materials, as described.—Patent completed.

1384 W. BRACEWELL, W. PICKUP, and B. LUND. *Improvements in valves for steam and other fluids.* Dated May 10, 1867,

This invention consists in making the seating of the valve with two or more faces; this seating is provided with a lid or cover with a corresponding number of faces, and the faces of both seating and cover will be so perforated as to allow the cover to be in equilibrium, or otherwise, if preferred. The patentees propose to make valves on the above principle either round, square, oblong, or polygonal, and to arrange them so as to have a separate valve for the admission of steam and for the exhaust; or so that one valve will answer for both admitting the steam and for exhausting.—Patent completed.

1385 R. MELLARD. *Improvements in the construction of machinery for preparing and mixing food for pigs and other animals.* Dated May 10, 1867.

According to this invention a hollow cone is employed, with its apex placed downwards, the interior surface of the cone being provided with a series of cutters or mixing knives or blades. A vertical spindle provided with mixing knives or blades, corresponding with those in the cone, is mounted in the centre of the cone by suitable bearings. At the upper part of the spindle is a revolving cone, which is made to rise and fall by means of suitable mechanism for opening and closing the aperture from the

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supply of meal. A hopper is suitably placed for the supply of the roots, meal, &c. On the spindle being caused to revolve the objects of the invention are effected.—Patent completed.

1386 J. NORMAN and W. HAY. *Improvements in the manufacture of flour.* Dated May 10, 1867.

This invention consists in drying the meal or flour by preference with the aid of heat, between the processes of grinding and dressing it, and the dressing process is thereby very much facilitated, and the finished flour in the best condition for use by the baker.—Patent completed.

1387 A. COOPER. *Improvements in the manufacture of single and double box pickers for looms.* Dated May 10, 1867.

The patentee claims the manufacture of single and double box pickers for looms of a solid foot made from a piece of hide, felt, or leather, or a solid foot with an enlarged end, and a second piece of hide, felt, or leather, or two or more thin layers of hide, felt, or leather, for forming the leg and cap, the said leg and cap being made, and the leg, cap, and foot secured together (substantially as described and illustrated in the drawings) whereby the pickers are without the exposed edges which are common to ordinary pickers, and are stronger and more durable than ordinary pickers.—Patent completed.

1388 C. JONES. *Improvements in coal mining machinery.* Dated May 10, 1867.

This invention relates to a former invention for improvements in rails, patent dated October 19, 1866 (No. 2708), and consists in forming the said rails with teeth like a toothed rack, and constructing the whole or a portion of the width of the bearing wheels, or other wheels connected with the machine, with teeth to gear into those on the rails, and thereby prevent the machine from moving backwards or forwards when at work. The invention also includes arrangements for making the machines self-feeding; also the use of double or single-acting screw or other jacks for jamming the rails between the floor and roof; also means for carrying, holding down, and keeping up to their work coal mining machines generally. Also a novel arrangement of arms or levers and cutters to plane or pare away coal or other mineral so as to form deep shallow channels or grooves therein.—Patent abandoned.

1389 J. JOHNSON and A. GILES. *Improvements in machines for drying yarns, paper, and fabrics.* Dated May 10, 1867.

This invention consists in the employment of a species of skeleton cylinder mounted upon a horizontal axis, each disc or end of the cylinder having channels or grooves running in a radial direction, and in which frames carrying the material to be dried are placed.—Patent completed.

1391 J. COMBE. *Improvements in machinery for winding cop and warping from cops.* Dated May 10, 1867.

This invention relates to several former patents, dated respectively June 17, 1859 (No. 1466), August 11, 1862 (No. 224), April 14, 1863 (No. 937), and May 19, 1864 (No. 1264). The patentee claims, first, the arranging machinery for winding cops from bobbins in such manner that the bobbins from which the yarn is drawn away be supported on spindles carried in oil cups, so that the bobbins are able to revolve very freely until the tension becomes less than is desired when the bobbins are caused to come in contact with suitable rubbing surfaces. He also claims, in arranging machinery for winding cops, the combining with a tension lever acted on by the yarn a wire or instrument, which, by passing from one side of the centre of the lever to the other, acts on a catch and stops the winding spindle, both when the tension lever rises too high, and when it falls below its proper position. He also claims the arranging machinery for warping from cops with L-shaped weights pressing on the mouths of the eyes through which the yarn from the cops passes, so as to give an uniform tension to the yarn as it comes from the eyes.—Patent completed.

1392 W. SMYTH. *Improvements in machinery or apparatus for navigating the air.* Dated May 10, 1867.

This invention relates to apparatus for navigating the air, a certain novel description of collapsible and expanding apparatus being used in connection with the explosion of mixed gases. The gases used are preferably hydrogen and oxygen, and may be obtained in the air by the decomposition of water by electricity. The patentee proposes also to ignite and explode the gases to produce the expansion and power by an electric current.—Patent completed.

1393 W. CLARK. *Improvements in brick-making machines.* (A communication.) Dated May 11, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

1394 C. MARLOW. *Improvements in the cases for clocks.* Dated May 10, 1867.

This invention consists, essentially, in cementing or lueing together strips of wood round a mould or former, and then submitting the same to pressure by means of a metal strap and bolts or wedges, or otherwise. The cylinders or cases thus formed can be finished in the usual way, or otherwise, as described.—Patent abandoned.

1395 J. A. KNIGHT and C. BASTAND. *An improved self-acting and ventilating nose or feed bag for horses.* (Partly a communication.) Dated May 10, 1867.

This invention consists, mainly, in inserting one or more pieces of perforated zinc or wire gauze in the nosebag of a horse for the purpose of ventilation.—Patent abandoned.

1396 J. REILLY. *An improved system of mechanical aids worked by hand.* Dated May 11, 1867.

This invention is not described apart from the drawings. —Patent completed.

1397 J. WALKER. *Improvements in the construction of the standards and other parts of scales.* Dated May 11, 1867.

One part of this invention consists in a method of constructing the standards of scales or weighing machines. Instead of making the standards in a straight line, the patentee makes the top part of the standards cranked, so as to place the centre or fulcrum of the beam some distance from the lower or remaining portion of the standard, thereby providing ample space for a larger goods scale than could be applied to scales where the fulcrum of the beam rests on the ordinary standard. By this improvement neither the standard nor the beam need be so large as those used for the ordinary stand scales. Another part of the invention consists in fitting the beam with box ends so constructed that at any time required the parts may be immediately disconnected for any readjustment or repair of the centres or bushes. Another part of the invention consists in a mode of connecting the goods and weight scales with the beam.—Patent completed.

1399 G. BROWNING. *Improvements in the construction of button-hole sewing machines.* Dated May 11, 1867.

The patentee claims, first, causing the points of the loop spreaders of button-hole sewing machines (the union button-hole sewing machine) to move towards a line drawn intermediate of the planes of motion of the vibrating needle, in the manner and for the purpose set forth. Second, the arrangement described for effecting a saving in the gimp and silk used in the formation of button-holes. —Patent completed.

1400 J. PIDDINGTON. *Improvements in boring gun barrels and ordnance,* (A communication.) Dated May 11, 1867.

According to this invention the liquid employed in boring gun barrels (usually water and soap) is conveyed to the extremity of the drill or boring tool, and to the very point at which it is in contact with the metal to be removed, by means of a small tube of the same length as the boring tool, and laid parallel therewith. This tube is connected at one end thereof by a flexible joint of caoutchouc with a larger tube which conveys the liquid from a reservoir above the boring engine. The heating of the drill or boring tool, and of the barrel of the gun, is thus very much reduced, and the exterior of the barrel or gun does not require to be kept cool by the application of any liquid. The boring bench is slightly in the direction of the mouth of the barrel or gun, so as to facilitate the escape of the borings, which are removed by means of the current of liquid which is conveyed by the before-mentioned tube, and which liquid in returning carries with it the borings, thus obviating the necessity for the removal of the barrel or gun from the boring bench for the purpose of getting rid of the accumulated borings. The invention is equally applicable to the boring of the barrels of small arms and of ordnance of any calibre.—Patent completed.

1401 J. STEVEN. *Improvements in gauges for steam boilers.* Dated May 11, 1867.

This invention consists, essentially, in forming a hollow annular conical valve seat on the outer end of the upper and lower ducts or passages leading straight or direct into the steam and water spaces of the boiler, each fitted with a corresponding conical pointed screw hand plug or spindle working steam-tight on the said seat, and through a screw and packing gland fitted on the front part of the hollow chamber of the metallic socket pieces carrying the upper and lower ends of the glass tube of the gauge; and, further, in the use of two ducts, passages, or channels, closed at one end, formed in the "blow-off" nozzle, the one leading into the small chamber at the lower end of the glass tube, or in direct communication with the interior of the tube, and the other leading out through the blow-off nozzle or "nose-cock" with or having a small division or thickness of metal between them, through which a lateral orifice is formed leading from the former into the latter direct, having fitted or applied thereto a conical seat and pointed screw, tap, or valve, with screw and stuffing gland controlled at pleasure by a handle outside (as described in reference to the outlet steam and water valves), so as to allow the water in clearing out or "blowing through" the gauge to escape down the first duct and out through the lateral opening controlled by valve-plug and off by the outlet passage open to the air at the blow-off nozzle; so that when these steam, water, and blow-off valves are shut, or not required for the time being, the valve surfaces are not exposed to the pressure or action of the steam or water, while the narrow annular surfaces really necessary in this construction of tap or valves, and their extreme simplicity, render the whole instrument most durable, and with little or no liability to leakage or derangement in its action.—Patent abandoned.

1402 T. NELSON. *Improvements in the manufacture of cards.* Dated May 11, 1867.

The patentee claims the manufacture of cards, tablets, and other articles from which marks made with water colours, ink, or pencil may be repeatedly erased by moisture without injury to the surface, by coating cards, tablets, and other articles with soluble silicate, and then exposing them to heat, as described.—Patent completed.

1403 W. CLARK. *Improvements in bleaching textile materials or fibres.* (A communication.) Dated May 11, 1867.

According to this invention, when the fibres of wood are to be operated upon, the wood, after being split up, is deprived of the bark, the knots and heart are then cut up diagonally into pieces of about 3in. square. It is then subjected to the action of vertical stones or edge runners, turning in an enclosed space for containing the material; these stones, by the aid of water and quicklime, in the proportion of from 15 to 18 per cent. of the wood treated, effect the disaggregation of the wood, and roughly separate the filaments. The wood after being cut up, as above described, should be immersed for about a month in water saturated with lime, before being acted on by the stones, as above mentioned, whereby the disaggregation of the fibres is greatly facilitated. The wood should remain in the liquid until it acquires sufficient weight to sink to the bottom, being stirred and turned from time to time. The wood being thus crushed is placed in heaps on an inclined surface to facilitate draining off the lime water it contains, and after being macerated for several days in this manner it is placed in a washing and subdividing cylinder, whence it emerges bleached.—Patent abandoned.

1404 J. WATKINS. *Improvements in axles for carriages.* Dated May 11, 1867.

The patentee claims connecting the axle boxes of carriage axles to the arm of the axle by means of a revolving collar, bush, or socket applied to and rotating upon the cone or front collar of the said arm, the said revolving collar, bush, or socket bearing in its rotation between the ordinary or back collar and a nut, or a flanged nut screwed or otherwise fastened to the arm of the axles, substantially as described.—Patent completed.

1405 J. W. DALBY and P. CONSTANTINE. *An improved species of yarns.* Dated May 11, 1867.

This improved species of yarn consists of two important points. The first point is the spiral or double spiral coil or twist put on at any given intervals upon an ordinary thread of yarn; such coiled threads or yarns may each be of distinct colours, if wished, to simply alternate colours, thus producing, when woven, and in the piece, a pleasing effect. The second feature of the invention consists in the apparatus by which the inventors effect this result, and this consists, viz., of a sectional wheel placed under the back rollers, and which in its revolutions retards at given intervals the passage of the same. In front of the front rollers they place an additional creel board, which carries the coloured threads of yarns, and these are passed by means of wires so as to perform a junction with the thread or yarn emitted from the front rollers betwixt the latter and the flyer, the number of such colours being of course dependent upon the pattern required.—Patent abandoned.

1406 W. R. LAKE. *An improved castor for tables, chairs, and other articles of furniture.* (A communication.) Dated May 11, 1867.

This invention consists in the employment in combination with the ordinary parts of castors of an auxiliary anti-friction roller with a convex periphery supported to turn freely upon a stud or pin attached to the frame of the castor, and arranged to roll upon a concave surface formed upon the foot or leg to which the castor is attached, or upon a circular plate secured upon the same.—Patent abandoned.

1407 W. R. LAKE. *An improved mode of constructing metal cocks, faucets, and other similar articles.* (A communication.) Dated May 11, 1867.

This invention consists, chiefly, in forming a cock, faucet, or other article, in parts or sections which are cut or stamped from sheet brass or other suitable metal, and united by brazing and soldering, and also in the employment in combination with the same of a hollow plug formed of sheet brass or other suitable metal.—Patent completed.

1408 G. A. NEUMEIJER. *Improvements in gunpowder for mining purposes.* Dated May 13, 1867.

This invention has reference to certain Improvements in gunpowder for mining and war purposes, for which letters patent granted to A. Klein, June 17, 1863 (No. 1636), being a communication made to him from abroad by the present patentee. Instead of soaking the soda-lye, and generally preparing and incorporating the ingredients, as described in the specification to the said letters patent, the patentee proceeds as follows:—He mixes about 72 parts by weight of saltpetre with about 18 parts by weight of charcoal prepared in the ordinary manner, and from any suitable description of wood, and to these he adds about 10 parts by weight of flowers of sulphur to form together 100 parts by weight of gunpowder. These ingredients are not incorporated in the ordinary manner, but are placed in a cool cylinder of wood, copper, or other suitable material, through which passes a revolving shaft having a number of radial arms, and which may be arranged in any suitable known manner, or any other known form of apparatus having a similar stirring or mixing action may be employed. Together with the above ingredients he introduces water into the said cylinder in the proportion of about 40 parts by weight of water to about 100 parts by weight of the compound, and he then subjects the compound to the incorporating action of the revolving arms for about fifteen minutes, after which the compound is removed from the cylinder and dried without being subjected to the operation of granulating, and it is then fit for use. Such powder when burnt in an unconfined space will have a considerable residue, but when ignited in a confined space will leave considerably less residue than ordinary gunpowder.—Patent completed.

1409 J. G. N. ALLEYNE. *Improvements in puddling furnaces.* Dated May 13, 1867.

The patentee claims, first, so constructing the beds of puddling and other furnaces that the outer surface of the bottom and sides thereof are enclosed in a chamber, the bottom of which is a water tank or trough forming hydraulic joints with the sides, into which chamber a jet or jets of air or of water spray, or of air and water spray combined, is or are forced through one or more pipes, while the hot air and water spray or steam are caused to pass away through one or more other pipes, substantially as described. Second, constructing rotating furnace beds with flanges dipping into a water tank or trough below the bed, so as, by means of hydraulic joints, to form an enclosed space surrounding the outer surface of such bed, into which space a jet or jets of air, or of water spray, or of air and water spay combined, is or are forced, substantially as and for the purposes set forth with reference to the drawings. —Patent completed.

1410 R. H. PADBURY. *A new or improved shuttle for sewing machines.* Dated May 13, 1867.

This invention consists in the construction of shuttles for sewing machines in two parts, and in the following manner:—The first part, or the shuttle proper, is made of one solid piece of metal; it is pointed in the ordinary way, and is bored to receive a reel; the back is slotted, which acts as a bar to guide the cotton from the reel, and there is a slot on the top for the spring which bears on the reel. The second part or heel of the shuttle is swivelled on the tension plate, and fits into the rear end of the solid shuttle; it is drilled, and countersunk on its inner end to receive one end of the reel spindle, the other end of which works in the nose end of the solid shuttle drilled and countersunk in a similar manner. The tension plate has a notch or recess cut in it, which, when the plate is closed, passes over or on a stud or ridge on the solid shuttle, and the heel end is thus prevented from leaving the shuttle, and at the same time the reel is kept in position. A ridge is also formed on the forward end of the tension plate which, when closed, springs into a recess on the forward end of the shuttle, and the plate is thus prevented from opening.—Patent abandoned.

1411 G. LUNGE. *Improvements in the preparation of ores, metals, and other substances for working in furnaces.* Dated May 13, 1867.

This invention consists in a certain mode of treatment whereby the smelting, subliming, or working of substances in a state of sand or minute division is rendered practicable in furnaces in which such operations have hitherto been impossible, principally owing to the fact that such substances are apt to fall through the fuel and choke the furnace. This object is effected by combining such substances, as metal or ores in any state, oxides, cinders, slags, common salt, silica, or any other materials or mixtures of materials, when in too small a state to work, smelt, or sublime, in a draught or blast furnace, with coal, such combination being formed into lumps or pieces sufficiently large to work in furnaces of that description. The lumps of combined materials are then converted into coke by any of the known means.—Patent abandoned.

1412 H. A. BONNEVILLE. *An improved washing powder.* (A communication.) Dated May 13, 1867.

This invention relates to a compound fit for washing purposes, and consists, in a mixture of maize flour, of the cakes of the arachis or arachidna quadrifolia, of sesamum, or of poppy, and of sub-carbonate of soda, or artificial soda, to which mixture is added, for the washing of rough materials, a sixth of non-hydraulic lime. This powder

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is steeped in water when required for use.—Patent completed.

1413 J. LEETCH. *Improvements in cartridge holders.* Dated May 13, 1867.

This invention consists in the use of elastic or flexible pouches, which are attached to a coat, waistcoat, or other garment, or to a separate belt. Each pouch receives one cartridge, and holds the same in such a manner as to prevent its being injured or accidentally displaced, but will allow its ready removal when required for use.—Patent abandoned.

1414 C. EASTWOOD. *Improvements in looms for weavinr.* Dated May 13, 1867.

This invention relates to the "letting-off motion" in looms for weaving, or to the self-acting means or apparatus employed for supplying warp from the warp beam in regular order or suitable quantity as it is taken up in or by the process of weaving. The inventor applies a star wheel or notch plate (instead of the brake pulley) with a spring catch or stop to enter the notches in succession, and hold therein until forced out by excess of tension on the warp. The number of notches in this plate or wheel correspond to the number of teeth in the ordinary catch wheel employed in this apparatus. By this invention the inventor is enabled to obtain uniform tension on the warp, and render such apparatus less liable to be tampered with by the attendants than heretofore.—Patent abandoned.

1415 W. CORMACK. *Improvements in means and apparatus for effecting the revivification of animal and vegetable charcoal.* Dated May 13, 1867.

The object of this invention is to effect revivification in less time and at less cost than by calcining or burning it, and the inventor accomplishes this by passing superheated steam at or about 500 deg. Fah. through or amongst a mass of the inert charcoal, the said charcoal being contained in a specially constructed apparatus. Or instead of superheated steam he employs superheated air for the same purpose at a temperature of between 300 and 350 deg. Fah.—Patent abandoned.

1416 W. E. DE BOURRAU. *Improvements in evaporators for concentrating saccharine fluids.* Dated May 13, 1867.

This improved evaporator is composed of a basin or trough to receive the syrup, and carrying above each of its ends suitable bearings for supporting a hollow axis; the end of each hollow axis projects a short distance over the end of the trough, and carries a hollow steam chest which is concentric with the axis, and is of such a diameter as to pass down nearly to the bottom of the trough or basin. The ends of the two steam chests, which are opposite one another, are connected by a number of straight pipes which pass from the end of one chest near its outer circumference to the outer circumference of the end of the other steam chest; a central pipe is also employed to connect these two ends of the steam chest, in order to give strength. The pipes which connect the outer circumference of the ends of the two steam chests are at the centre of their length stayed to one another and to the central pipe by a ring placed within the circle of pipes, so that each pipe rests against and is supported by the ring, and the ring is connected by radial arms to the centre pipe above mentioned. The steam chests are of copper, and steam is admitted to them through their hollow axis. Within each steam chest, and at a short distance in front of the open end of its hollow axis, is fixed a disc, against which the steam impinges as it enters the steam chest, and the steam is thus thoroughly dispersed. Around the outer circumference of each steam chest, pockets or recesses are formed in which the condensed water collects, and from which the water is led away by pipes passing out through the axis. On the hollow axis carrying one of the steam chests is a toothed wheel, into which gears a pinion to which a rotary motion is imparted, and thus a rotary motion is given to both steam chests, and the pipes which pass from one chest to the other as they are carried round with the chests will be alternately dipped into the fluid in the basin or trough and raised out therefrom.—Patent abandoned.

1417 J. W. BUTLER. *Improvements in the construction of armour-plated ships and batteries.* Dated May 13, 1867.

The patentee claims backing the armour-plating with tubes with their axes at right angles, or nearly so, to the armour-plate, as described.—Patent completed.

1418 M. D. ROGERS and J. WILSON. *An improved fire-escape.* Dated May 13, 1867.

This invention consists in constructing a fire-escape in the following manner, that is to say:—To the upper windows, by preference, and to the brickwork at each side thereof, and outside of the building, the inventors hinge a bar or "davit" by its lower end, and to the upper end of each bar or davit aforesaid they connect one end of a chain or fireproof rope, the other end whereof is connected to a counterbalance weight sufficiently heavy to balance a cage or balcony slung by its ends, or suspended from the upper ends of the aforesaid bars or davits. They propose to pass a tube or tubes through the several floors of a house or other building, and allow the counterbalance weights before mentioned to pass freely up and down the said tubes, so that, supposing the fire-escape to be in use, and persons to have entered the cage or balcony, they can lower themselves down by means of a chain, or other suitable contrivance, and when they get out, the cage or balcony will be lifted up by the counterbalance weights before mentioned, thus rendering the fire-escape self-acting. The tubes containing the counterbalance weights the inventors propose to connect by their lower ends with a water main, fitted with cocks for establishing a communication with the main, when it is required to use the aforesaid tubes for extinguishing fire in a house or other building, and they perforate the said tubes for the escape of water into the rooms of a house, the said perforations being made near the ceiling by preference; by these means a large body of water may be discharged inside a house. The aforesaid tubes when not charged with water serve to carry off the vitiated air from rooms, the air entering the tubes by the perforations therein, and passing off through the upper ends thereof into the open air.—Patent abandoned.

1419 E. FIELD. *Improvement in apparatus for generating and condensing steam.* Dated May 13, 1867.

The patentee claims, first, in apparatus for generating steam, the use or employment, in combination with pendant water tubes or series of pipes or tubes placed at an inclination from the horizontal, and so arranged that their higher extremities communicate with another pipe, tube, or chamber, or other pipes, tubes, or chambers constituting a steam space or steam spaces, the lower ends of such inclined pipes or tubes being likewise a communication with another pipe, tube, or chamber, or other pipes, tubes, or chambers forming a water space or water spaces, in which sediment may collect or deposit, substantially as described. Second, in apparatus for generating and condensing steam, the use or employment, substantially as set forth, of the means described for preventing the deposit of saline, earthy, and other matters.—Patent completed.

1420 J. CLARK. *Improvements in railway brakes.* Dated May 13, 1867.

This invention relates in part to continuous brakes, or those applied in several carriages, and in part to ordinary brakes in single vehicles of the train, and to the means of applying the same. The objects of this invention are, first, to obtain the power for applying the brakes from the axles or wheels of the train when in motion. Second, to regulate the power so obtained as required. Third, to introduce between the force applied and the brake blocks self-adjusting motion for compensating the wear of the blocks. Fourth, to prevent the jar or pressure on the carriages when the blocks are applied. And, lastly, to improve certain parts of the mechanism by which the ordinary blocks are applied. The specification of the invention is too voluminous to be quoted here in detail.—Patent completed.

1421 W. SODO. *A new universal floating apparatus.* Dated May 13, 1867.

This invention has for its object an improved method of and apparatus for drawing liquor or liquids from casks or vessels of any description, and the refining of such liquor or liquids. The apparatus to be used consists of a float made of wood, copper, and india-rubber, or any other material suitable for the purpose, and is connected to an india-rubber tube; at the other end of the india-rubber tube is connected a leaden pipe or pipes; the said leaden pipe or pipes is connected to a pump where the liquor or liquids are drawn through the float from the interior of any casks, vessel, or vessels of any description.—Patent abandoned.

1422 A. H. COLLES. *Improvements in apparatus for signalling between passengers.* Dated May 14, 1867.

This invention relates to apparatus for effecting communication between guard and driver, or between the passengers and either the guard or driver, or both, and consists in means of signalling danger or calling attention for assistance in a railway carriage compartment. The improvements consist in the application of two cords running along the top of each carriage, equi-distant on both sides of the longitudinal centre of the carriage; these cords are firmly secured to one end of the carriage, their opposite ends being caused to coil round the axle of a pulley or drum, one on each carriage, situated midway between the two cords; over these pulleys or drums a through cord passes, being coupled up in lengths so as to form a continuous connection between the guard's van and engine, a certain amount of slack being allowed for the varying distances of the carriages. This cord is caused to press upon such pulleys or drum by means of a bar or other equivalent, one end of which is attached to an alarum in the guard's van, and the other end to the handle of a steam whistle on the engine. The separate lengths of cords with which each carriage is provided, and which are connected to the axle of the pulley or drum before mentioned, are connected with pendant strings or chains running over small guide pulleys, and protruding through the roof of the carriage, two in each compartment, each one terminating in a button and tassel, the button being constructed so as to press against and be attached to an ornamental piece of paper arranged to cover it, so that when the tassel is pulled for giving an alarm, the paper is torn or destroyed, thereby indicating the compartment in which the alarm was given. To each of these pendant cords a catch is secured, which is in connection with a spring and bell crank lever, the said lever being provided with a signal or semaphore which, when the pendant cord is pulled, becomes released, so as to project and signal the carriage from whence the alarm was communicated. If a passenger desires to raise an alarm, the tassel secured to the length of rope coiled round the axle of the pulley or drum over which the continuous rope passes is pulled down in the carriage, which immediately transmits motion through the medium of the axle and large pulley or drum to the rope communicating an alarm on the engine, or in the guard's van, and simultaneously the catch holding the spring semaphore is released, and the signal remains extended to indicate the position of the required assistance.—Patent completed.

1423 C. RANDOLPH. *Improvements in apparatus for propelling vessels.* Dated May 14, 1867.

This invention is not described apart from the drawings.—Patent completed.

1424 B. BARRETT and H. MACKENZIE. *Improvements in egg boilers.* Dated May 14, 1867.

Egg boilers for the table, as ordinarily constructed, consist of a small boiler or vessel with a lid or cover in which vessel the eggs are boiled. The said boiler or vessel is supported on legs, and is heated by a lamp placed on a stand underneath the said boiler, the lamp stand being carried by the legs of the boiler. This invention consists of the improvements in or additions to the said egg boilers hereinafter described. The patentees provide the edge of the lamp stand with two, four, or other required number of small radial platforms or supports to carry the egg cups. These supports may be made in one piece with the lamp stand, or soldered thereto. Each of the said supports has a small peg fixed to a conical seat at its upper side, upon which the hollow foot of the egg cup fits. The egg cups are thereby prevented from falling from the platforms or supports at the base of the egg boiler. They also provide the egg boiler with a minute or sand glass for indicating the time for boiling the eggs.—Patent completed.

1425 J. J. BASTIN and L. A. BAUM. *The use of all kind of industry.* Dated May 14, 1867.

Provisional protection has not been granted for this invention.

1426 J. G. JENNINGS. *Improvements in water-closets and sinks.* Dated May 14, 1867.

According to this invention the patentee arranges water-closets in such manner that, whilst the excrementitious matters which the basin may receive, together with the small quantity of water which the basin holds, are discharged into a receiver, so as to be applicable for use as a manure; the comparatively large quantities of water which are used to scour the basin are kept out of this receiver, and directed away into a sewer or otherwise, as may be desired, but without mixing with and diluting the excrementitious matter, which is consequently discharged almost in an undiluted state into the receiver, whatever be the quantity of water used to cleanse the pan. For this purpose the patentee employs a pan with a valve at the bottom, and when this valve is opened the matters in the pan press into the manure receiver. The same act of opening the valve of the pan also in the usual way opens a valve for the supply of the scouring water, and this water supply valve is so arranged, as is well understood as to remain open for a regulated time. The scouring water is, however, prevented from passing into the pan so long as the valve of the pan is closed; the scouring water is admitted and the excess passes away by a side opening from the pan, leaving therein only a small quantity of water, say a depth of half an inch, but more or less, as may be desired, and sufficient to prevent the adhesion of soil.—Patent completed.

1427 A. M. CLARK. *Improvements in the means of raising liquids.* (A communication). Dated May 14, 1867.

This invention relates to an improved method of raising fermented and other liquids by the pressure of carbonic acid gas, which latter becomes compressed in proportion as it is used. The improvements are especially applicable for raising beer from the cellar, instead of by the ordinary mode. The carbonic acid gas is produced pure by the reaction in a wet state of tartaric acid on bicarbonate of soda; in this manner the inventor is enabled to dispense with washing and purifying apparatus. The reaction is operated in any suitable chamber or capacity of sufficient strength, the affinity of the acid for the salt being such that a relatively considerable pressure is produced by the generation of the gas. The generator may contain ice for cooling the carbonic acid gas, and it is also enclosed in strips of cloth, coal, or sawdust, or other non-conductor of heat. The carbonic acid gas produced under pressure in the generator passes into a condensing reservoir provided with a pressure gauge, and is supplied to the cask by the aid of a cock and supply valve for acting on the beer or other liquid to be raised and supplied to the counter or other point. For the purpose of cooling the beer, it is usual to enclose the ascending pipe in another, the space between containing ice; or a current of cold water is sometimes applied; from this arrangement it often results that the beer is kept too cool, as the temperature at which it should be consumed is about 50 deg., above or below which it loses its qualities. To obviate this the inventor proposes to surround the ascending pipe with strips of cloth or felt, and a layer of pulverized coal, sand, sawdust, or other non-conducting material; in this manner the beer may be applied to the tap at the same temperature.—Patent completed.

1429 A. V. NEWTON. *Improvements in axle-boxes and bearings.* (A communication.) Dated May 14, 1867.

This invention relates, first, to the reduction of friction by the employment of pasteboard saturated with oil, and then subjected to pressure and inserted in suitable recesses in journal boxes and other bearings. Second, to the combination with the metallic or other non-absorbent bearing surfaces of axle and journal boxes or their linings of wood in the form of strips inserted within the same in an intermediate or intervening manner relatively to the metallic or other non-absorbent bearing surface. The said strips may either be saturated with petroleum, or other lubricating oil or matter, previous to insertion, or serve by their absorbent character to convey lubricating matter from a suitable supply to the axle or shaft during its rotation to and throughout the bearing, and, preferably, they will extend to the ends of the same. Thirdly, to a novel construction of journal or axle box or lining thereof in which anti-friction strips are disposed in an intervening or intermediate manner, so as to form a portion of the bearing in combination with the harder material of which the box or lining piece is composed, the said strips being cast, slidden, or otherwise fitted within the box or its lining, so as to form end presentations on opposite sides or ends of the bearings successively or alternately to lubricate the shoulder and collar of the axle or shaft.—Patent completed.

1430 J. C. ELLISON. *A machine or apparatus for removing the card boards from the folds of fabrics.* Dated May 15, 1867.

This apparatus consists of a rectangular frame or box of suitable size to receive a piece of fabric with the cardboards, metallic plates, or other substances which may be used placed betwixt the folds thereof. The bottom of this frame or box constitutes a movable table capable of supporting and raising the folded fabric with the projecting ends of the cardboards or metallic plates into contact with reciprocatory hooks, pushers, fingers, or pins, which, at each stroke, catch on the edge of the top cardboard and remove it a suitable distance, to be seized by a pair of rollers which draw it out of or from the fold of the fabric, the said fold being held in position by fingers caused to enter in betwixt the folds at the proper time and hold them against the crease until the cardboard or plate is withdrawn therefrom; consequently, at each reciprocation of the said hooks, pushers, fingers, or pins one of the cardboards or plates is removed alternately in opposite directions from the folds of the fabric, which remains in its folded state.—Patent completed.

1431 C. BRAZIL and R. GRIME. *Improved arrangements and apparatus for wetting and drying wefts.* Dated May 15 1867.

This invention consists in improved arrangements and apparatus for wetting or preparing weft for wet weaving, whereby the patentees dispense with the necessity of submitting the cops to mechanical pressure, or subjecting them to the action of centrifugal force for the purpose of expelling or getting rid of the superfluous water. The cops of weft must be first skewered, as in the present or general practice, or they must have been spun on metallic tubes. They place the cops in a strong vessel capable of being made steam tight, and cover them with the usual mixture of soap and water, after which they close the vessel and supply steam of about twenty to thirty pounds pressure to the square inch to the interior, which pressure forces the soap and water into and through the cops.—Patent completed.

1432 H. C. BAILDON. *Improvements in "nature printing."* Dated May 15, 1867.

The patentee claims the production of fac-simile copies of fronds of ferns, leaves of plants, and other suitable natural objects, by taking impressions on transfer paper direct from a frond or leaf, or other natural object, and transferring the same on to lithographic stones, and printing therefrom, as described.—Patent completed.

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1433 E. SMITH. *Improvements in obtaining violet colouring matters.* Dated May 15, 1867.

The patentee claims the producing of violet colouring matters by the action on rosaniline, or on a salt thereof, of chloride of mesityl, or of a bromine derivative of oil obtained from rubber or gutta percha, substantially as described.—Patent completed.

1434 F. BONNEY. *Improvements in the construction of ships and boats.* Dated May 15, 1867.

This invention consists in building ships or boats with semicircular or projecting angular sides, gradually curving upwards from midships to the stem and stern, so as to extend throughout the entire length of the vessel immediately above the water line, by which construction the said vessels, on inclining to either side of a horizontal position, through the action of the wind or waves, shall present an increased superficial displacement and consequent controlling action in the lateral and longitudinal movements of the said vessels, additional room being obtained through the medium of the extended sides and flush deck.—Patent abandoned.

1435 C. PERRY. *An improved machine for flattening hackle pins.* Dated May 15, 1867.

This invention relates to an improved machine for flattening hackle pins or comb teeth employed in machines for combing wool or other fibrous substances, or the wire therefor. This machine is constructed so that it can be worked by a belt from a drum of a main shaft to a pulley fixed upon its own shaft; upon the latter shaft a spur wheel and fly wheel are keyed. The spur wheel last mentioned gears with a larger wheel keyed upon a second shaft above it; both of these shafts are mounted in bearings in a suitable or oblong frame, across which they run transversely. The frame is formed with an opening in the centre, the gearing wheels, fly wheel, and driving pulley being placed upon one side. On the top of the frame, over the space between the two sides, the patentee mounts a lever beam. Upon the upper cross shaft, and under the long end of the lever beam, he fixes an eccentric wheel, and near the long end of the said beam he fits a bearing pulley. This bearing pulley is mounted in bearings at the lower end of a screw shaft or spindle which passes through the beam, and is held in position by two lock nuts, one above and one below the same; by means of these nuts the bearing pulley can be raised and lowered, and fixed as required, so as to adjust the rise of the long end of the lever as it is worked up and down by the eccentric before mentioned. For further regulating the rise and fall of the lever he mounts it in adjusting plummer blocks, so that the centre of motion may be raised or lowered by bearing screws or adjusting wedges, or partly by each. At the short end or crushing head of the lever beam he forms proper spaces for receiving a steel die, and in a tool bed or block immediately under the same he fits a second steel die. The tool bed or block is adjustable horizontally and vertically. The latter adjustment is effected by means of a set screw or screws and adjusting wedges. The pins or comb teeth or wire therefore are placed between the dies in the beam head and tool bed. On giving motion to the eccentric the beam will be caused to rise and fall, and compress or flatten the pins, teeth, or wire to any required degree, which can be regulated, first, by altering the clock nuts on the screwed spindle in the long end of the beam; second, by varying the centre of motion of the lever by the plummer block adjustment before described; or, third, by altering the level of the tool bed by means of the screw and wedge bearing pieces.—Patent completed.

1437 W. D. TATE. *Improvements in apparatus for stopping bottles and other vessels.* Dated May 15, 1862.

For this purpose the inventor employs a tube or socket which is conveniently made of thin metal, and he springs on to the lower end of it a short piece of india-rubber tube, which naturally is somewhat smaller in internal diameter than the socket. The socket, with the india-rubber tube covering it, is forced into the mouth of the bottle or vessel, like a cork, and the india-rubber gives a sufficient elasticity to ensure a tight joint between the socket and the neck of the bottle or vessel. The bottle or vessel being thus fitted is closed by a stopper, made by preference of glass or earthenware; the stem of this stopper is of such a size as to pass quite freely down through the socket, but it is embraced by the free end of the india-rubber tube which projects somewhat beyond the socket, and so an air-tight joint is made. To obtain access to the contents of the bottle or vessel, the stopper is drawn out, leaving the socket and india-rubber tube still in the neck of the bottle or vessel. The stopper will always come out very easily, the india-rubber tube yielding when a slight force is applied.—Patent abandoned.

1438 J. JOHNSON. *Improvements in submarine longs.* Dated May 15, 1867.

This invention is not described apart from the drawings. —Patent completed.

1439 G. NIMMO. *An improvement in metal wheels.* Dated May 15, 1867.

In performing this invention the patentee takes a metal ring of wrought iron or steel to form the tire of the wheel; the same may be a new ring, or it may be an old wrought-iron wheel or tire; and he bores, cuts, or forms round, oblong, or polygonal holes into or through the same at suitable distances apart around the periphery, and he turns or cuts grooves in the cylindrical surface of such ring near the edges thereof; the said grooves are of any desired sectional shape; he, however, prefers to make them V-shaped. He prepares a mould either in sand or metal of a shape corresponding to the exterior of the intended wheel, and adapted to receive the said metal ring, and he places each metal ring in the said mould, and casts around the same iron or steel, or a mixture thereof, of the desired character, and it forms a complete union with such metal ring, in consequence of the grooves and holes in the same, so that the cast metal tire and wrought metal ring are inseparable, thus obtaining the lightness and strength of the wrought metal wheel, and the durability under wear of the cast metal surface. The wrought ring may be heated before being placed in the mould, and a flux employed to effect a more firm union of the metals.—Patent completed.

1440 A. V. NEWTON. *Improvements in billiard tables.* (A communication.) Dated May 15, 1867.

It has been ascertained by experiment that when vulcanized india-rubber is entirely confined laterally, so that it cannot spread laterally, the reacting force which it will impart is nearly equal to the direct force with which it was struck; but that if not so held laterally when struck it will spread, and for that reason fail to react with sufficient force. It is on this fact that the first part of the present invention is based, and with this view the said invention consists of a new manufacture of billiard table cushions, composed of alternate layers of soft vulcanized india-rubber and two or more of cloth or other thin pliable substance which will not readily stretch, previously coated with india-rubber, the whole being united whilst the india-rubber is in the green or plastic state, and then vulcanized. The two or more layers of cloth or equivalent substance have the effect of binding together the interposed layers, so as to prevent the spread of the india-rubber when the cushion is struck by a ball, thereby obtaining a greater reacting force than by cushions differently constructed. The face of the cushion inclines inward, so that when struck by the ball the reacting force of the cushion will be exerted on the ball above the horizontal plane of its axis. This is to prevent the ball from jumping, as it is termed. This form of cushion admits of being made sufficiently low that the player may reach the ball with the cue when close to the cushion. Another improvement in this branch of the invention consists in making billiard tables with reversible cushions, with both faces inclining inwards from parallel planes at right angles to the top surface, by reason of which form cushions may be produced with a materially less weight of india-rubber than by any plan heretofore known, and with an equal thickness where the elastic force is required. That part of the invention which refers to converting billiard tables into dining tables cannot be described without reference to the drawings.—Patent completed.

1441 G. COLES, J. A. JAQUES, and J. A. FANSHAWE. *Improvements in wheeled carriages.* Dated May 15, 1867.

The object of this invention is to prevent the shocks or jars usually experienced in wheeled carriages, as at present constructed, and the invention consists in constructing carriages with elastic or flexible joints, the different joints or parts being connected by vulcanized india-rubber, or its compound.—Patent completed.

1442 G. COLES, J. A. JAQUES, and J. A. FANSHAWE. *Improvements applicable to the permanent way of railways.* Dated May 15, 1867.

This invention consists in placing under the rail, and between it and the chair or sleeper, a compound elastic plate or pad consisting of two or more thin metal sheets or discs coated with brass, and between each plate is placed a sheet of vulcanized india-rubber or its compounds. This arrangement prevents the usual violent shocks or jars which are experienced in railway travelling. —Patent completed.

1443 E. EDWARDS *Improvements in apparatus for treating mineral substances.* Dated May 15, 1867.

This invention consists of a box or cistern filled with water, and having one part of the top open, and fitted with a frame carrying a perforated plate or wire screen, upon which the substance to be treated is fed from a hopper. The other part of the top is closed and inclined downwards, and has an aperture closed by some flexible substance, upon which is screwed a block plate carrying a block upon which one or more cams strike, fixed to a shaft revolving in a carefully adjusted position above. When the cistern is filled with water, each depression causes the water to rise suddenly through the perforated plate or screen, and thus to throw up the mineral substances resting upon it. When the cam leaves the block, the pressure of the water below, increased by the inclination of the top of the cistern, causes the flexible substance to rise slowly until again depressed by a cam. The mineral substance thus has time to fall slowly through the water, the heavier particles falling first upon the screen and forming the lower layer and the lighter particles forming the upper layer. This upper part is removed by rakes or scrapers carried upon a frame running on wheels and driven by a crank upon the driving shaft.—Patent completed.

1444 J. HARPER. *Improvements in single cylinder printing machines.* Dated May 16, 1867.

These improvements apply, principally, to the inking apparatus of single-cylinder printing machines. Instead of driving the "doctor" roller (which furnishes the composition roller with ink) by means of bevil gearing and shaft placed outside the framing of the machine in connection with the spur-wheel shaft, as usual, the inventor drives the said roller by means of gearing placed entirely within the said framing, and actuated directly from the main driving shaft, so that the machine occupies less space, and the danger of outside gearing is avoided. Part of this gearing consists of a wheel having spur teeth round its circumference, and also three concentric circles or segments of teeth on its face, so that by sliding a pinion into gear with one or other of these circles or segments of teeth, the doctor roller can be driven at a greater or less speed, as may be required, and the cone pulleys usually employed for that purpose are dispensed with. When it is desired to stop the supply of ink without stopping the revolution of the machine, all that is requisite is to slide the pinion into a position between two of the circles or segments of teeth, and the revolution of the doctor roller is stopped immediately. Another improvement consists in having a rod constantly revolving in the ink so as to keep it in motion, and hence at an equable temperature in cold weather, thereby avoiding the necessity for the frequent application of heat thereto.—Patent abandoned.

1445 P. A. DE BERENGER. *Improvements in kilns for burning limestone.* Dated May 16, 1867

This invention consists in constructing the said kilns in the form of vertical chambers provided with gratings or bottoms, and arranged transversely in sets one above another in such manner as to admit of the lower ones being brought immediately over the furnace, by which the heat is caused to ascend through the lime placed within the said kilns for the purpose of being burnt, the said transverse sets being alternately supplied, discharged, and brought successively next in turn over the fire. An opening is left within the said column for the admission of air for regulating the draught, and in peeting materials under operation, as may be necessary.—Patent abandoned.

1446 C. ROBERT. *Improvements in breech-loading firearms.* Dated May 16, 1867.

The barrel of this firearm is at its breech fixed into the front end of a body of a trough-like form open at the top to allow room for the introduction of the cartridge in loading and for pushing it forward into the barrel. The trough-like space in the barrel is closed after the cartridge has been introduced by a block jointed at its fore end to the top of the body. The block has a central hole formed through it from end to end, and contains a needle or striker for exploding the cartridge by a blow on the centre of its base. The block also has on its under side a strong hook or projection through which descends, through a slot cut in the bottom of the trough, from part of the body, and it is locked by a sliding bolt working in guides on the under side of the body. This bolt receives its motion from a lever which, when the block is locked in position, fits close underneath the trigger guard; the lever works on a horizontal axis at its forward end, and has teeth upon it around the axis, and when the hinder end of the lever is thrust downwards and forwards, as in unlocking the block, or when the contrary movement is made, in locking the block, the teeth gear with rack teeth formed on the bolt. To lock the block the bolt enters into the hook upon it, and in unlocking the bolt is withdrawn, whilst at the same time another part in connection with the bolt comes against the back of the hook, and by pressing against it partly raises the block so that the hand may readily get hold of it to turn it back. On the joint of the block there is a spring catch like the spring of a pocket knife, and tending to bring the block to one or other of its extereme positions. The blow to fire the cartridge is struck by an internal hammer mounted on a spring arm which, when released, throws the hammer head forward, so as to cause it to impinge upon the instrument or striker within the block, and this striking the base of the cartridge fires it. The striker passes through a cavity containing grease, and is so kept lubricated. The spring arm of the hammer is forced back to prepare it to strike the blow by the action of the lever which locks and unlocks the breech block; when the lever is moved so as to unlock the breech block, a projection upon it comes against the spring arm of the hammer, and forces it back until it is caught and retained by a detent at the end of a short lever, and when the trigger is drawn back to fire the charge, it moves the short lever on its centre, and so sets the hammer free, and the tension of its spring arm causes it to fly forward and strike the blow which fires the charge. In order to prevent the arm from being discharged accidentally, the inventor employs a bolt or rod, by turning which the trigger can be prevented from releasing the catch or detent that holds back the striker.—Patent abandoned.

PROVISIONAL PROTECTIONS.

Dated September 11, 1867.

2573 W. Baird, Glasgow. An improved apparatus to be used for registering the number of passengers entering vehicles.

Dated September 25, 1867.

2698 J. Musgrave, Belfast. Improvements in stable, cow-house, and harness-room fittings, parts of which are also applicable for other purposes.

Dated November 2, 1867.

3087 H. W. Grylls, Dalston, civil engineer, H. Neville, Mile End, builder, and J. Holt, Hackney-road. Improved apparatus for obtaining and applying motive power.

Dated November 13, 1867.

3213 T. Taylor, Wellington-row, Bethnal-green. New or improved implements or apparatus for playing games of skill and chance.

Dated November 23, 1867.

3324 J. H. Johnson, Lincoln's Inn-fields. Improvements in breech-loading firearms, and in cartridges for the same. (A communication.)

Dated November 28, 1867.

3384 J. Rayls, Kinburn-cottage, Durdham Down, Bristol. An improved chemical preparation or compound to be used in preparing mixed textile fabrics for dyeing or colouring.

Dated November 29, 1867.

3386 T. B. Jordan, South Lambeth, mechanical engineer, and J. Darlington, Moorgate-street-chambers, City, mining engineer. Improvements in machinery for boring rocks, and in apparatus for driving, rock-boring, tunnelling, coal-cutting, and other machinery employed in mines, collieries, and quarries.

3394 A. Turner, Leicester, elastic fabric manufacturer, and W. E. Newton, Chancery-lane, civil engineer. Improvements in the manufacture of carpets and in warping and preparing warps for the same, and in the machinery or apparatus to be employed therefor.

Dated November 30, 1867.

3409 R. Clay, jun., Muswell-hill. Improvements in breech-loading firearms.

Dated December 2, 1867.

3414 G. Hetron, Leadenhall-street, City. An improved method of constructing a castor for containing pepper, salt, or other condiments for domestic use.

Dated December 3, 1867.

3436 W. Pidding, Beresford-street, Walworth. Improvements in placing, arranging, or fixing needles and threads and other like fibrous materials on to reels or receivers so as to render them more convenient for use, also in the manufacture and forms of such reels or receivers, and in the materials thereof.

Dated December 4, 1867.

3448 J. Newton, Globe Foundry, Leeds. Improvements in the means of and apparatus for lubricating certain parts of doffing-knife apparatus.

3453 E. Walker, Westmoreland-street, Pimlico. Improvements in the construction of breech-loading ordnance.

3455 J. T. Webster, Mansfield, Nottinghamshire, and W. Oxley, Manchester, mill furnisher. Improvements in machinery for spinning and doubling fibrous materials.

3457 W. A. Herring, Chertsey, engineer and ironfounder. Improvements in apparatus for warming buildings in which high-pressure steam-engines are employed.

Dated December 5, 1867.

3459 D. Smith, Bury, Lancashire. Improvements in steam boiler furnaces, and in apparatus connected therewith.

3461 J. Green, Lockwood, near Huddersfield, grocer. Improvements in machinery or apparatus for cutting or breaking sugar.

3462 J. Mahon, Newcastle-upon-Tyne. Improvements in bags for coffee and other such like cots.

3463 S. Perkins, engineer, and W. Smellie, forge manager, Gorton, near Manchester. Improvements in the manufacture of malleable metal of a steely quality, partly from Bessemer "scrap" or other Bessemer metal.

3464 J. G. Scott, Edinburgh. An improved means to be employed for effecting the safe transmission of money or money orders; also improvements in the formation of documents that have to be separated.

3467 M. Tildesley, manufacturer, and J. Bird, manager,

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Willenhall, Staffordshire. Improvements in annealing furnaces, and in apparatus to be employed therein, parts of which improvements may be applied to certain other descriptions of furnaces and fires.

3469 P. G. L. G. Designolle, Rue de la Seine, and J. Casthelaz, Rue St. Croix de la Bretonnerie, chemists. Improvements in the manufacture of explosive and fulminating powders.

Dated December 6, 1867.

3473 J. Durrans, Thurlstone, near Penistone, Yorkshire. An improved material or composition to be employed for covering or coating the interior surfaces of moulds, crucibles, or ducts, previous to their receiving molten metal in the process of casting, and for other purposes.

3475 W. N. Nicholson, Trent Ironworks, Newark, Nottinghamshire, agricultural engineer. Improvements in machinery for spreading grasses, part of which improvements are also applicable to machines for cutting and collecting grasses or corn.

3477 F. Roper, Monson-street, Lincolnshire, machine maker. Improvements in apparatus for driving straw elevators.

3479 R. Jones and J. Abrahall, Birmingham, jewellers. Improvements in the manufacture of hollow metallic seamless spheres and ornaments.

Dated December 7, 1867.

3481 C. Brazil, Chorley, Lancashire, manufacturer. Improvements in machinery for sizing cotton and other yarns.

3483 R. B. Jones, Nelson-terrace, City-road, telegraphic engineer, and W. Powell, Circus-place, Finsbury, telegraph engineer and contractor. Improvements for the prevention of incrustation in steam boilers.

3485 O. Barrett and H. Leggott, Bradford. An improved knife cleaner.

3487 J. Partington, Astley, Lancashire. Certain improvements in the method of heating buildings, and in the apparatus connected therewith.

3489 W. Clissold, Dudbridge Works, near Stroud, Gloucestershire, engineer. Improved machinery for preparing fibrous substances for spinning.

3491 C. M. Barker, Kennington-park-road, engineer. Improvements in socket and flange spigot pipes.

3493 A. M. Clark, Chancery-lane. Improvements in orthopœdic apparatus for the prevention and treatment of spinal diseases. (A communication.)

Dated December 9, 1867.

3497 W. Clapperton, manager, Walkenshaw Foundry, Johnstone, Renfrewshire. Improvements in machinery for shaping cask headings and similar articles.

3499 L. Rose, Leith, lime and lemon juice merchant. An improved mode of preserving vegetable juices.

3501 H. Bessemer, Queen-street-place, Cannon-street, City. Improvements in the manufacture of fire-bricks, tiles, and solid or hollow fire-lumps, and in the manufacture of retorts, pipes, crucibles, or other hollow vessels or moulds required to resist a high degree of heat, and also in the manufacture of ornamental bricks, tiles, quarries, trusses, bosses, vases, busts, figures, columns, capitals, bases, cornices, copings, tablets, finials, and other articles of an ornamental character employed in building and in architectural decorations.

Dated December 10, 1867.

3503 C. Kerby, St. Dunstan's-hill, City. Improved apparatus for filtering liquids.

3504 R. G. Lowndes, bleacher and finisher, Auldhousefield and Crofthead, Renfrewshire. Improvements in finishing textile and other fabrics, and in the machinery or apparatus employed therefor.

3505 C. Connor, Old Ford, shoemaker. Improvements in umbrellas and parasols.

3506 W. H. Barlow, Old Palace Yard, Westminster. Improvements in apparatus for measuring approximately the quantities of earthwork in continuous cuttings or banks, such as are used in the formation of railways.

3507 W. Palliser, Major unattached, Army and Navy Club, Pall Mall. Improvements in ordnance and in projectiles used therewith, as also in the processes employed in their manufacture.

3508 W. B. Leachman, Leeds, engineer. An improved rotary water or steam motive power engine.

3509 J. Grout, ironmonger, and E. Mathews, agent, Hereford. Improvements in apparatus for training or growing hops and other plants, which improvements may also be applied to line posts and other posts or supports for various purposes.

3510 J. W. Burton, Leeds. Improvements in the treatment of fibrous materials, and in apparatus used therein.

Dated December 11, 1867.

3511 J. Woolfield, St. Peter's, St. Alban's, Hertfordshire. An improvement in machinery for corrugating sheets of metal.

3512 G. Holcroft and W. N. Dack, Manchester, engineers. Certain improvements in steam engines.

3513 H. Giles, New North-road. Improvements in the manufacture of hats and bonnets, and in the apparatus employed therein.

3514 W. J. Fraser, Commercial-road East, engineer. Improvements in tubular steam boilers.

3515 A. Camme, Boulevart de Strasbourg, civil engineer, and F. Delpech, Grande Rue Batignolles, Paris, engineer. Improvements in manufacturing iron and steel chains without welding.

3516 A. M. Clark, Chancery-lane. Improvements in presses for stamping or endorsing. (A communication.)

3517 A. M. Clark, Chancery-lane. An improved process for the reduction of tin, so as to render it applicable for coating metals and for other purposes. (A communication.)

3518 A. T. Carr, Winkleigh, Devonshire. An improved manure.

3519 J. M. Napier, York-road, Lambeth. Improvements in apparatus or appliances for serving mustard and other condiments.

3521 G. H. Nick, Passage Saulnier, Paris. An improved sheave or pulley for ships' blocks or other purposes.

3522 T. A. Weston, Birmingham, engineer. Improvements in saws. (A communication.)

Dated December 12, 1867.

3523 G. A. Young, Eagle-street, Red Lion-square, surveyor. An improved curtain or screen for separating the stage from the audience part in theatres and music halls, in order to prevent the spreading of fire, also applicable to other buildings where it is desired to prevent the spreading of fire from one part of the building to another part.

3524 J. Goodman, Loughborough, Leicestershire, coach builder. Improvements in the manufacture or production wheels used for carriages or other vehicles.

O. Butler, Kirkstall Forge Company, Leeds. Improvements in securing the tyres of railway engine and carriage wheels.

3526 J. R. Baillie, Rochefort-villas, Hoe-street, Walthamstow, Essex, naval architect. Improvements in caissons.

3527 J. Ward, Port Glasgow, Renfrewshire. Improvements in lamps to be used under water.

3528 R. Roberts and P. Williams, Pontypridd, Glamorganshire, engineers. An improved equilibrium slide valve for steam engines.

3529 R. W. Brownhill, Walsall, Staffordshire, manufacturer. Improvements in water tuyeres for blast furnaces, smiths' fires, and for other like purposes.

3531 E. Death, Leicester, engineer. Improvements in steam pumps.

3532 W. G. Hanning and G. B. Knott, Newcastle-upon-Tyne, and L. C. F. Clerc, St. Mary Axe, City. Improvements in lamps. (Partly a communication.)

3533 J. Collingham, worsted spinner, and T. E. Smith, machine maker, Keighley, Yorkshire. Improvements in spinning and twisting frames, known under the denomination of "cap frames" and "flyer frames."

3534 P. Bawden, Norland-square, Notting-hill, brick manufacturer. Improvements in machinery for the manufacture of bricks and tiles.

3535 E. R. Sintzenich, Duke-street, St. James's. Improvements in the treatment of paper and certain woven fabrics for rendering them ornamental and durable as articles of dress, and for decorative and ornental purposes.

3536 H. Field, Tulse-hill. Improvements in the manufacture of candles, and in the moulds or apparatus employed therein.

3538 R. Boby, Bury St. Edmunds, agricultural implement maker. Improvements in hay-making machines, horse hoes, horse rakes, and other analogous agricultural implements or machines.

3539 W. Richards, Birmingham. Improvements in firearms and cartridges.

3540 J. Robinson, Dalton, near Huddersfield. Improvements in the manufacture of mohair and similar fabrics.

3541 J. H. Pepper, Boundary-road, St. John's Wood, professor of chemistry, and T. W. Tobin, Old Jewry, City, architect. Improvements in apparatus used in producing scenic illusions.

Dated December 13, 1867.

3544 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of artificial fuel. (A communication.)

3546 J. Williams, Great Saughall, Cheshire, schoolmaster. An abacus or apparatus for imparting instruction in arithmetic, and which apparatus may be advantageously employed in teaching reading.

3550 J. G. Settle, Horncastle, Lincolnshire. Improvements in door bolts and indicators.

3552 W. E. Newton, Chancery-lane, civil engineer. Improvements in bench planes and moulding tools. (A communication.)

Dated December 14, 1867.

3554 H. Atkinson, Wharf-road, City-road. Improvements in gas retort ovens and furnaces. (A communication.)

3558 W. and F. Bates, Sowerby-bridge, near Halifax, machine makers and millwrights. Improvements in washing machines known as "dollys," which improvements render such machines also applicable for crushing and fulling fabrics.

3560 R. Tinkler, Penrith, churn manufacturer. Improvements in churns.

3562 G. Clark, Arundel-street, Strand. Improvements in guns, projectiles, and cartridges, and in the construction of the same.

3564 T. C. Parson, jun., Bristol, surgeon dentist. Improvements in skates.

3566 A. M. Clark, Chancery-lane. Improvements in the extraction of ammonia from fermented and other liquids, and in the regeneration of the agents used in such extraction. (A communication.)

3568 E. Rimmel, Strand, perfumer. An improved construction of portable fountain.

3570 W. Conisbee, Herbert's-buildings, Waterloo-road. Improvements in cylindrical chromo-lithographic and typographic printing machines.

Dated December 16, 1867.

3574 J. Dawson, Greenock, engineer and sugar refiner. Improvements in treating sugar syrups.

3576 G. D. Kittoe, Clerkenwell, engineer. Improvements in engines actuated by air, steam, or other fluids.

Dated December 17, 1867.

3582 N. Haley and J. Hodgson, Bradford, machine makers. Improvements in machinery for twisting or doubling wool, silk, cotton, or other fibrous substances, part of which is also applicable to machinery for spinning such substances.

3384 A. Shrimpton, Redditch, Worcestershire, fishhook manufacturer. Improvements in papering needles or making up packets of needles for sale.

3586 W. Ross, Grove-street, and A. Long, Aylesbury-terrace, Walworth. Improvements in means for preventing and removing incrustation in steam boilers.

3588 S. Marsters, Lynn, Norfolk. A new or improved machine for rubbing, washing, and sizing ropes, cords, or twines.

3590 W. A. Gilbee, South-street, Finsbury. Improvements in the method of and apparatus for raising water. (A communication.)

Dated December 18, 1867.

3592 H. Green, Preston, gas engineer. Improvements in furnaces for steam boilers and other purposes.

3594 R. D. Dwyer, Liverpool. Improvements applicable to metallic bedsteads and mattresses.

3596 J. Murray, Whitehall-place. Improvements in the construction of roads or streets.

3604 H. H. Murdoch, Staple Inn. Improvements in means or apparatus for propelling canal boats and other vessels, parts of which improvements are applicable to other purposes. (A communication.)

Dated December 19, 1867.

3606 G. H. Ellis, Outram-road, Addiscombe, Surrey, engineer. Improvements in apparatus for cleaning boots and shoes.

3610 J. Atkins, Birmingham, merchant and manufacturer. Improvements in metallic bedsteads, cots, and couches.

3612 A. Cochran, Kirtonfield, Renfrewshire, bleacher and dyer. Improvements in machinery for finishing woven fabrics.

3614 W. H Richardson, Glasgow. An improved apparatus to be employed in the manufacture of iron and steel.

3616 J. Kerr, King William-street, City, gun maker. Improvements in breech-loading firearms

3618 W. B. Pullar, Bread-street, City. Improvements in the manufacture of fabrics to be made into skirts.

3620 B. Monson, Colchester. Improved apparatus for sliding the sash frames of windows, and for sliding shutters.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated December 18, 1867.

3602 M. H. Collins, Mass., U.S. An improved lamp.

Dated December 20, 1867.

3624 L. L. Tower, Mass., U.S. Having reference to faucets and vessels for measuring liquids. (A communication.)

Dated December 21, 1867.

3626 J. T. Kershaw, surveyor, St. Paul's-road, Islington. An improved ventilator.

Dated December 23, 1867.

3645 W. Walker, Liverpool, consulting engineer. Improvements in cotton ties. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," December 24, 1867.

2063 T. Berney. Bending bars.
2297 C. Hohgrefe. Chimney tops.
2307 F. H. Holmes. Electric light.
2308 C. D. Abel. Removing sulphur. (A communication.)
2314 A. M'Dougall. Separation of sulphur from sulphuretted hydrogen.
2322 J. J. Bright. Actuating propellers.
2323 G. and J. Pilling and F. Jennings. Covering the edges of fabrics.
2327 A. Swan. Recovering lees.
2331 J. Fawcett. Extracting oils.
2332 T. Walker. Cutting grooves.
2334 W. B. Leachman and J. Holroyd. Pumping fluids.
2335 A. M. Clark. Securing bayonets. (A communication.)
2339 W. Betts. Metallic capsules.
2340 W. Betts. Metallic capsules.
2341 G. Buxton and S. Bann. Axles.
2344 J. T. Way. Treating phosphate of lime.
2354 G. Clarke. Fire-escapes.
2355 J. Day and W. Dorber. Carriages.
2360 J. W. Dudley. Cutting corks.
2362 A. Leveson. Coverings for perambulators.
2371 C. E. Brooman. Ornamenting fabrics. (A communication.)
2388 A. Cohen. Watches. (A communication.)
2389 J. Murgatroyd. Steam boilers.
2391 C. E. Hall. Hoeing turnips.
2394 G. Luvekx. Waterproof tubes.
2405 R. King, J. Lowden, W. Gartside. Carding engines.
2412 T. W. Lawson. Ships.
2422 J. Varley. Measuring water to steam boilers.
2433 F. J. Cleaver. Screw presses.
2436 E. Sonstadt. Treatment of sea-weed.
2455 W. B. Smith. Lever watch movements.
2460 A. Stewart. Textile fabrics.
2477 W. J. Matthews. Breech-loading firearms.
2507 J. Howard and E. T. Bousfield. Cutting grass.
2508 G. A. Buchholz. Hulling wheat.
2594 R. Lowe and J. Taylor. Jewellery.
2604 J. Jeyes. Substitute for oiled silk bladders.
2626 J. Soames. Candle fixer.
2691 P. H. Colomb and F. J. Bolton. Production of light.
3031 W. E. de Bourran. Concentrating saccharine fluids.
3093 J. Orr. Plaiting woven fabrics.
3110 H. Allman and F. N. Gisborne. Lamps.
3248 I. Swindells. Separating minerals.
3277 W. Anderson. Evaporating apparatus.
3319 W. Boulton. Transmitting motive power.
3361 J. S. Smith. Ventilating buildings.
3410 J. Fitter. Expanding tables.
3437 J. Thorpe. Waterproof paper.
3440 J. Gjers. Cast steel.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

3119 F. A. Chevallier
3150 J. Butchart, S. A. Morrison, and H. Stroud
3171 J. Ramsbottom and T. Blackburn
3174 W. Reid
3175 J. H. Johnson
3176 J. Hargreaves
3191 J. Paterson
3195 R. A. Brooman
3236 T. R. Harding
3250 T. Bouch

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending December 21, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1247	0 6	1385	0 10	1408	0 4	1422	0 10	1436	0 10	1452	0 4
1308	0 10	1387	1 8	1410	0 4	1424	0 8	1437	0 4	1453	0 4
1329	0 10	1391	3 2	1411	0 4	1425	0 4	1432	0 6	1458	0 4
1334	1 0	1394	0 4	1413	0 4	1427	1 0	1442	0 8	1459	1 0
1346	0 8	1395	0 4	1414	0 4	1429	0 8	1443	0 10	1460	0 4
1349	0 10	1398	0 4	1415	0 4	1431	0 4	1444	0 4	1461	0 6
1354	1 6	1401	0 4	1416	0 4	1432	0 4	1445	0 4	1462	0 4
1362	0 10	1404	0 8	1418	0 4	1433	0 4	1446	0 4	1464	0 4
1363	0 10	1405	0 4	1419	0 6	1434	0 4	1448	0 6	1465	0 4
1364	0 10	1406	0 4	1421	0 4	1435	0 8	1450	0 4	1491	0 8
1366	1 4										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JANUARY 10, 1868.

TORPEDO EXPERIMENTS.

WE have from time to time said enough upon this question to render it unnecessary now to remark how very important an arm we consider it to be for naval warfare. In view of this importance, we are glad to see that our authorities are not losing sight of the question, although they are not proceeding so vigorously to develope a perfect torpedo as we could wish to see them. There would be no difficulty whatever about this if they would only accept the suggestion made by us some time since that they should try Captain Harvey's torpedoes. From an examination of these agents of destruction, we assert that they are the most judiciously constructed and effective ever planned,* and ought to have the serious attention of Government. Recent experiments have, however, taken place in this direction, both in England and on the Continent. Those at home were made at the close of the past year at Portsmouth, the object being to prove the effects that would be produced on a steam launch by firing a submerged torpedo containing a charge of 100lb. of gunpowder, when suspended from the end of a spar projecting over the bows of the launch, and supposed to be in contact with the bottom of an enemy's vessel or a marine obstruction of any kind. The torpedo was fired by one of the "Excellent's" boat batteries, the construction and manipulation of which is now taught to all seamen gunners passing through the ship as part of their ordinary drill. The spar, with the torpedo attached to its outer end, was slung and fitted with a running rope fall in the same manner as was applied, or nearly so, in the first experiment of the kind when the captain's gig of the "Excellent" was converted into a temporary torpedo boat. The torpedo was exploded at the desired moment, throwing up an immense mushroom-shaped column of water, while the only effects felt by the steam launch from the explosion was the taking in of a quantity of water over the bows. This was of no moment, however, as endangering the floating power of the boat; but even its entrance could have been prevented, by simply covering in the boat forward with canvas, as is done with gigs and other small boats in all experiments of the kind made with them. So far, then, the experiment proved successful, but it is not a new idea, and moreover is not exactly the kind of experiment we would wish to see carried out. Instead of a torpedo with a charge of 100lb. of gunpowder, let us have a fair trial of one charged with a mere modicum of Horsley's powder, as Captain Harvey proposes, and then let us see where the vessel opposed to its action will be.

But they are carrying out the investigations into the torpedo question in a better manner in France, and they seem to be nearer a solution of the problem than we are. We hear that at Brest some extraordinary effects were lately produced by a new kind of torpedo tried in the River Landerneau, which flows into the bay. The vessel selected for destruction was an old ship, the "Wagram," of 100 guns, the first tier of which had been cut down. The new torpedo appears to be far superior to either the English or American and Russian one. The former is only efficacious when the vessel is passing over it; the latter are so contrived as to stick to the vessel and cause a shock. But the new French torpedo produced its effect at a distance of 12 metres from the hull and six metres below water. There were four torpedoes thus placed around the vessel, and connected by wires with an electric battery on shore. On the signals being given, three immense sheaves of water were seen rising to the height of a sixth storey; the wire of the fourth torpedo being broken, it did not go off. Nevertheless, the ribs and planks of the vessel were shivered, and there was barely time to run the vessel on shore. The effects approach those which would result from the use of Horsley's powder, but the absence of any details prevents us discussing the matter further. It is clear, however, that such torpedoes as Captain Harvey's and the above will, with judicious arrangement, prove invaluable for the protection of ports in time of war.

Having referred to Captain Harvey's torpedo, it may be well to state that that officer is still endeavouring to convince our Government, through the Obstruction Committee (rightly so named), of the efficiency of his torpedo. We hope he may succeed, but fear it will require a little of Horsley's powder to force home to their convictions the fact that in this torpedo we have the best known practicable means of destroying vessels at sea without coming into collision. Although Horsley's powder, the explosive used by Captain Harvey, is exceedingly powerful and rapid in its action, it is perfectly under control. This is evidenced by some experiments which were recently made in a cutting for a tunnel at Milford between nitro-glycerine and the explosive powder which is manufactured, without danger of decomposition or spontaneous explosion, by Mr. Horsley. The preference was given to the powder, not only for its power when exploded in a particular kind of cylinder, but also for its economy, and its greater safety in use and storage. With this desirable agent at command we urge upon the Admiralty the importance of testing the merits of Captain Harvey's torpedo. If it be a failure a very few pounds will prove it such. If it be the success we believe it to be, then thousands will be saved to the country in useless experiments in other directions.

* For particulars of Captain Harvey's torpedo see MECHANICS' MAGAZINE for March 29, 1867, page 189.

ELECTRICITY AND TELEGRAPHY—ITS PAST AND FUTURE.

IN reviewing the progress made during the past year in electricity and telegraphy, we pause at the outset to dwell for a short time on the great loss the scientific, but more particularly the electric, world has sustained. One of the greatest ornaments to science has passed away from amongst us. Michael Faraday is dead. We published soon after that melancholy event a short memoir of him, but in reviewing the electrical facts of the year we cannot but allude to him who for so long a period has been so intimately associated with the science. Who that has listened to him, as he lectured at the Royal Institution to crowded and delighted audiences for so long a time, can ever forget the man, possessed as he was with that rare power of conveying thoroughly, and in so easy a manner, the facts and theories he himself was so conversant with. To him more than to any one, and to his many and important discoveries, the present advancement of electric science, and consequently, we may add, telegraphy, is mainly due, and though the man may have passed away, yet the name will live so long as electricity is studied and the world lasts. His numerous discoveries and researches were reprinted some years ago from the "Philosophical Magazine," where they were originally published, as from time to time the experiments were made. This edition is now very rare, and is much sought after. We trust before long to see a reprint of the labour of a life devoted to the elucidation of electricity. During the late years of his life he was unable to bring his faculties to bear upon science, and he died honoured by his Queen and his country.

Passing on to the progress made in the various branches of this science, we will first allude to the machine of Mr. Wilde, of Manchester, which created so much excitement at the Royal Society's soirée. The invention itself is one of the facts of the preceding year, and, as such, was alluded to by us in our annual summary; but as no description of it had appeared, and its début before the public did not take place until early last year, we mention it prominently here. As a description with drawings and full details appeared lately in our columns, we will only briefly allude to it. The induced current obtained from a small magneto-electric machine is used to excite a large electro-magnetic machine, and the current induced from the latter is applied for the purpose of experiment. The armatures in both machines are those known as Siemens', their peculiarity being that the wire is wound longitudinally round the armature. These armatures are driven at a high velocity by a small steam-engine, or by manual labour. The electricity induced from the larger machine is of a power far exceeding anything hitherto obtained; and the results shown in fusing large wire, and the incandescence of charcoal, are astounding. But it must be remarked that these results were obtained at the expense of great mechanical force. At a subsequent soirée of the Royal Society, Professor Wheatstone and Mr. Siemens exhibited machines similar in construction to that of Mr. Wilde, but differing materially in the manner of excitation. Those gentlemen pursued their investigations independently of each other, and, strange to say, almost simultaneously arrived at similar conclusions. Instead of using an independent machine to excite the larger, they found that the machine once excited, the residuary magnetism by its action was sufficient to induce a weak current in the armature, this current, owing to the wires of the armature being in connection with those of the electro-magnet, excited it further, which, of course, acted again upon the armature, producing a more powerful current. This action and reaction continued until a maximum current of enormous power was induced. The time required to arrive at this maximum was but small. It was found only necessary to excite the electro-magnet in the first place with a single cell, after that there would be always sufficient residuary magnetism to set the machine in action. More powerful results were obtained by Professor Wheatstone, by the insertion of a shunt in the circuit between the armature and the electro-magnet. Mr. Ladd subsequently made an alteration in Wilde's machine; instead of the horse-shoe form of electro-magnet, he made his with two bar magnets, with a Siemens armature at each end, the one being used to re-act on the electro-magnet, and the other for applying the induced electricity to experimental purposes. The electricity obtained from these machines is of enormous power, and will be of great advantage for lectures, where a large amount can always be obtained readily. The only practical purposes to which this invention has at present been applied are those by Mr. Siemens, who uses his large machine for magnetizing large bars, &c., and a small machine, similar in principle, for blasting purposes. This latter is a very pretty instrument, to which we hope shortly to call the attention of our readers.

Magnesium has been tried as a positive element and has given very satisfactory results; in some experiments made, it was proved that this metal used with water was equal to a similar amount of zinc in acidulated water. We are waiting further experiments with this metal before we can fairly judge of its practical advantages.

Some highly interesting experiments were made by showing the mechanical action in voltaic circuits. Results were obtained by currents from a Ruhmkorff coil, as well as

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rom an ordinary battery. A similar result is also mentioned by De la Rive, in a paper that appeared during the year on "Stratified Discharge in Vacuo." This paper contained many interesting experiments, and adds many facts to the elucidation of Grove and Gassiot, on discharges in vacuo. Some experiments have since been made which prove that no discharge takes place in a perfect vacuum. A valuable machine was exhibited at the Royal Society for the production of ozone, by induced currents, obtained from a powerful Ruhmkorff coil, passed over a series of condensers.

We mentioned in our last summary that the Government had the question of telegraphs before them with the view of obtaining the control of the various telegraph lines throughout the country, and placing them under one system in the hands of the Post Office administration. Since then the matter has been constantly before them, and it is now decided that such shall be carried out, and sufficient inquiries have been made, and the matter has been so far advanced that the Government has given a notice of their intention to bring in next session a most comprehensive bill, with the view of obtaining the sole control of our entire system.

A bill was brought into Parliament by Mr. H. B. Sheridan, passed the Commons, and withdrawn after Committee in the Lords, for establishing a system of communication between passengers and guards of trains in motion. At the Committee, railway managers and the inventors of the various systems now in use were examined, and it was decided that further experiments be made. Since our last notice, trains fitted with electric passenger communication have been constantly running—on the South-Western on Mr. Preece's plan, on the South-Eastern on Mr. Walker's; and trains have also been fitted with Mr. Martin's plan on the North-Western. These different plans are to be again tested on various lines, and it is most probable that if the reports are in any way satisfactory, further action must be taken in the matter.

Great activity has been shown in the India Telegraph Department during the past year, and steps taken to improve in every way the working of the system out in India. New poles and insulators have been sent out in quantities, and we are happy to find that progress is really the order of the day. Appointments were hitherto made in a somewhat reckless manner, and anyone joining in India, with a superior knowledge to those already engaged, found the groove too deep to get out of, and was simply compelled to follow the old track. Now the appointments are filled up by persons somewhat qualified by previous instruction in electricity and practical telegraphy, who, after satisfactory examination, are sent out to India. In addition to this, some special instructors are being sent out with the view of imparting a knowledge of testing throughout the staff, so that the Indian telegraphist may now know where a fault is to be found; but it is a pity to stop here. Undoubtedly such instruction is very material, but what is most needed is a thorough instruction in constructing lines, in order that the faults might not be produced. Prevention is certainly better than cure; and although we believe that the knowledge of how to locate and cure a fault is most essential, yet we cannot but give the greater importance to that of prevention, by establishing such a thorough system of construction as would render the recurrence of faults but rare. The great energy that has been shown in this department of late has been due to the presence in England of the Director-General Colonel Robinson, R.E., who on lately assuming the reins, has been most active and energetic in introducing as many improvements as possible in order to bring the standard of the Indian system more on a par with that of the mother country.

The Paris Exhibition brought together a large collection of electric and telegraphic apparatus, but there was but little to attract any very especial attention. Since the previous Exhibition a steady improvement might be observed in the manufacture of the instruments; and with regard to speaking instruments, a large increase was noticed in the number of recorders, as compared with ordinary sight and sound instruments. The almost entire absence of submarine cables of our manufacture was greatly to be wondered at, Mr. Henley being about the only one who exhibited. Mr. Hooper exhibited some specimens of his manner of insulating with india-rubber, and obtained a gold medal.

The system of weather signals, as adopted by the late Admiral Fitzroy, and of prognostication and warnings being telegraphed from the central office, has been for some time abandoned, but at the time a great deal of good was derived from it. An agitation has been going on during the past year relative to it, and we shall again see before long the resuscitation of the signals, which, at seaports, will again, as formerly, be a boon to the whole seafaring class.

In Submarine Telegraphy extension is gradually but surely going on. Although many breakages and repairs have taken place, we are happy not to be able to chronicle the decease of any member of this important family. The Atlantic Cable of 1866 has suffered from breakage twice, once close to the shore at Heart's Content, the second time at some little distance at sea, where the cable crossed a shallow patch. In both cases the damage was stated to have been done by icebergs, and the necessary repairs quickly executed. The Malta and Alexandria Cable has been periodically troubled, but the precaution of having a repairing ship on the station has prevented the interruption from being of long duration.

A small length of cable, thirty-five miles, was laid from Ceylon in 1866, but notice did not arrive until after our summary. This cable is remarkable for the excellence of its core, which consists of Hooper's Insulator. The resistance of the insulating medium is stated at 7,000 million ohms per knot, exceeding any core yet produced.

The New Zealand Cable, from Lyall Bay to Disaster Point, a distance of forty-two miles, was laid in 1866, but as the news did not appear in our last summary we mention it now. This was a large cable of one wire, manufactured by Mr. Henley, and weighed over nine tons per mile. It was protected externally by a coating of asphalte compound. Mr. Henley also manufactured and laid a large cable from South Foreland to La Panne, a distance of forty-seven miles. The main cable weighed nearly ten tons; the shore ends of ten miles, nearly twelve tons per knot, contained four conducting wires, and had an exterior protection of asphalte compound.

The Telegraph Construction and Maintenance Company manufactured and laid cables from Placentia Bay (Newfoundland) to St. Pierre, and from St. Pierre to Sidney, a distance of 300 miles. The cable consisted of one conducting wire, protected by external iron wires weighing 2¼ tons. From the excessive coldness of the water where this cable is submerged, the insulation test is very high, being over 4,000 million ohms per knot.

The past year has seen the advent of a new cable manufacturing company, the India-Rubber, Gutta-Percha, and Telegraph Works Company at Silvertown having erected some excellent machinery, manufactured and laid a cable from Cuba to Key West, and from there up the Florida coast. The cable was 245 miles in length, consisted of one conducting wire, protected in the ordinary manner by external wires. The insulation was higher than anything previously manufactured. We are glad to see that they have taken up this branch of manufacture, for it is only at their works that one can have a cable manufactured in its entirety. The conducting wire is covered with the insulator, served, and finally protected with the external wires, all on the same premises.

Of Cable Expeditions, the Cuban has proved as yet the most melancholy that ever left our shores. The ship arrived out there in the height of summer time, the most unhealthy season of the year; before the completion of the work yellow fever appeared on board, sparing but few, and almost disabling the ship; when the fever finally disappeared, fourteen of the staff had fallen victims to this fearful scourge. Amongst the number, we regret to find the names of Mr. W. E. M. Medley and Mr. Phillip Crookes, two most promising young electricians.

A short length of heavy cable, protected by asphalte compound, for insertion in the Portpatrick cable, has been also lately manufactured at the Silvertown works.

Railway Telegraphs appear to be on the increase, the block system of signalling coming more and more into favour. We notice with pleasure its extension on the various lines, but still trust to see its adoption more general. A new repeating signal apparatus, the joint invention of Messrs. Preece and Warwick, exhibited at the soirées of the Royal Society, and of the Institution of Civil Engineers, has been adopted and used largely on the Midland and South-Western Railways. It is intended for signal boxes, where the distant signals are so situated as to be out of sight of the signalman. The apparatus consists of a small indicator surmounted by a miniature semaphore, the state of the distant signal being always indicated by the position of the arm of the semaphore, and the condition of the light, whether in or out, by the tell-tale indicator. It is a very pretty and most useful apparatus, and one well worthy of adoption. We intend shortly to describe it, with illustrations.

The literature of the telegraphic year has not been very prolific. Amongst our books we can only find two—the "Electric Telegraph," by Robert Sabine; and a new edition of the "Handbook of Practical Telegraphy," by R. S. Culley. The latter is an invaluable book, and one that no practical telegraphist should be without. Several brochures have appeared on the question of Government and the telegraphs, and a fair proportion of new and interesting matter has appeared in the scientific periodicals.

In looking forward to the prospects of telegraphy in the year before us we must first admit that the present stagnant state of things has affected telegraphic enterprise, which, for lack of capital, is at a standstill, but we hope that with the coming of spring we shall be able to welcome a return of confidence, and consequently of telegraphic extension. Good and useful schemes are ripe, and only await that return of confidence to be brought forward. The extension to India *viâ* the Red Sea and Bombay will we trust be again brought forward, and enable us shortly to bring our Indian possessions within easy certain telegraphic distance. The extension of the telegraph from Cuba to Jamaica and Panama may be confidently looked forward to as one of the enterprises of the year. The late successful completion of the Florida and Cuba Cable has made this extension a necessity, the carrying out of which again will lead enterprise on to the South American continent, and bring us within easy communication of many important points. The concession lately granted by the French Government for a new American route makes us look forward with anticipation to a Franco-American line, enabling us to communicate with our transatlantic friends on cheap terms.

In the course of the year we shall probably see the transfer take place of the various private systems of telegraph throughout the country to our Government, and

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placed under the administration of the Post-office, a result that must in the end, under good and skilful management, tend to the advantage of the public by increasing the facility of telegraphing, and by greatly reducing the rates. We look forward to the day when telegraphy will be employed as much as the postal system is at present. In glancing back upon the progress made during the past year we cannot be unmindful that the great work is slowly and steadily advancing. Our knowledge of the hidden mysteries of the science daily become greater, and the practical applications of electricity are becoming more and more general, and we feel with confidence that the year before us will not close without some special developments in this mysterious but beautiful science.

RAILWAY REFORM.

OWING to causes into which it is unnecessary here to enter, our railways have, during the past year, attained a most unenviable notoriety. The financial condition of many of them is at the present moment truly pitiable, whilst the whole system is in a most questionable position. Had it not been for Government intervention during the year just closed some lines would doubtless have yielded to the pressure under which they laboured. How much longer some few others will be able to hold their own it is impossible to say. In fact, the commercial attitude of numerous lines just now is by no means calculated to inspire confidence in this class of securities, nor to encourage the development of the railway system in quarters still open to the improvement it ever carries with t. Of course we shall be told that railway depreciation and derangement is only part and parcel of the universal commercial convulsion which the past two years have witnessed. This is admitted; but it forms no excuse for railway defection which might have been materially lessened, if not altogether avoided, by stricter economy in outlay, and closer attention to the working details of the system. Now, it is by no means our intention to pour out lamentations for the past, nor to hurl invectives at the heads of railway directors or managers. Such a course would neither be of practical value nor lead to any good result. Seeing the present condition of matters, our purpose is rather to point out a remedy than to visit the shortcomings of officials with meaningless condemnation—for meaningless it would be just now. And in touching upon the matter at all we do not pretend to have discovered a perfect remedy for the general disorganized condition of railways. There are many departments in which reform is required that do not fall within our province to discuss. But there is one department—and that a most important one—which does peculiarly belong to us to consider, and which we hope to show may be materially benefited by a thorough reform, and this is the locomotive department. Of course, reform here would have a direct bearing upon the health of the whole system which it would unquestionably benefit in a greater or less degree.

One of the leading causes of railway depreciation is that heavy item of expenditure—maintenance of way and rolling stock. This item stands out with unpleasant prominence in every railway account, and although the means by which it might be reduced are, and have been for long past, really within reach, there is no sign of decrease, but rather the reverse. And it comes about in a very simple way; trains are run at excessive speeds with engines unnecessarily heavy for the work they have to perform. Of course we must have high speeds for some purposes; we need not knock off our express trains, but they can be drawn by engines of lighter build than we are now using, and fifty or sixty miles an hour will be as readily attained. The destruction to rails and rolling stock is as the square of the velocity, and this destruction, the bugbear of all railway accounts, would be greatly reduced by the use of lighter engines, that is of engines in which wheels are not overweighted. If instead of placing from six to seven tons on each wheel, as is at present done, not more than from three to four tons were brought to bear upon them, a great economy would be the result. Speeds should be regulated, and passengers charged according to the speed at which they travelled. With goods trains an uniform speed of fifteen miles per hour might be maintained. This is about half the present rate of speed at which these trains travel, but the compensation appears to us to lie in doubling the power of the engine, and giving them the same work to do in the same time at half the present speed. To prove that this could be done, let us suppose a thousand tons of goods requiring conveyance daily between two given points. Now, if instead of sending these in batches of 250 tons each by four trains, at the rate of thirty miles an hour, we made only two batches of them, and despatched them by two trains at fifteen miles an hour, we should effect an enormous saving. Precisely the same amount of work would be accomplished in the same period, with just half the number of trains. We should thus arrive at a reduction of risk of accident—and we all know what a fruitful source of accident goods trains are—and we should get besides fifty per cent reduction in the cost of haulage per ton of merchandize, to say nothing of doubling the carrying capacity of the railway itself.

We have so far indicated the theory of railway reform in one important department; its practice, it must be admitted, is another matter. But we are quite prepared to prove that the course we have pointed out is not only perfectly practicable but easy of accomplishment. This is by no means the first time we have discussed the question of railway reform; we have before debated the point upon exactly the same grounds over which we are now going. Nearly three years since in an article upon Locomotive Reform* we pointed out the great economy which would result from the use of engines constructed upon the very practical plan designed by Mr. R. F. Fairlie, C.E. Since we wrote, these engines have made substantial practical progress, some being in use on several lines of railway at the present time. Those of our readers who wish to investigate the details of Mr. Fairlie's engines are referred to the number of the Magazine quoted at foot. It will be sufficient here to notice the general principle of the system. The boiler is of greater length than in the ordinary locomotive, and is divided in the centre by the fire-box. Each end of the boiler terminates in a combustion chamber. Thus there are double sets of tubes running in opposite directions from the fire-box. There is also an upper series of tubes running from the tube plate in the combustion chamber to a smoke chamber placed inside the fire-box shell over the fire-box. The heat and products from the fire-box pass through the lower series of tubes to the combustion chamber, returning thence through the upper series to the smoke chamber, and passing out from thence through the chimney, which is over the fire-box shell. There is a division plate each side between the fire-box and shell in the water space, reaching up to 9in. above the ordinary water level, so that on going up steep gradients the tubes are not uncovered at either end.

The advantages arising from this system of construction are numerous and important. We have first a greater generating and maintaining power than can by any possibility be obtained by the ordinary system. In the next place, the whole weight of the engine, including fuel and water, is made available on the rails for traction power. Tenders are entirely dispensed with, and thus an unremunerative and costly incumbrance is got rid of. The boiler being carried on the centres of two distinct frames, each having its engines, wheels, and gearing complete, made on the bogie principle, distributes the weight over the number of wheels, say four or six in each frame. These being driven by their own engines act separately and independently of each other, although forming but one whole. The general arrangement of the engine enables it to pass round any curves, down to a radius of one and a half chains, with the greatest facility, the friction being reduced to a minimum. Turn-tables are not required for these engines, as they will run either end on. Thus upon all points this system presents important advantages, and if railway companies would only avail themselves of them a little more generally they would unquestionably find it greatly to their own interests and to those of the unfortunate shareholders.

Perhaps the most valuable testimony we can adduce upon the merits of the Fairlie system is contained in the report of Captain Tyler, the Government Inspector of Railways. The captain has just returned from an examination of the condition and prospects of the Grand Trunk Railway of Canada, and in his able report we find him stating that the engines which find most favour in Canada, and generally in America, are constructed with a four-wheeled bogie-truck under their leading and four-coupled wheels under their trailing ends. And engines of this description are now being built, to weigh about thirty-two Canadian tons, for future use on the Grand Trunk Railway. The tenders run upon two bogie-trucks. Six-wheeled coupled engines, such as are used in this country, are apt to leave the rails on an uneven or frozen road, and it is not safe to use them in Canada. This disadvantage of the existing pattern of the engine is, that neither the four wheels of the bogie-truck, nor the eight wheels of the tender, are available for adhesion; and that, in order to obtain sufficient adhesion for heavy loads in slippery weather, a considerable weight is required upon the four driving wheels. Referring to the durability of the rails, Captain Tyler observes that it is very important to keep the weights on the wheels as light as possible, especially in cold climates, and in pointing out the means of attaining this object he says:—"The class of engine best suited to the climate, and for the various circumstances of the case, would, I have no doubt, be an engine running on two bogie-trucks, each provided with a pair of cylinders, and four-wheeled or six-wheeled according to the work required—and without a tender. Such an engine would be peculiarly safe to travel over a winter road; would combine a minimum wear and tear to itself and the rails, with a maximum of adhesion, and would be the most effective and the most economical that the company could employ. I had the opportunity some time ago of testing engines of this description on the Neath and Brecon Railway, designed by Mr. Fairlie, and have found the principle to be good, though certain points of detail require improvement. Such engines are also in use for the sharp curves and steep gradients of the Queensland Railway." The points of detail referred to by Captain Tyler have been improved upon, and the principle is now as perfect as the present state of engineering science can render it. Seeing, then, that we possess, ready to hand, the means of effecting important improvements in our locomotive system, which would not only materially reduce the cost of rolling stock, but of maintenance of way, we urge upon railway officials and others interested to lose no time in adopting these means of special economy. The question is attracting much attention at the present time, and in another column we give an exceedingly well-written article upon the subject from a daily

* MECHANICS' MAGAZINE, February 3, 1865.

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contemporary. By all means let there be unity of action in pointing out the evil, and let each do his best in his special department to aid in solving the important question of Railway Reform.

ELECTROPLASTIC.

UNDER this title the art of depositing metals in moulds is generally known on the continent of Europe, while in England it has been known by the name of electro-typing; but probably the best name for it is electro-casting, in contradistinction to pyro-casting, or casting by heat, as in ordinary foundries. The first idea of this art was suggested to Mr. Daniel on the invention of the galvanic battery which bears his name. M. Jacobi took up the suggestion, and produced some small castings of seals and other small objects; the process being so simple it was extensively practised by amateurs as an amusement. These castings were all on pure copper, as other metals were found too difficult or too expensive for the process; indeed, even yet when the process has been introduced into the fine arts, copper still is the metal that is mainly used.

The only other metals that have been electro-cast are silver and gold, but these to a very limited extent. The process of electro-casting in silver is a very slow process as compared with that of copper, notwithstanding that the equivalent of silver is nearly twice that of copper, and the electro-conductivity of silver is also greater. The difference in the rapidity of deposition in favour of copper is owing no doubt to the difference in electro-conductivity of the solutions in which they are dissolved, sulphuric acid and water, in which copper is usually dissolved, being a much better conductor of electricity than cyanide of potassium and water, in which silver is usually dissolved. This is very evident when the same solution is used for both metals; the deposition of copper then is not half that of silver with the same current of electricity. Gold can be electro-cast more rapidly than silver, cyanide of potassium dissolved in water being used as the solution, which might have been expected, as its equivalent is greater than that of silver. Hitherto, these three—copper, silver, and gold—have been the only metals that have been successfully electro-cast. It has often been attempted to deposit some white alloy which might serve as a base for electro-silvering, but hitherto without success. Ordinary German silver has been deposited, but the process is so slow, and, moreover, a considerable heat has to be maintained, so that for more than a simple coating it has not been successfully used. A white alloy for the above purpose is still a desideratum. From experiments that have been made, there appears no doubt that this desideratum will be supplied before long, but it will not be of the precise composition of ordinary German silver, but tin will take the place of nickel. There seems to be no doubt that pure tin could be electro-cast if we could make those solutions which give a reguline deposit conduct electricity more freely. We have seen some experiments made in this direction also, wherein there is every probability of success. At present, many articles are electro-cast in copper which are intended to be electro-silvered, such as jewel-cases, work-boxes, tea-caddies, ink-trays, &c.; in fact, all such articles as are highly enriched by sculptured ornamentation and electro-silvered, this process being much cheaper than pyro-cast German silver, as all such castings require the use of the chisel and graving tool besides smoothing and polishing, which electro-castings do not. There is no metal that will pay for pyro-casting and finishing but silver or gold, and even these, if done in quantities, are much more cheaply done by the process of electro-casting.

In the process of electro-casting copper there is nothing to be desired. It is very simple, and easily managed; in fact, when once fairly started, it will almost work of itself, and is less expensive than any alloy can possibly be, but the drawback exists in the metal itself in it being so readily oxidized. Not that there is any difficulty in silvering it—that is now easily enough done, but it is after the article is silvered that the defect of this metal appears. Unless the coating of silver is very thick it is soon cleaned off, or if by accident it should receive a blow on any salient part, the silver might be taken off, and the red copper would appear, which would soon turn to green and black by contact with the atmosphere. But ordinary German silver is subject to a similar objection; even common plated spoons and forks of this metal soon become very unsightly, and not only so but even poisonous, if great care be not taken so that a white alloy containing but a small proportion of copper would be a great acquisition for all electro-plate goods, but more especially for electro-casting in the finer branches of the art.

PHOTOGRAPHY.

PERMANENT PHOTOGRAPHS — PROTECTING SILVER PRINTS—IMPROVED METHOD OF PRINTING.

THE falling off in commercial prosperity in England is felt by photographers as severely as by others, but has had the good effect of drawing attention to those defects in ordinary portraiture which tend in some degree to add to the prevailing photographic depression. The photographs which now fill the windows of so many shops in our leading thoroughfares are historically worthless, for there is very strong evidence that they will all fade, though a small minority of them, which have been produced by good manipulations, founded upon the best principles of photographic chemistry, have a greater degree of permanence. Swan's carbon process gives capital pictures, infinitely more permanent than the ordinary silver print, yet commercially this process makes little headway against its silver rival, because the difficulties and expenses incidental to its adoption are barriers. The inventor of the process turns out carbon pictures regularly, but he charges more for carbon printing than his host of competitors do for the silver printing of pictures the same size.

Accordingly, at the late meetings of the London and Provincial Photographic Societies, the discussions relating to the fading of photographs scarcely ever include the suggestion that carbon prints shall be substituted for the present kind of pictures. Much time has been spent, and many experiments have been made, with a view to find some transparent substance with which to coat the present silver pictures, thereby protecting them more effectually from atmospheric influences, and rendering them more durable. Mr. Valentine Blanchard, a good practical photographer, well known for his instantaneous views of the streets of London, has been very actively advocating the coating of the present pictures with a film of collodion laid on by a brush, and he has produced evidence that prints so treated are more stable than others. But the film of pyroxyline thus left upon the paper is itself of an unstable character, and there are other little practical objections to its use, which, however, would be readily encountered if confidence in the utility of the plan were once established. Other experimentalists have recommended the coating of the print with a good lac varnish, and pictures so treated have resisted the action of some destructive gases, which would have injured an uncoated print. Yet the safe exposure of a picture to one particular gas gives but approximate evidence as to the effects which would be produced by the long action of light and air. Another plan is that proposed by Mr. Cooper, who recommends the coating of the picture with paraffine and gum resin, which are applied dissolved in benzole. By his plan one part of dammar, mastic, or copal, and four parts of pure paraffine, are dissolved in benzole, and a little of the solution is rubbed over the picture with a tuft of cotton-wool; this causes slight cloudiness, which disappears when the face of the print is polished with a clean piece of cloth. The silver surface is thus covered with the very durable substance paraffine, and, from a chemical point of view, this is perhaps the best of the methods yet suggested to lengthen the lives of photographs. A photograph, when finished off by either of these plans, is a very complicated production, consisting of the unstable substance albumen, with a thin film of darkened silver which forms the picture upon its surface, the whole being then coated with a fine film of pyroxyline, resin, or paraffine. Sulphur is the deadliest enemy of the silver print, and as albumen contains sulphur, no chemist would like to guarantee the permanence of such pictures, with whatever film they might be coated.

In this dilemma, Mr. J. R. Johnson has just published an improved method of printing, which he says gives better pictures than at present, and of a far more durable character. Everybody who has seen them must have noticed the delicacy of the photographs turned out by Disderi, for they are black and white, like an engraving, and have a very pleasing appearance. They are evidently not printed in the ordinary manner; in fact, they are copied upon collodion, and the film is afterwards transferred from glass to the paper, and then mounted in the ordinary way. Mr. Johnson states that his process produces pictures like those of Disderi. The negative is taken in the ordinary way, but is not intensified so much as usual, and positives or collodion are taken from it, by means of a copying camera. He prepares the plates for the positives by coating them with a thin film of white wax dissolved in sulphuric ether. When the film is dry it is polished with a little dry cotton-wool. It is then coated with a bromo-iodized collodion, slightly tinged by the presence of free iodine, and sensitized in a bath containing a trace of free nitric acid. The plate should then be slightly over-exposed, and under-developed, to get clean shadows full of detail. A developer containing 10 grains of iron and 20 or 30 minims of acetic acid is employed to bring out the picture, which must then be thoroughly washed. He next immerses the picture in a bath, containing 20 grains of bichloride of mercury, 20 grains of chloride of ammonium, and a few drops of hydrochloric acid, to each ounce of water, and the plate is left therein till the picture disappears, or becomes quite white. After this operation, it has again to be thoroughly washed, then it is fixed in hyposulphate of soda, which restores its black colour, after which it is again washed.

The picture thus completed upon glass has to be transferred to paper. Mr. Johnson uses ordinary albumenized or gummed paper, previously coated with a solution of 10grns. of gelatine, 1oz. water, and enough Chinese white from a water-colour tube to render the solution opaque. The paper may be allowed to dry. When the transfer is to be made the paper should be wetted, and laid upon the collodion picture, taking care to place it on in such a way that air-bubbles shall be excluded. A piece of blotting paper should then be laid over it, and pressed, and the plate stood on end to dry in a warm room. The film may then be removed from the glass, for the collodion picture will attach itself to the paper, and a good black and white enamel-looking picture is the result. Mr. Johnson considers that the pictures thus taken contain more sulphide of mercury than metallic silver, and are consequently more permanent than ordinary photographs.

Within the next few months, all these plans of printing on paper will undergo rigid scrutiny by practical men, though none of them

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at present are admitted to be satisfactory. Those who now want small permanent photographs cannot do better than adhere to small transparencies on glass, with a second sheet of glass cemented over the face of the picture with Canada balsam, in the same way that glasses of achromatic lenses are cemented in optical contact with each other.

STREET TRAMWAYS.

THE promoters of a scheme of tramways, for certain streets and thoroughfares of London, who have unsuccessfully petitioned Parliament in the last two sessions for powers to carry their project into effect, have, for the third time, published the prescribed notices of their intention to apply for a bill in the session of 1868. The plans and sections, descriptive of their scheme, have, in accordance with the standing orders of Parliament, been duly lodged in certain public offices in the localities proposed to be affected, and in the private bill offices of Parliament. It is now many years since tramways were laid in Westminster, Birkenhead, and elsewhere in this country, but those first laid—on Train's plan—were open to the insuperable objection that they broke the level of the street, and were dangerous to ordinary street vehicles. In attempting to cross the lines they were subjected to rude shocks, and were dragged along the lines in a strained course to the damage of the vehicles, and the peril of drivers, passengers, and horses, and to the injury of the tramway itself, by wrenching the fastenings and throwing the rails out of gauge. The system now proposed by Messrs. John Noble and Co. obviates these objections, inasmuch as the tramways they propose to lay down will not break the level of the street, or prevent the passage upon the roadway, in any direction, of ordinary carts and carriages. The crescent rail, which they propose to employ, has already been fully described in the MECHANICS' MAGAZINE, and it is unnecessary to do more now than recall the statement that the rail will be on a level with the street both on its outer sides and between the rails. The only break on the surface will be a groove at the inner side of the rail for the flanges on the wheels of the tramway cars; such groove being too narrow to take in the tire of any ordinary street vehicle. A tramway upon this system does not present any objection of a mechanical nature, unless perhaps it be the liability of the groove to get choked up with ground stones and street waste, but a preventive of this result may be easily provided. If the continued public use of the whole width of the road can be preserved, it seems difficult to conceive any objection that can be urged against a trial, at least, of the system in some of the thoroughfares of London.

Wherever street tramways have been laid, the shopkeepers and owners of property have found that their trade has been greatly increased, and the value of their property enhanced, by the adoption of the improved mode of conveyance. This has been notably the case at Birkenhead and Liverpool. In the former town, some of the shopkeepers of Argyle-street objected to the tramway in that street, and it was in consequence diverted. They soon found that they had gained a loss, and petitioned, but too late, to have the tramway restored. In Liverpool some of the traders of Bold-street had opposed the project to lay a tramway in that fine thoroughfare, but they are wise in time, and are now very much in earnest that Bold-street should be embraced in a scheme now proposed for Liverpool. Two of the lines proposed to be laid by the Metropolitan Tramway Company pass through St. Pancras and Marylebone, and considerable activity is being manifested in these districts in relation to the scheme. An opposition is threatened, but by whom instigated or led does not seem quite clear. The promoters should be pleased rather than otherwise by an opportunity of exhibiting the voluminous and conclusive evidence which, we are informed, they have collected in support of their application; to the effect that the tramway carriages are much more comfortable and commodious than the ordinary street omnibuses, that they run much more quickly and smoothly, and with less noise, that they convey a larger number of passengers in a smaller number of vehicles, and can afford to do so at lower fares than the ordinary conveyances. Train's tramway—whatever its shortcomings in other respects—bore ample testimony on these points, to which we can speak from experience. As regards the maintenance of the road, the company takes the entire cost of maintaining part of the width upon itself, and by its operations reduces the tear and wear upon the whole. Whatever the evidence pro. and con. that any trustworthy witnesses have to offer, it is desirable that it should be placed upon record, and that this important subject should be thoroughly ventilated, and a wise conclusion arrived at.

THE FRENCH MONITOR "ONONDOGA."

IN troubled times men often reason wildly, and believe that danger exists where it is not. The French have recently given us an example of this by the purchase, for a fabulous sum, of the Monitor "Onondoga," to prevent her falling into the hands of the Prussians. It must be borne in mind that neither the Minister of Marine nor the Navy are responsible for the purchase of this wretched specimen of a sea-going vessel; to the Minister of Foreign Affairs the honour solely belongs. Some time in the month of August last she sailed from New York for France, but was compelled to return to port, which, after a second refit, she left for Halifax, Nova Scotia, under convoy of H.I.M. frigate "Themis" and sloop "Phlegethon." Her behaviour at sea was deemed so unsatisfactory that it was decided on remaining at Halifax during the winter, and she is now safely moored alongside the Royal Dockyard.

As Englishmen have long been familiar with the external appearance of this sort of ship, I shall not enter into a long description of the "Onondoga," but only touch on a few prominent points of her construction, as one of a class which, according to the version of the citizens of the United States, is to cross the Atlantic, destroy the British Navy, put our towns under contributions, and return to America unscathed. These are pretty "tall words" to be addressed to a first-class naval power, and indicate either a great deal of boasting on their part or a lack of preparation on ours to meet such a novel method of warfare. I have for some time been of opinion that the stem is the best offensive weapon to encounter such vessels, and have before published the same. The "Onondoga" is 226 feet in length, 48 feet in breadth, and 13 feet in depth; draught of water when loaded, 11ft. 6in.; tonnage (inclusive of engine-room and bunkers), 1,000; horse-power, 140 nominally, but her purchasers affirm that she does not work up to 100; pressure on safety valves, 16lb.; consumption of coals about 16 tons per day; bunker room, 300 tons. She is armoured in a peculiar manner. First, there is 4½in. of plating, then 12in. of wood, which is covered with inch plates, and forms the external skin. The waterways are about 24in. wide; the deck is pine, but lined with iron underneath to keep out shell. Amidships is the smoke stack, and some 40ft. abaft and before it stand the turrets, which are worked by steam machinery below the deck. A wooden bridge connects the turrets, running on either side of the smoke stack, and is useful in stormy weather for a promenade. The upper deck is about 1ft. from the water, with a slight iron railing in lieu of a bulwark. This deck is painfully free from fittings, there being neither chocks nor pipes to anchor or moor by the stern. One pair of small bitts forward, a second pair abaft the companion on the quarter deck, and a few badly forged and worse fitted ring-bolts, comprise the whole, if we except the dead lights which are flush with it. The hawse holes lead through the bows into the lower deck, where the anchor is purchased by the aid of a small windlass. The accommodation for the officers and crew is cramped and uncomfortable; under steam in hot weather it would be impossible to live below, and no one but a salamander could cook in such a galley. With the engine fires out, and the thermometer on deck at 10deg. of Farenheit, the perspiration was streaming down the faces of the cooks.

The framing and general finish of the engines is rough in the extreme; even the save-alls and similar articles must have been fashioned by the rudest hands. Indeed, it is long since I have seen such inferior work in a Government ship. In the officers' mess-place, and also before the engine-room, are rotatory steam pumps. One happened to be disconnected as I passed, and I remarked that the faces of the valves were not only rough but the deep scratches left in casting had not been removed. These pumps can be driven either with steam from the main or an auxiliary boiler which stands in the engine-room. The main boilers are fitted with Martin's vertical tubes. I had no opportunity of examining how they were stayed, but the workmanship about the furnaces looked very inferior. The furnaces were athwartships, and in hot weather the stoke-hole must be almost unbearable.

Her armament, if it is ever placed on board, will be four of Rodman's 450-pounders. I am not going to discuss the merits of these guns for general service in comparison with our own. I would simply remark that for the various services which a ship may be called on to perform I should prefer the English 12½-ton rifled gun. I do not believe, however, that England, or any other nation, need trouble themselves on this subject, for a ship which cannot move without convoy, or steer within any reasonable number of points, is not likely to inflict much damage on her enemies in a naval engagement. Truly, the Prussians must be a dangerous people, when the possibility of such a ship falling into their hands causes uneasiness to a nation of warriors, and sends them across the Atlantic to purchase, at any price, such a bugbear. As a point of honour, they will try next year to navigate her to France; after that is accomplished, I am of opinion that her services will be adapted for harbour only. X.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

EFFECT OF SUNLIGHT ON GLASS—PAINT—DRYING OILS, AND THE BEST PROTECTING COAT FOR IRON—NEW VOLTAIC PILES—TEST TO DISTINGUISH BETWEEN CARBOLIC ACID AND CREOSOTE—A HARMLESS FORM OF PHARAOH'S SERPENTS—THE INDUSTRY OF BARIUM.

SOME months ago, we noticed the experiments and observations of Mr. Gatfield and M. Pelouze on the changes of colour in glass effected by exposure to sunlight. In the last number of the "American Journal of Science," the first-named gentleman concludes his observations, from which we gather some interesting practical information. It will be readily seen that the choice of glass for a photographer's room is a matter of great importance to him. Photographers have remarked that they could take better pictures in a newly-glazed room than in one long exposed to sunlight. The explanation of this is clear. A glass containing iron becomes yellowish on exposure, and thus the transmission of the actinic rays is seriously interfered with. The best glass for photographers, Mr. Gatfield says, is a pure glass of light green or bluish-white colour. These

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are the most free from the oxides of iron and manganese, the latter of which the author believes to be the cause of nearly all the changes he has noticed. There are many, we dare say, who will be inclined to doubt the reality of the changes of colour described. To convince such, Mr. Gaffield suggests a simple experiment. Let them take a piece of glass, and cover a part with a strip of black paint. Let it then be exposed for some months, and after this time let the paint be cleaned off. The difference in colour between the exposed and protected part will be at once evident to every observer. The author also points out that when an old pane of glass is removed from a window the colour of the glass under the putty is very different from that exposed to light. To glass makers the practical result of the author's experiments is to suggest great care in the selection of their materials. Iron and manganese are to be specially avoided in the manufacture of the better kinds of plate and sheet glass. The author speaks well of English crown, but states that the most permanently enduring kind of plate glass he has met is a superior kind of white plate made by the French and Belgian plate glass companies, and a German crystal plate made in Hanover.

The celebrated chemist Mulder has recently published a very valuable work on paint. The starting point of his investigations was an enquiry as to the best material to protect iron from rust. The result has been his rejection of all oil paints as unlikely to answer the purpose, and his conclusion that coal tar contains the best materials for a protecting coat. The author very completely investigated the nature of paint, and the chemical changes involved in the drying of oils. As regards linseed oil, we are told that the essential constituent is "linolein," a compound of glycerine and linoleic acid. The latter body the author could not obtain quite pure, but he decides that its formula is HO, $C_{32}H_{27}O_3$. When exposed to air linoleic acid rapidly oxidizes, first to "linoxic acid," a sticky body resembling turpentine. On longer exposure, "linoxyn" is produced. This is a tough leathery substance, sharing, we may say, many of the properties of caoutchouc. It is soluble in the same menstrua, and can be vulcanized like india-rubber. It is manufactured in considerable quantities in this country, and is the binding material used to consolidate emery wheels. It forms also the surface of linoleum cloth. According to Mulder, there are two linoxyns, the white and red; the white modifications become red on exposure to 80deg. Centigrade, and the red again turns white on exposure to sunlight. The browning of white paint in dark places, the author ascribes to the gradual change of white linoxyn into red. Oxidation does not end with the production of linoxyn. It still proceeds to the complete decay of the material, as is seen in very old paint.

One useful result of Mulder's labour is a simple process for preparing a good colourless drying oil. For this purpose it is only necessary to boil linseed oil for two hours with 3 per cent. of red lead, filter it, and then expose it to sunlight in large shallow vessels, frequently renewing the air above. Another result is a denial of the existence of albuminous and gummy matter in linseed oil, to which are ascribed the slowness of drying of unboiled oils. For these matters, Mulder searched in vain, and, at last, came to the conclusion that they had no existence. Oxides and acetates of lead, he tells us, act as driers not by precipitating albuminous matters, but by forming a little linoleate of lead, which rapidly oxidizes and communicates its activity to the oil. We shall return to this subject with fuller information on the chemistry of paint when we have Mulder's book before us.

Bottger has recently described some cheap and simple modes of constructing galvanic batteries when constant currents of long duration are required, as for electric clocks and bells. He takes a glass or earthenware jar and places in it a hollow cylinder of zinc, within which, placed so as the two do not touch, is set a cylinder of retort coke. The space between the coke and the zinc is filled up with a mixture of equal parts of common salt and sulphate of magnesia, heaped up a little, and wetted with a strong solution of the two salts. As many of these cells as may be necessary may be connected in the usual way.

Not quite so easy of construction is another battery described, in which no porous cell is required, and no evolution of gas in the action. A hollow cylinder of gas coke is first made, 8in. high, ½in. thick, and 3in. in diameter. This is varnished on the outside, and within it is set a solid cylinder of amalgamated zinc, which is kept in its place by means of cork. The vessel is then filled with a mixture of equal weights of water and persulphate of iron. The action of this battery goes on until all the ferric is converted into ferrous salt.

Two modes of distinguishing between carbolic acid and the true creosote from beech wood tar are given by H. Rust. Collodion and carbolic acid when mixed form a gelatinous mass, of which some use is made in surgery. True creosote and collodion, on the contrary, form together a clear solution. Another test is a solution of perchloride of iron to which sufficient ammonia has been added to form a little permanent precipitate. Carbolic acid added to this mixture gives a blue or violet colouration; creosote gives a green colour which turns to brown.

Pharaoh's serpents had but a short day, one reason for which no doubt was the poisonous nature of the sulphocyanide of mercury, of which they were made. If any one should care to introduce a harmless variety of the toy, Vorbringer tells him how to make it. He takes the black acid residual liquor of the purification of coal oils with sulphuric acid, and treats it with fuming nitric acid. A dark-coloured resinous matter swims on the surface of the mixture, which the author collects, presses, and dries, when it forms a yellowish-brown mass having about the consistence of sulphur which has been melted and poured into water. The mass, we may say, is evidently an impure picric acid. However, it is easily ignited, and on combustion undergoes a vast increase of bulk. The author states that a cylinder one inch long will give a snake about four feet long.

The great importance of the industry of baryta induces us to quote another mode of treating the impure native sulphate, first, to extract the sulphur, and next to make a pure sulphate, or permanent white, as it is called, which is well known to possess many advantages over the ground native sulphate, if ever so white. This industry has been carried on with partial success by Kuhlmann, of Lille, but the process is defective, and Dr. Wagner has improved it as follows:—The sulphate is first reduced to sulphide by calcining four parts ground to a fine powder with one part of coal in powder and from 5 to 8 per cent. of coal tar. This calcination is effected in iron crucibles, and continued for several hours. The mixture is then removed from the crucibles and recalcined on the floor of a closed furnace, so as to prevent any oxidation. When cold the sulphide so formed is treated with hydrochloric acid, leaving, however, the liquid alkaline to keep metals out of the solution. The solution of chloride of barium so obtained is precipitated with sulphuric acid to form permanent white, or is sold to remove incrustations from steam boilers, for which it is largely employed. When hydrochloric acid is added to the sulphide of barium, sulphuretted hydrogen is of course evolved, the sulphur of which is separated by bringing the gas into contact with sulphurous acid gas. When these two gases react, water is formed, and sulphur is separated according to the following equation:—

$$2\,H\,S \quad S\,O_2 = 3\,S + 2\,H\,O$$

The profit of this operation would depend upon the cost at which the sulphurous acid is obtained; and Dr. Wagner suggests that it might be made a means of utilizing the gas evolved when metallic sulphides are roasted in free air. It might perhaps be possible to make the process available at Swansea or St. Helen's.

THE THAMES EMBANKMENT WORKS.

MR. BAZALGETTE, the Chief Engineer of the Metropolitan Board of Works, has reported the following progress of the Thames Embankment Works:—As regards that portion between Westminster and Waterloo bridges, the whole of the dams had been completed, and considerable portions thereof had subsequently been removed from the face of the work. A length of 3,700ft. of the low level sewer, 3,400ft. of the subway, 3,019ft. of the smaller sewer for intercepting the several drains discharging in the foreshore, and 284ft. of the flushing culvert, is complete. The Westminster steamboat pier and the Charing-cross steamboat pier were in progress, and other necessary works were considerably advanced. Filling in behind the embankment walls and in the works generally had been carried out to the extent of about 500,000 cubic yards. For the purposes of the Waterloo and Whitehall Railway, the outlet portions of the Victoria-street and Regent-street sewers, from Scotland-yard to the Thames, had been diverted, and the sewers constructed in the new channel, and part of the railway tube has also been formed. With respect to the contract between Waterloo-bridge and the Temple-gardens, a length of 1,290ft. of the parapet was complete, and there remained but 210ft. to be formed to complete the entire length of the river-wall comprised in the contract. The Temple steamboat pier was also in a forward state, not more than 2,000 cubic feet of stone, the whole of which was upon the ground, being required to complete this portion of the work. The approximate cost of the whole of the works executed, including £350 for the materials upon the ground, was £224,600, of which the sum of £1,069 was due to the progress made in the past month. The whole of the roofing of the engine-house of the Abbey-mills Pumping-station was complete, with the exception of the portion to be occupied by the cupola, which was also in a forward state. The bedding of the stonework on the top of the brick shafts was in active progress, and the paving of the boiler-house was entirely completed. The reservoir for the water supply to the banks was fast progressing; the culvert and pipes from the Abbey-mills River were laid, and the foundations for the external walls were being got in. The total estimated cost of the completed works was £161,080. As regards the south side of the river, of the 2,370 feet of dam and staging constructed between Westminster and Lambeth bridges, 1,100 feet had been removed from the face of the works. Within the completed dams a length of 1,900 feet of the river wall had been constructed to a height of 7¼ feet above Trinity high-water mark, and other parts of the work had been greatly advanced. The approximate value of the whole of the completed works, including £23,800 for the materials upon the ground, is £147,000, of which the sum of £1,000 was due to the progress made in the past month.

LOSS OF THE UNITED STATES STEAMSHIP "MONONGAHELA."

THE following is a copy of Commodore Bissell's report to his government upon the loss of the American steamship "Monongahela." It is dated November 21, 1867:—I have to state, with deep regret, that the United States steamship "Monongahela," under my command, is now lying on the beach in view of the town of Fredericksted, St. Croix, where she was thrown by the most fatal earthquake ever known here. The shock occurred at three o'clock p.m. of the 18th inst. Up to that moment the weather was serene, and no indication of a change showed by the barometer, which stood at 30deg. 15min. The first indication we had of the earthquake was a violent trembling of the ship, resembling the blowing off of steam. This lasted some thirty seconds, and immediately afterward the water was observed to be receding rapidly from the south. In a moment the current was changed and bore the ship toward

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the beach, carrying out the entire cable and drawing the bolts from the kelson, without the slightest effect in checking her terrific speed toward the beach. Another anchor was ordered to be let go, but in a few seconds she was in too shoal water for this to avail. When within a few yards of the beach the reflux of the water checked her speed for a moment, and a light breeze from the land gave me a momentary hope that the jib and foretopmast staysail might pay her head off shore, so that in the reflux of the wave she might reach waters sufficiently deep to float her, and then be brought up by the other anchor. These sails were immediately set, and she paid off so as to bring her broadside to the beach. When the sea returned, in the form of a wall of water twenty-five or thirty feet high, it carried us over the warehouses into the first street of the town. This wave in receding took her back towards the beach, and left her nearly perpendicular on the edge of a coral reef, where she has now keeled over to an angle of 15deg.

All this was the work of a few moments only, and soon after the waters of the bay subsided into their naturally tranquil state, leaving us high and dry upon the beach. During her progress toward the beach she struck heavily two or three times; the first lurch carried the rifle gun on the forecastle overboard. Had the ship been carried ten or fifteen feet further out, she must inevitably have been forced over on her beam ends, resulting, I fear, in her total destruction, and in the loss of many lives. Providentially, only four men were lost; these were in the boats at the time the shock commenced. The boats that were down were all swamped except my gig, which was crushed under the keel, killing my coxswain, a most valuable man. During this terrific scene the officers and men behaved with coolness and subordination. It affords me great pleasure to state that after careful examination of the position and condition of the ship I am enabled to report that she has sustained no irreparable damage to her hull. The sternpost is bent, and some twenty feet of her keel partially gone; propeller and shaft uninjured. The lower spintle of the rudder is gone, but no other damage is sustained by it. No damage is done to her hull more serious than the loss of several sheets of copper, torn from her starboard bilge and from her keel She now lies on the edge of a coral reef, which forms a solid foundation, on which ways may be laid. She can thus be launched in ten feet of water at one hundred feet from the beach. Gentlemen looking at the ship from shore declare that the bottom of the bay was visible where there was before, and is now, forty fathoms of water.

To extricate the ship from her present position, I respectfully suggest that Mr. J. Hanscom be sent down with suitable material for ways, ready for laying down, and india-rubber camels to buoy her up. I think there is no insuperable obstacle to her being put afloat, provided a gang of ten or twelve good ship carpenters be sent down with the naval constructor, as her boilers and engines appear to have sustained no injury. A valuable ship may thus be saved to the navy, with all her stores and equipments.

THE MECHANICAL VENTILATION OF MINES.

THIS important subject has been discussed several times by the members of the South Wales Institute of Engineers. At the annual general meeting of the Institute recently held it again formed the subject of some interesting remarks. Mr. Bates, after stating his ideas upon the subject generally, observed:—Mr. Pearce, in his paper on Mechanical Ventilation, has given some valuable information, also the results of some useful experiments at Pelton and Elswick Collieries, with Guibal's fan, as well as some very useful statistics gathered from various sources. At Pelton, in the fifth experiment, with 64 revolutions, the shutter half open, and horse-power of engine 58·18, they got 106,802 cubic feet of air per minute, with a water gauge pressure of 2·8 inches, which gives 80·99 per cent. of power utilized, excluding back pressure, an extraordinary percentage indeed; and in the ninth experiment, at Elswick, they have, with $57\frac{1}{4}$ revolutions, the shutter half open, and 19·73 horse-power or engine, 60,441 cubic feet of air per minute, with a water-gauge of 1·4in. which gives 67·56 useful percentage of the power transmitted to the fan, which is also very good. We have also commenced a fan on Guibal's principle at the Gethin Collieries, belonging to the Cyfarthfa Ironworks. The diameter of the fan is 29ft. 6in.; breadth, 9ft. 8in.; diameter of engine cylinder, 2ft.; length of stroke, 2ft. 6in. over vanes. The results are as follows:—

No. of experiments.	Position of shutter open.	Revolutions per minute.	Pressure on piston, not including exhaust.	Pressure on piston, including exhaust.	Horse-power, not including exhaust.	Horse-power, including exhaust.	Cubic feet of air per minute near the fan.	Water-gauge at the fan.	Cubic feet of air per minute in the mine.	Water-gauge in the mine.	Horse-power in air.	Percentage utilized, exhaust not included.	Percentage utilized, exhaust included.
1	[illegible]	68	28	—	130·5	—	—	—	138,900	1·2	26·3	20·1	—
2	[illegible]	64	27	27·3	118·4	121·95	158,400	3	—	—	74·99	63·3	61·49
3	[illegible]	75	31·2	32·9	160·3	169·1	199,200	3¼	—	—	117·89	73·5	69·7
4	[illegible]	42	11·45	11·95	32·96	34·4	96,000	1·4	—	—	21·2	64·3	61.6
5	[illegible]	61	21·65	22·4	90·52	93·65	141,600	2·6	—	—	58·1	64·1	82
6	[illegible]	61	23·35	24·15	97·6	100·97	153,600	2·6	—	—	63	44·5	62·6
7	[illegible]	61	23·35	—	97·6	—	—	—	126,250	1·4	27·89	28·57	—

We have also obtained the workings or the general results of a Struvé ventilator working at Risca Colliery, with two tanks 18ft. in diameter each, 6ft. stroke, and eight strokes per minute, driven by a single engine, 18in. in diameter of cylinder, 3ft. stroke, and 35lb. steam pressure; this gives the horse-power of engine 41·51, allowing one-fifth for friction. Under these conditions 43,866 cubic feet of air per minute was got, with a water-gauge pressure of 2·31in. This gives the power utilized, or duty done, to be 38·37 per cent. The capacity of these tanks at the above dimensions and rate of going is nearly 49,000; and at this place a furnace was put into operation to supplant the ventilator; and the average of twenty-four experiments or working days, commencing July 19, 1863, and ending August 28, of the same year, show that mechanical power, as a means of ventilating coal mines, is above that of the furnace, except under the circumstances of extraordinary deep pits, with an average barometer when the furnace was at work of 30·8in., and a water-gauge pressure of 1·41in., they got 34,088 cubic feet of air per minute. The furnace was stopped and the ventilator set to work again, with an average barometer of 30·4in., which is near to the case of the furnace, and a water-gauge pressure of 2·31in., we got 40,866 cubic feet of air per minute, showing in favour of the ventilator 9·778, and nearly 1in. of water pressure. We will now analyze these results of the ventilator and the furnace, then we will be able to see the relative merits under these conditions. Experiments of this description are very useful, and, as I have said before, the particulars and details ought to be carefully registered. But in this case it is to be regretted that the temperature of the downcast and upcast pits are not given, which makes the calculations a little more tedious to arrive at the two systems. Notwithstanding this, as the time of year is given, and the knowledge we have of temperatures in furnace pits, we may suppose very near what it would be; therefore, we will assume the average temperatures of the two pits to be 50deg. and 170deg. respectively; and by using one of the usual formulas to find the weight of a cubic foot of air under any temperature or pressure, we may test our suppositions in order to see if they will confirm this state of things. We shall thus find ·08019lb. the weight of a cubic foot of air in the downcast pit, and ·06489lb. the weight of a cubic foot of air in the upcast pit. Then ·08019 — ·06489 = ·0153lb. the difference per cubic foot between the two pits, this into the depth of the pit. Whence .0153 — 480 = 7·344lb. pressure per square foot area, this divided by 5·2lb., the pressure per square foot area for 1in. of water-gauge. We have 7·344 — 5·2 = 1·412, the water-gauge got by the furnace; therefore, this proves our hypothesis to be near the truth. I will now apply an ordinary process of reasoning to arrive at what depth the pit ought to have been to equal the power of the ventilator at these temperatures, and find it to be 785·27ft. the depth of the pit, and consequently 2·31in. water-gauge, the same as that which the ventilator produced when at work. Again, if they took the temperatures instead of the depth, we will see what temperatures it would have taken in the upcast pit of 480ft. in depth to equal the power of the ventilator. Whence, as 278deg. nearly is the temperature required to raise the water-gauge 2·31in. under the same conditions, and by using the formula as before, we have ·055lb. the weight of a cubic foot in the upcast pit, and ·0801lb. the weight of a cubic foot at 50deg.; therefore, 2·32in. is the water-gauge that these temperatures would give under the same circumstances, which equals nearly the water indication got by the ventilator; or, if we take the given quantity of air, together with the water-gauge in these cases, in order to see if the quantities correspond, we ultimately get 34,271 cubic feet, which is very near to the quantity measured when the furnace was at work—34,088 cubic feet; therefore, it is plain it would have taken a pit 785ft. deep, instead of 480ft., or an average temperature of 278 deg., which is almost impossible to be got, to equal the power produced by the ventilator.

Mr. Wilkinson gave the following results of experiments upon Guibal's fan ventilation at work at the Middle Duffryn Colliery, taken with a view of ascertaining the best position of shutter, the engine being driven at a uniform rate of fifty revolutions per minute:—

No. of experiment.	No. of strokes by engine.	Pressure of steam.	Extent of shutter open.	Area of shutter open.	Number of revolutions of anemometer.	Area of space under fan where experiments were taken.	Total quantity of air going through workings.	Area of space between the fan and upcast shaft, where the experiments were taken.	Revolutions of anemometer.	Total quantity of air ascending the upcast shaft.	Water-gauge at 30 yards from pit bottom.	Water-gauge on surface.
1	50	34	7 in.	5·83	4·00	83·19	33,276	80·61	4·50	36,274	·25	·30
2	50	34	1 ft.	10·00	4·50	83·19	37,435	80·61	5·13	41,352	·50	·55
3	50	34	2 ft.	20·00	5·00	83·19	41,595	80·61	5·75	46,350	·62	·70
4	50	34	3 ft.	30·00	5·50	83·19	45,754	80·61	6·62	53,363	·68	·80
5	50	34	4 ft.	40·00	5·00	83·19	41,595	80·61	7·00	56,427	·62	·80

Barometer on surface, 28·60; thermometer on surface, 53. Barometer underground, 29.15; thermometer underground, 54. Air going through fan at second experiment:—8 revolutions of anemometer × 70 area of space = 56,000. Third experiment:—8·25 revolutions × 70 area of space = 57,750.

Mr. Thomas attributed the loss of Mr. Wilkinson to a leakage in his valves, and contended that he ought to have got 65,000 cubic feet of air through his upcast instead of only 40,000. At his pit they were able to get from 56,000 to 67,000 cubic feet at a very reasonable velocity.

Mr. Wilkinson said the difference spoken of by Mr. Thomas was easily accounted for, through the fact that his upcast was from 50 to 60 yards higher than his downcast shaft, whereas his (Mr. Wilkinson's) upcast and downcast shafts were upon the same level.

Mr. George Elliot said that he had been working Struvé's fan at one of his collieries for ten years. It had been of great service, because although in its effects not equal to the furnace, it was a substitute for the furnace when the application of the latter would have been attended with difficulty and danger. With regard to the fan ventilators, of which they had heard so much, two or three were in existence in that part of the country; and others were in operation in the county of Durham. It was his opinion that the day was not far distant when furnace ventilation would be entirely superseded by the use of mechanical ventilation. He believed, moreover, by such appliances they would very much add to the safety of mining operations. The question of higher water-gauge was merely a question of force of friction, whether the machine was Struvé's or Guibal's; and, therefore, if they made the engine large enough, and the air course small enough, they would get plenty of water-gauge.

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MAGNETO-ELECTRIC SIGNALLING APPARATUS.

BY M. AUGUSTE BERLIOZ.

FIG. 1.

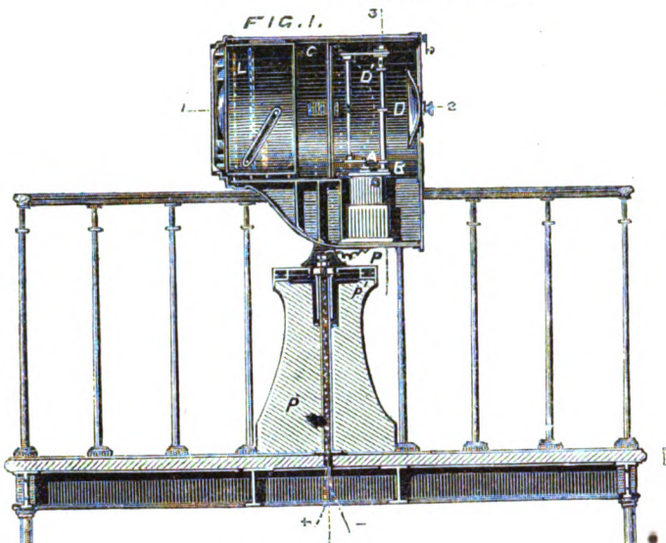


FIG. 3.

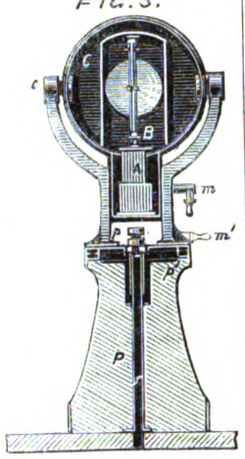


FIG. 2.

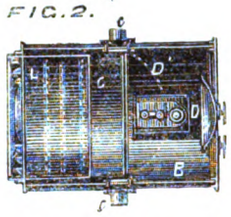
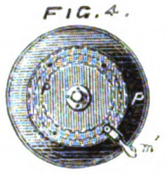


FIG. 4.



They need not, therefore, waste time in discussing that point. But it seemed anomalous that with the same power (Struvé's ventilators in both cases), Mr. Thomas should be able to get 10,000ft. more than Mr. Wilkinson, he having 2½in., and Mr. Wilkinson ½in. water-gauge. There must be some inaccuracy in the statements. It would, from what was being done in that district and other parts of the country, become apparent that to get any necessary quantity of air underground all that would be requisite would be to have sufficient power with the fan, or whatever other appliance might be employed, and to have the air courses sufficiently large.

BERLIOZ'S MAGNETO-ELECTRIC SIGNAL LIGHTS.

AT the present time, when "the rule of the road at sea" is one of the topics of discussion, it will not be inappropriate to introduce to the notice of our readers an invention bearing very closely upon the question. This is a system of magneto-electric signal lights, the invention of M. Auguste Berlioz, an electric machine maker, of Paris. This invention has reference particularly to the application of a peculiar arrangement of magneto-electric signal light apparatus to ships for the purpose of showing their course, and for the purpose of illuminating a portion of a coast, and for showing the works of an enemy by night. Fig. 1, in the accompanying engraving, is a longitudinal section of the apparatus mounted; fig. 2, a horizontal section taken on the line 1, 2; fig. 3, a vertical section taken on the line 3, 4; and fig. 4, a plan of the part which admits of the motion of the apparatus in a horizontal plane.

The apparatus is composed of a copper cylinder C mounted on trunnions c in supports fixed to a plate p which rests on a fixed metallic base plate p^1, forming the top of a pillar P somewhat similar to a capstan; this pillar is secured to a platform provided with hand rails, and is erected on the deck of the ship. The back part of the cylinder communicates with a chamber B in which the electric lighting apparatus A, consisting of a Duclos or other lamp, is placed. This lamp is connected by wires to one or two magneto-electric machines erected in the interior of the vessel, the wires passing through a hole x made in the centre of the pillar. The front part of the cylinder C is provided with a plano-convex stepped lens L, and, at the end of the part B, that is, behind the electric lamp, there is a spherical reflector D, the light, of course, occupying the focus. A parabolic reflector, shown by the dotted lines D, figs. 1 and 2, may also be used behind the light; either of these reflectors may be employed to project the light. The lens is used to indicate the route, and the reflector to observe objects at short distances of, say, within one and a-half miles. The parabolic reflector is employed alone without the lens. The cylinder C after being inclined is turned round on its trunnions c to adjust it to the required angle with the horizon, in which position it is fixed by the bolt m, fig. 3. The cylinder is also capable of motion in a horizontal plane by turning the plate p on the surface plate p^1 of the pillar P. These plates are connected together by screws, the heads of which are inclosed in the recess in the plate p^1, and when the apparatus is adjusted to the required angle the two plates are held fast together by the bolt m^1 (figs. 3 and 4). The pedestal admits of the lamp being moved on each side of the longitudinal axis of the ship to about 135 degs. from the bow; this lamp is inclined, in order to indicate the course of the bow of the vessel.

M. Berlioz exemplifies three cases in which ships may avoid a collision when fitted with this apparatus:—First, two vessels running the one into the other proceed both "starboard" to avoid running foul. Second, with two ships following parallel routes there can be no collision, for they both proceed to "starboard." Third, the course of two ships being oblique, the rays of light meet together; these vessels each proceed to the opposite side of the meeting point of the half angle of convergence of the two routes. The ship at larboard allows that which is at starboard to pass, and indicates that it is diminishing its speed by ringing the bell.

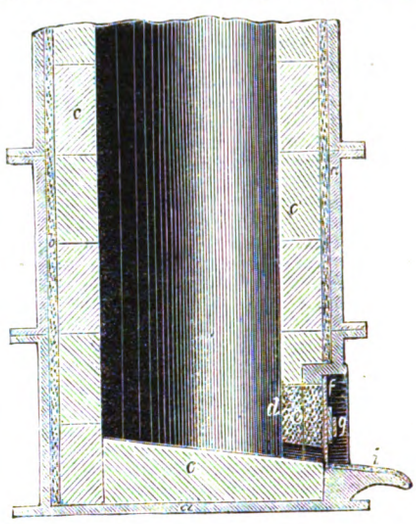
This apparatus may also be used to give night signals, whether in squadron navigation or for a ship aground. These night signals constitute a species of electric telegraphy; the apparatus with an ordinary lens, produces the numbers 1 to 3; the numbers 4 to 6 are found by employing a screen with a red glass before the lens; and the numbers 7 to 9, with a screen and a green glass before the lens. The interruption of the light indicates the number formed, for which purpose a black screen may be employed, or obscurations may be also made with a screen.

IMPROVED METHOD OF MANUFACTURING STEEL AND SOFT IRON.

MR. JAMES HARGREAVES and Mr. Thomas Robinson, the former an analytical chemist, and the latter an ironfounder, of Widnes, have conjointly patented an improved method of manufacturing steel and soft iron. Their invention consists in the use of any of the salts which yield oxygen on the application of heat, such as the nitrates, chlorates, chromates, manganates, and stannates, in combination with any of the oxides of iron or manganese, as agents to act on fused or molten cast iron to burn out therefrom at any desired speed the excess of carbon in, and at the same time to remove other impurities from the cast iron, and thereby convert it at one operation into steel or soft iron. The oxidizing salts are placed in contact with the fused or molten cast iron. The proportion of the salts to the oxide determines the rate at which oxygen will be eliminated, and the proportion of the converting agents mixed with the cast iron will determine whether the product is steel or soft iron; either can be produced. The object in employing these converting agents is to regulate the otherwise rapid action of the oxydizing salts. The oxydizing salt at present most suitable is nitrate of soda, in consequence of its lower cost and the high proportion of oxygen which it yields, as well as from the fact that the soda contained in it acts effectually in removing silicium, sulphur, and phosphorus.

The proportions of oxygen capable of being liberated or evolved from the oxydizing salts and oxides of iron and manganese are well known to chemists. The quantity of oxygen capable of being liberated from any given quantity of these substances mixed with clays, ochres, or other substances can therefore be ascertained with ease. The removal of carbon from molten cast iron by means of this invention is effected by converting the carbon into carbonic oxide or carbonic acid. When carbonic oxide is formed every eight parts of oxygen remove six parts of carbon, and when carbonic acid is formed every eight parts of oxygen remove three parts of carbon. Now, nitrate of soda in contact with molten cast iron will yield 47 per cent., sesquioxide of iron, 30 per cent., and binoxide of manganese about 36·25 per cent. by weight of oxygen. With the foregoing information the proportions of the materials required to form the converting agents, and the quantity of the said converting agents necessary to remove any desired amount of carbon to produce any desired quality of steel or iron can easily be ascertained. In all cases the soda contained in the nitrate is in excess of the quantity required to combine with or extract the silicium, sulphur, and phosphorus contained in cast iron if the cast iron is of ordinary quality.

When a separate converting vessel is used, it is formed as shown in the accompanying engraving,



which is a vertical section of the converter. a are semicircular pieces of metal bolted together; b, fire-clay backing, and c fire-brick lining; d is the discharging way closed by fire-clay e, door f, bar and wedges g in the same manner as a foundry cupola; h, the tap hole, and i the runner. The bottom slopes downwards towards the door, so that the whole of the charge run or poured in at the top may flow out. In practice, to make steel suitable for cutting tools for every hundredweight of white cast iron the following mixture is used:—Nine pounds of nitrate of soda and five pounds of binoxide of manganese are mixed intimately, and whilst in a moist condition are placed in the converting vessel, and tamped down tightly into the bottom. The nitrate of soda of commerce is generally sufficiently moist for the purpose without any addition of water. If the converting vessel has just been used, the heat will usually be sufficient to dry the mixture into a solid mass. If the heat is not sufficient a small fire-grate containing fire is placed over the converting agents. If the converting vessel has not been used immediately before filling in the converting agents it is heated by a fire, placed inside. The fused iron is then run into the converting vessel over the dried mass of the converting agents, when decomposition takes place, the oxygen and other products rising through the mass of molten metal and removing the excess of carbon as well as the silicium, sulphur, and phosphorus. The excess of carbon is removed by combining with oxygen and forming carbonic oxide, and carbonic acid, and the other impurities, together with the soda contained in the nitrate, when nitrate of soda is used, rise to the surface of the mass in the form of a slag.

When the converting agents have been decomposed, and no further gas is evolved, the vessel is tapped and the steel run out into moulds. At other times the inventors make steel suitable for cutting tools by using the same proportions of converting agents to those above mentioned, first making the converting agents into bricks or blocks and packing them tightly into the bottom of the converting vessel. When a separate converting vessel is used, it is

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found in practice that the greater the depth of metal through which the products of the decomposition of the converting agents have to ascend the better are the results, inasmuch as the products have more time to burn out the carbon and absorb the impurities which it is desirable to remove from the iron. It is, therefore, preferable that the converting vessel should be narrow or small in proportion to its depth.

To make soft or malleable iron the inventors take for every hundredweight of white cast iron the following mixture:—Twelve pounds of nitrate of soda and eighteen pounds of sesquioxide of iron, mixing and tamping them into the bottom of the converting vessel, and in other respects proceeding as in making steel for cutting tools.

In the ordinary puddling furnace in the course of the ordinary process of producing malleable iron, the hematite ore is ground and mixed into a plastic condition, and to every three parts of the hematite is added one part of nitrate of soda, the mixture being made into balls or blocks. While the blocks are soft they are fixed on the ends of rough puddled billets, and then thoroughly dried. As soon as the cast iron is melted in the puddling furnace the balls or blocks are pressed down to the bottom of the metal, when the gases and other products evolved cause violent agitation and effect the removal of the excess of carbon and other impurities, thereby reducing the time required to bring the iron to nature, producing a better quality and a larger quantity as the converting agents supply iron. To the charge of an ordinary puddling furnace containing about 480lb. are added 32lb. of the mixture of hematite and nitrate of soda.

COLOUR OF THE CLOUDS AND SKY.

A SHORT time ago "Poggendorff's Annalen" contained a paper by M. Lommel on "The Evening Glow and Similar Phenomena"; but before the apearance of that paper, Mr. Sorby had discussed the same subject in a more popular form, extending it to the colours of the clouds and sky, which he explains on the principle that the clear transparent vapour of water absorbs more of the red rays of light than of any others, whilst the lower strata of the atmosphere within no great distance from the surface of the earth, offer more resistance to the passage of the blue rays. This is especially the case at sunrise and sunset, and very perceptible in the case of dark-coloured fogs, through which the sun appears red. This is often due to only a few hundred yards' thickness of such a fog, and it is highly probable that the same effect will be produced by a thickness of as many miles of pure air containing watery particles very thinly disseminated. It is thus Mr. Sorby explains nearly all the phenomena connected with the question. The blue colour of the sky is due to the absorption of a considerable amount of red light by aqueous vapour, far from the earth's surface; but if minute particles of liquid water form a thin mist, the blue of the sky will be diminished, as is the case in winter, and in cold countries. If the air be much charged with transparent vapour, the blue colour will be deeper, and will thus become an indicator of rain. At sunrise and sunset the light of the sun has to pass through about 200 miles of atmosphere within a mile of the surface of the earth, in order to illuminate a cloud a mile from the ground. In passing through this great thickness the blue rays are absorbed to a far greater extent than the red, and much of the yellow is also removed. Hence, clouds thus illuminated are red; but when the sun rises higher, the yellow light passes more readily, and the clouds become orange, then yellow, and finally white. Clouds in different parts of the sky, or at different elevations, might show these various colours at the same time, as indeed is often the case.

A YEAR'S SHIPBUILDING ON THE CLYDE.

THE year 1867, though by no means characterized by excessive briskness in the shipbuilding trade of the Clyde, and unable to stand a favourable comparison with the last five or six years, has yet produced a very large amount of tonnage in the various yards between Greenock and the Broomielaw—a greater amount, perhaps, than could have been expected. The number of vessels of all classes launched during the year, as we gather from exhaustive tables published in the "Glasgow Morning Journal," is 241, being only six less than 1866 and 26 less than in 1865, while, as compared with 1864, it is larger by 21. In respect of tonnage, however, the comparison is more unfavourable to 1867. During the past year the tonnage launched on the Clyde amounted to 114,598 tons, while in 1866, a year during which there was a long period of suspended operations, owing to the lock-out, the amount was 129,989; in 1865, 158,300; and in 1864, 134,000. The year 1864 may almost be regarded as an exceptional year, owing to the impetus given to the steam shipbuilding trade by the American war, many of the blockade-runners having been destroyed or used up, and their places supplied by the firms on the Clyde. A noticeable feature of the work of the past year is the large number of iron barges (exclusive of hopper barges) built on the river, no fewer than 56 of that class of craft having been launched, as compared with 32 in 1866, 25 in 1865, none at all in 1864, and 13 in 1863; 58 barges were launched in all, all being iron save two. Of paddle steamers there were 26 launched, as compared with 35 in 1866; of screw steamers (iron and composite), including hopper barges and dredges, 84, as compared with 121 in 1866; and of sailing vessels 75, as compared with 57 in 1866. With regard to the prospects for 1868, they are, so far as can be judged by the orders on hand, of a very favourable character. At present, the orders are for 130 vessels, including 5 gunboats, 5 screw armour-clads, 11 paddle steamers, 57 screws, 3 steam dredgers, 49 sailing vessels, and 2 iron barges, with a total tonnage of 115,124 tons. In 1866, at the same period, the orders on hand were 106 vessels, and 78,000 tons; and in 1865, 180 vessels, and 130,000 tons.

THE TRADE OF THE PAST YEAR.

TRADE matters, as a whole, possess but a limited interest for our readers. Some of its branches, however, are of importance to them, and we have, therefore, selected the following extracts from a series of reports which lately appeared in the "Times." They will be found to convey an idea of the leading features of each branch of our trade noticed during 1867. With few exceptions the markets have been characterized by a continuous fall in prices, and hence, although the extent of the business has been good, a feeling of uncertainty and dissatisfaction has been prevalent throughout. Grain importers and shipowners have been almost alone prosperous, the latter having been benefited not only by the wheat importations, but by the Abyssinian war.

AGRICULTURAL IMPLEMENTS.

We are happy to report a great increase in the demand for agricultural implements, particularly for reaping and mowing-machines. This is attributable mainly to the necessity for machinery which the increasing deficiency of agricultural labourers creates, especially in all that relates to the securing of crops, and also to the improvements recently made in constructing these machines. As the season advances the demand for such machinery will, doubtless, be largely increased.

METALS.

To review the metal trade for the past twelve months is by no means a pleasant task. All metals, with the exception of tin, have been signalized by a continuous fall in prices since the year commenced, and all through its progress there has been but one long cry of complaint on all sides. Hopes of a better tone in the markets have been raised from time to time by a slight demand springing up for a particular article, which led, however, only to disappointment and to a further reduction from even the low prices before ruling, till we have arrived at the commencement of another year with prices of most metals at lower rates than have ever been known before. To predict what the year now opening may produce to the metal trade is impossible, but with such low prices, trade depressed for the last two years, and money at a mere nominal rate, it is but reasonable to suppose that we have seen the worst, and that we may fairly calculate upon an increased demand and better prices.

PETROLEUM.

The features of the market throughout the year have been heavy stocks and declining prices. In the early autumn, on the rapid advance in America, refined Pennsylvanian S.W. petroleum rose to 1s. 7d. per gallon—indeed, in one case 1s. 7½d. was paid. This was the highest price of the year for spot. The lowest was in June, when 1s. was accepted for a parcel of 1,000 barrels, slightly inferior in quality. Cargoes ranged in value from 1s. 0½d. to 1s. 7½d. The fluctuations of the year have been both important and frequent, and as a consequence we have had considerable speculation. It was confidently asserted that the low quotations ruling everywhere for oil would tell materially on its production in the United States; at the same time it was foreseen that home-manufactured coal oil must cease to compete. The anticipated extinction of the coal oil trade has almost occurred, but the falling-off in supplies from the United States, so generally looked for, was not realized by the event. According to last advices, shipments from America were slightly in excess of those of 1866, although freights have ruled very high for some months past. The increase in the consumption here has been very great, but it is the general opinion that the deliveries would have been much larger but for the dulness of trade and distress among the poorer classes, the chief consumers of petroleum.

TIMBER.

In 1865 and 1866 we were overtrading in wood. The supply for seven years preceding 1860 had given an annual average of about 2½ millions of loads; for the three following years it became 3,000,000; in 1863 and 1864 the average rose to 3½ millions, and this expansion sufficing for our increasing consumption, the greater imports of 3 millions in 1865 and 1866 left a large unconsumed surplus. The importation of little more than 3,000,000 loads in 1867 takes us back five or six years for a parallel quantity; yet it has been enough for the demand of the building trade, and leaves ample stocks at the principal ports for consumption, while importation is suspended. The wood of the north of Europe has never before this time been laid down so cheaply at the principal ports of the kingdom, especially on the east coast; but we fail to see the wonted elasticity of our trade, which, after previous times of difficulty, had recovered from the troubles of one year before the end of the next. While merchants lack confidence, the public have profited by the depression of prices. To meet the increased difficulty of dealing with our skilled labour, foreign enterprise now provides the greater part of the timber sawn into deals, battens and boards very nearly in the form and shape required for use, instead of continuing to send so much timber in the log for conversion here by our own workmen. By the introduction of our machines large quantities of flooring boards have been prepared in Russia, Norway, and Sweden, so well made that they have become a regular importation in all parts of the country. So eager is this competition that an experimental trade has been commenced by the shipment of mouldings, and from Sweden of manufactured doors, well finished, and of the same patterns used by our builders. The colonial supplies, now contracted to one-third of our imports, have been chiefly and judiciously limited for several years to those descriptions of timber and other woods which are the peculiar growth of Canada and New Brunswick. The requirements of the northern provinces of the United States abstract a great portion of Canadian pine of the best sorts, and also draw from the upper lakes much wood which used to be carried to the Quebec market.

INDIGO.

Few articles of colonial produce have been so remunerative to the importer during the past year as indigo. The position of the dye at the commencement of 1867 was one full of promise; the general statistics of stocks, deliveries, and imports, combined with the low rate of money, with peace at home and abroad, seemed to justify the sanguine expectation of those whose commercial anticipations had been blighted in the previous year by a Continental war, monetary panic, and general commercial distrust. At the end of November, owing to telegrams from Calcutta announcing the high prices paid there at the opening of the auctions, a speculative inquiry set in, which raised the price here 3d. to 6d. per lb., or about on a par with the rates ruling in Calcutta, which are 25 to 35 rupees per maund above those of last year. The future prospects of the manufacture of indigo are exceedingly gloomy; the dislike shown by the natives to the enforced cultivation of the plants seem to increase; the growth of rice and other products used as articles of food are more profitable to them, and require less care and supervision. This, and the effects of the cyclone on the October plant, will render more than an average crop next season highly improbable. That indigo during the ensuring year will command relatively high rates, seem pretty certain; the low prices of cotton, flax, hemp, and jute, together with the abundance of money, all appear to point to this result; to these must be added the small stocks held by consumers and dealers both here and on the Continent.

HEMP.

The total shipments from St. Petersburg, which were reported in August would be 8,000 tons short, turn out to be only 3,738 tons below that of the previous year (1866). From Riga it is believed there are 3,000 to 4,000 tons short; but as the exact destination of the shipments from this port cannot be depended upon, it is impossible to say how much is the deficiency to the United Kingdom. The prospects of the coming season are, as usual, contradictory, and hardly any reliance can be placed upon reports; but, as the value for forward delivery is only £34 against £38 10s. on the spot, it is to be presumed that a large crop may be anticipated. Sisal hemp is a new fibre from Mexico, and has been used largely in substitution for Manilla hemp; in colour it rivals that fibre, but is deficient in strength. It has been introduced during the past year for the first time, and has sold at public sale as high as £54 per ton. About 1,200 tons have been imported, and it is said it can be produced in large quantities; should the high prices for hemps, which for so long have ruled, be maintained, it doubtless will form a staple article in the fibre market.

IMPROVED SYSTEM OF PNEUMATIC DESPATCH.

IN the ordinary arrangement for conveying letters or parcels through pneumatic tubes from one station to another, one end of the tube communicates with one station and the other end with the other station, the letters or parcels being conveyed through the tube inside piston carriages, which travel along the tube either by exhausting the air

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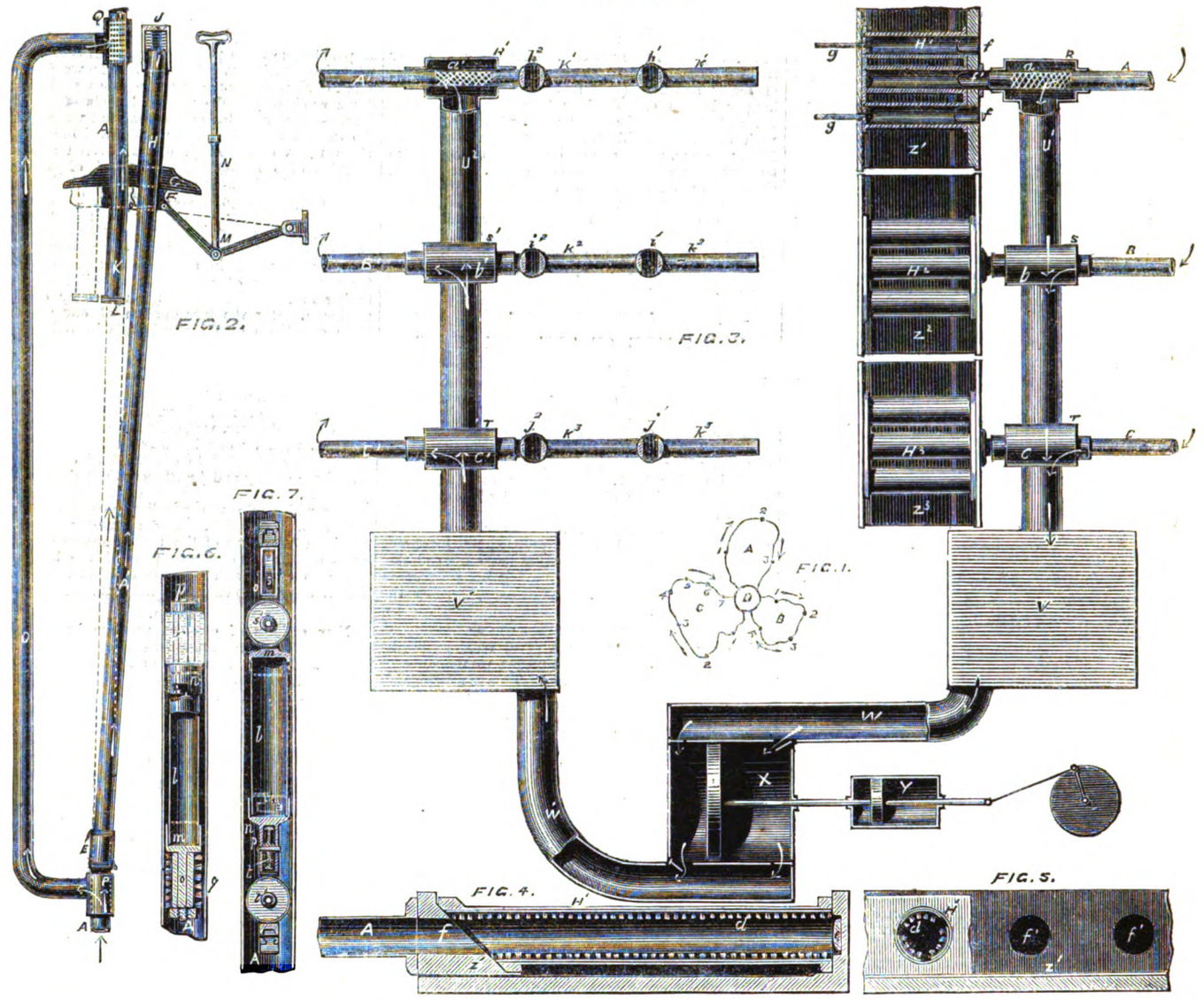
IMPROVED SYSTEM OF PNEUMATIC DESPATCH.

BY MR. C. W. SIEMENS, C.E.



from, or by forcing it into the tube. The tubes are made of comparatively large diameter in order to provide sufficient room in the carriages for their contents, thus entailing both a great outlay in establishing the system of tubes, as also the erection of large pumping engines for producing the required pressure for propelling the carriages. In addition to this a loss of the propelling power is occasioned both by the leakage of the air past the carriages when they do not fit the tube completely, and from the fact that when a carriage arrives at the end station the air constituting the propelling medium of necessity escapes into the atmosphere.

It is now, however, proposed by Mr. C. W. Siemens, of Great George-street, Westminster, to obviate all these defects by an improved system of pneumatic tubes which he has recently patented. He proposes to use tubes of comparatively small diameter, and consequently of an inexpensive nature, so arranged that while the carriages or pistons travelling in the same are of correspondingly small dimensions, and consequently require no great power to propel them, the smallness of the capacity of the carriages is compensated for by the rapidity with which they may be dispatched in quick succession from one station to another, while practically no loss of propelling power from the before-mentioned causes can take place. For this purpose the system of pneumatic tubes is so arranged as to have no terminal points, but to form one or more closed pneumatic circuits, constructed of light wrought-iron tubes of small diameter fixed together by flanged joints, and communicating at one point (a central station) with an air pump. The air will thus travel round and round in the circuit continually in the same direction, so that on introducing a carriage containing the dispatches into the tube at the pumping station it would if not intercepted at an intermediate point travel right round the circuit and thus eventually arrive at the pumping station again. At intermediate points in the pneumatic circuit thus established are situated the stations to or from which dispatches are to be conveyed from or to the central or pumping station.

Fig. 1 of our engraving is a diagram of three closed circuits A B C, all communicating with the central pumping station D, the pump at which causes the air to travel continually round in each circuit in the direction of the arrows. Upon the circuit A are established three intermediate stations 1, 2, 3, on the circuit B are four stations, and on the circuit C are seven stations. The carriages containing the light objects to be forwarded are introduced into the circuits at the central station D, and are carried forward in the direction of the arrows by the circulating air. If the carriage introduced at D into circuit C is destined for the station 1, it is there intercepted in its course and removed from the circuit; if, on the other hand, it is intended for station 7, it is allowed to pass all the intermediate stations and is only intercepted at that point. If, on the other hand, a carriage is to be conveyed from the station 1 to the central station D, it is also caused on being introduced into the circuit at that point to travel all round the circuit in the direction of the arrows, passing all the intermediate stations 2 to 7 until it arrives at D.

Carriages containing the dispatches and other articles may conveniently be forwarded at certain fixed intervals of time from each of the intermediate stations upon one circuit to the central station, where they are sorted and dispatched to the local stations upon the same or other circuits for which they are intended; thus a dispatch letter dropped into the receiving box of station 2, circuit A, and intended for station 4 on circuit C, would proceed in the first place to the central station, where it would be placed with other letters or small parcels into the carriage intended for station 4 on circuit C. Upon its arrival at this station the contents of the carriage would be handed to carriers to be conveyed to their destination; also, if required, carriages may be forwarded from one intermediate station to another on the same circuit by being introduced into the circuit at the one station and intercepted at the other. For receiving dispatches or parcels from the circuit into the stations, a portion of the tube forming the circuit is arranged similarly to a switch on railways. At one point it is capable of being moved away from the circuit and made to communicate with a closed chamber, into which the carriage destined for the particular station is passed from the circuit. Its momentum is gradually absorbed in this chamber by a series of brushes or projecting pieces of india-rubber or leather, arranged longitudinally so as to produce a powerful drag upon the piston, the closed end of the chamber being provided with a buffer for the carriage to strike against.

At fig. 2 of the engraving is shown Mr. Siemens' arrangement for receiving and dispatching the carriages at the intermediate stations, together with the by-pass for keeping up the circulation of the air in the circuit. A A are portions of the tube forming the pneumatic circuit, and A^1 is the movable part or switch. This is connected to the tube A at one end by a flexible air-tight joint E, while the other end is carried in a slide F, fitting air-tight against the curved surface of the block G in which the other part of the tube A is fixed. In this block is also fixed the open end of the receiving chamber H, the other end of which is closed and is provided with buffer springs I, while a small hole J is formed in the end to allow of the escape of the air as the carriage passes in. The slide F carries the open end of the dispatching branch K, the other end of which is closed by a sliding cover at L. The slide is connected to the toggle joint lever M, which is actuated by the handle N so as to move the switch A^1 and dispatching branch K simultaneously either into the position shown in full lines or into that shown in dotted lines.

When in the latter position the switch tube A^1 is in a line with the circuit tube A, in which position it will allow any carriage or piston approaching the station in the direction of the arrows to pass it on its way to another station. When, on the other hand, the carriage is to be received into the station, the switch is moved into the position shown in full lines in front of the receiving chamber H, and the carriage passes from the former into the latter. At the same time the dispatching tube K is moved in front of the open end of the tube A, and any carriage that has previously been placed in it for conveyance to the central or other station consequently passes into

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the tube A and is conveyed along the circuit, the current of air in which is maintained while the switch tube is thus diverted from it by means of the by-pass O. This is a tube communicating with the circuit at P and Q, so that the current of air passes uninterruptedly through from the part of the tube A just behind the switch to the other part beyond the switch, as indicated by the arrows. The communication between the by-pass O and the tube A is established by forming a portion of the tube A with perforations, enclosing which in an air-tight manner is the casing P and Q, thus forming an annular space round the tube with which the by-pass O communicates.

Fig. 3 shows the arrangement Mr. Siemens prefers to employ for dispatching the carriages from the central station to the intermediate stations of three different circuits in connection with it as indicated at fig. 1, and for receiving the carriages from the stations on those circuits into the central station. It also shows the mode in which the circulation of the air may be effected in the three circuits simultaneously by one and the same pumping engine. A A^1 B B^1 C C^1 are the three circuit tubes communicating on the one side with the dispatching chambers K^1 K^2 K^3, and on the other side with the receiving chambers H^1 H_2 H^3. Each of the tubes A B C is formed with perforations at points a a^1 b b^1 c c^1 just in front of the receiving and dispatching chambers. These perforated portions are enclosed in air-tight casings R R^1 S S^1 T T^1 communicating with the pipes U U^1. Each of these pipes opens into an air chamber V V^1 of sufficient capacity to equalize the flow of the air through the tubes, and which are put in communication by means of the pipes W W^1, with an air pump X, worked by a steam engine Y. The pump is surrounded by a casing, through which cold water circulates, to prevent the accumulation of heat by the compression of the air.

By the action of this pump the air is continually and simultaneously drawn from the parts A B C of the circuits through the perforations a b c, pipe U, air chamber V, and pipe W into the pump, as indicated by the arrows, and is forced through the pipe W^1, chamber V^1, pipe U^1, and perforations a^1 b^1 c^1 into the parts A^1 B^1 C^1 of the circuits, thus maintaining a continuous circulation of the air in each of the circuits. The ends A B C of the circuit tubes are fixed in an air-tight manner against the faces of three tables or troughs Z^1 Z^2 Z^3, in which are the movable receiving chambers H^1 H^2 H^3, of which there are three connected together to each circuit, in order to provide means for receiving the carriages arriving at short intervals without impeding the dispatch of business.

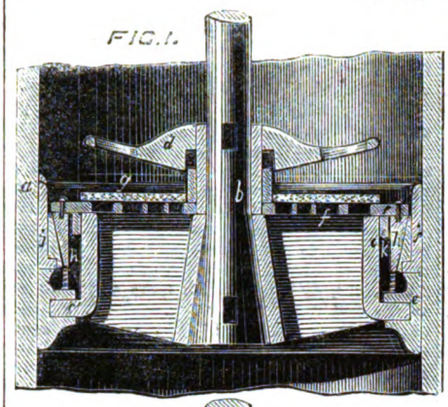
The construction of these tables and receiving chambers is shown to an enlarged scale at figs. 4 and 5. Fig. 4 shows a transverse section through one of the tables, and a longitudinal section through a receiving chamber, and fig. 5 shows a part longitudinal section through the table and a transverse section through one of the chambers. The chamber H^1 are made to fit air-tight, with smooth sloping surfaces at one end against the adjustable smooth sloping sides of the table Z_1 to which the tube A is fixed, while the other ends of the chambers may either be closed, as shown at fig. 3, or they may be open, as shown at fig. 4, and fit air-tight against the other side of the table Z^1, the weight of the chamber pressing against the sloping surface of the table tends to keep the surfaces in air-tight contact. An opening f is formed in the side of the table in continuation of the bore of the tube A, through which the carriages pass from this tube into the chambers H^1. These chambers are formed of thin sheet metal for the sake of lightness, and are provided internally with brush surfaces d for absorbing the momentum of the carriage as it enters, and a buffer spring e is fixed either on the end of the chamber, when this is closed, or in the side of the table Z, as shown at fig. 4, for finally stopping the carriage. As a carriage enters one of the chambers H the set is slid to the one side or the other of the circuit tubes so as to bring another empty one in front of the tube for receiving the next carriage, while the chamber containing the carriage just received is brought in front of one of the apertures f_1 in the sloping side of the table, through which the carriage is pushed out of the chamber by means of a rod g worked by a lever and introduced through a hole in the other side of the table, as indicated at fig. 3.

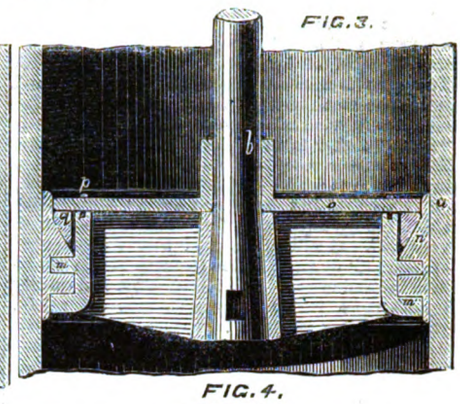
For dispatching the carriages from the central station, each circuit is provided with double dispatching chambers k^1 k^1 k^2 k^2 k^3 k^3 separated from each other and from their respective circuits by valves h^1 h^2 i^1 i^2 j_1 j_2, so that when a carriage is introduced, say, into k^1, the valve h^1 is opened so as to allow it to pass into k^1, after which the valve h^1 is closed and opened so as to allow the carriage to enter the circuit tube, and to be propelled along the same by the current of air entering through the perforations a^1. The opening of the one valve and the closing of the other may be effected simultaneously by an arrangement of levers. The carriages employed for transmitting the dispatches or parcels are made cylindrical in form, and are so arranged that they can be opened for the introduction of dispatches, letters, or parcels, and they are provided in front and behind either with a pair of wheels at right angles to each other, each wheel being nearly of the internal diameter of the tube itself, or they are provided with cylindrical brushes fitting the tube. The body of the piston or cylinder need not touch the internal surface of the tube, because the friction produced by the wheels or brushes is so slight as to render a close fit unnecessary.

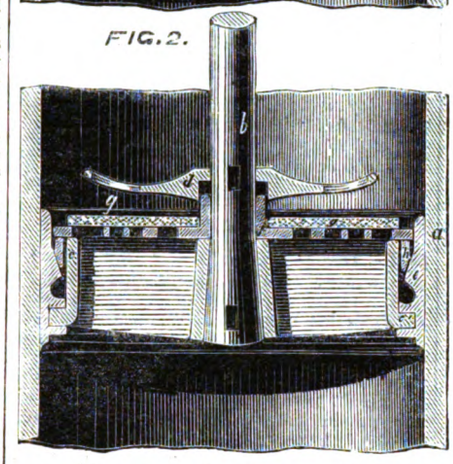
At figs. 6 and 7 of the engraving is shown the construction of the carriages. At fig. 6 the carriage is composed of a light metallic cylinder l fixed at one end into a socket m, and provided at the other end with are movable cover n secured by a bayonet joint and spring catch. The socket m and cover n have projecting rods o p upon which are placed the cylindrical brushes q r fitting the interior of the circuit tube A. The carriage at fig. 7 is of similar construction, but in place of the brushes the socket m and cover n each carry by means of the framing o p two wheels s s^1 t t^1 at right angles to each other and slightly less in diameter than the diameter of the tube A. For introducing or removing the letters or dispatches the cover n is removed.

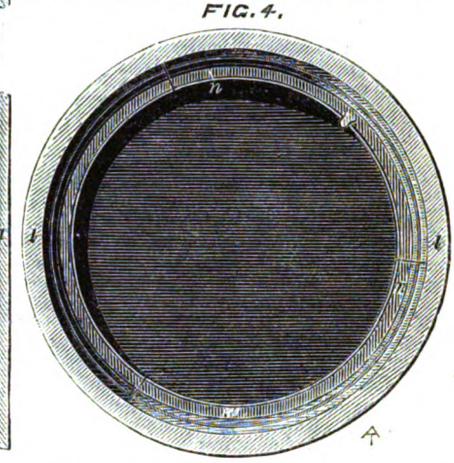
NEW SYSTEM OF PUMP BUCKETS.

BY MR. JACOB BIRD.









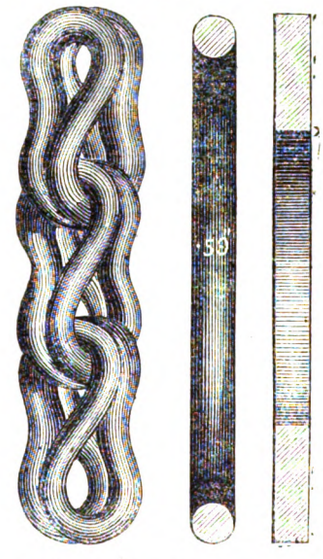
THE main object of the invention which we illustrate in the annexed engraving, is to provide a metallic bucket or piston for single-acting pumps which shall expand and fit tight against the inner surface of the cylinder in the up stroke, and contract in the down stroke so as then to work with a minimum of friction. The invention has been patented by Mr. Jacob Bird. Figs. 1 and 2 of our engraving are vertical sections of buckets and portions of pump barrels; a pump barrel; b bucket or piston rod; c bucket frame or piston formed with radial arms in the usual manner; d valve guard; e bucket ring fitted over the feather c^1; f perforated valve plate or seating; and g the india-rubber or other flexible valve; h expansion split ring secured to e; i spiral springs to assist in lifting f g and h, so as to allow the bucket to collapse during the down or return stroke; in ordinary cases in practice these springs can be dispensed with; j a packing piece or pieces encircling h and part of c.

In both figures the bucket is represented in the up stroke and consequently fitting tightly against a. The space between d and f represents the distance f, and the parts thereto connected are at liberty to travel on the boss of the guard plate or on the rod, so as to allow the bucket to collapse for and during the down stroke, so as to reduce friction. In fig. 1 j are used formed in three segments, although they can be made in one piece, but in fig. 2 c is made deeper so as to provide larger depth of wearing surface than has been used hitherto; k in fig. 1 represents the ring fastened to f, which by its being fitted to slide over c, or it can be made to slide into a groove in c, serves to form a valve should any solid substance prevent g from reaching its seating f In fig. 2 k is not used. The packing here shown can be easily applied to buckets now in use.

In figs. 3 and 4, which are respectively views in vertical section and plan of a lifting or forcing pump, l is the pump barrel; m the bucket frame; n the split bucket ring fitting into the groove m^1 formed in m; o is a cover secured to m by screws p, which when tightened up, forces the expansion ring or piece q against n, and causes it to fit tightly against l. In this arrangement, which is particularly suitable for double-acting pumps, no part of the bucket is free to slide or move up and down on the rod r or on the boss of the bucket.

WELDLESS CHAIN.

AN exceedingly simple method of making chains without welding the links has recently been patented in France, and of which Messrs. Chapman and Boyle, of John-street, Adelphi, are the English concessionaires. The sample from which



our engraving has been taken was manufactured by taking a disc of the diameter of the flat ring, shown in the cut, and punching a hole in it, so as to leave the ring, just as washers are made. It then measures 5·5in. in length, ·51in. in thick-

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ness, the hole being 3·62in. in diameter, leaving the metal of the ring ·94in. broad. This ring is then rolled by spinning it on outside rolls till it acquires the round bar section—·59in. in diameter—shown in the next figure, by which process also the direction of lamination or fibre is modified. The ring is then drawn out into a long loop, and interlocked with others, as in the engraving. The chain so formed is particularly flexible, though it "kinks" rather more readily than ordinary chains. This, however, may be avoided by a slight change in the form to which the links are set. A length of this chain has been laid down in the Seine steam towage navigation, and answers the purpose very well. It will be observed that the strength of each link depends on the strength of two members instead of one, in which—section and quality equal—there is an advantage in point of safety, just as there is in a wire rope composed of strands over a single bar of a section equal to the aggregate of the strands. The invention is one of promise, especially with regard to steel cables, to the manufacture of which the necessity for a weld has always been an insuperable objection. We believe this method of making chains was patented in England several years since.

THE HOOSAC TUNNEL.

SOME two years since we gave a lengthy description of the works of the Hoosac Mountain Tunnel in America. The object of this enterprise is to reduce the distance between the eastern terminus of the Erie Canal and tide-water at Boston. Since we wrote considerable progress has been made in these important works. In fact, during the past year, and especially during the past five months, much greater progress has been made than ever before upon the work. We take from the report of Mr. A. Beardsley, C.E., the assistant engineer on the works, the following particulars, which will doubtless prove interesting to our readers. We will first take the distances to the various points where the work is being prosecuted:—

Distance from east end to central shaft...	12,837·294	feet.
„ „ central shaft to west shaft... ...	9,747·072	„
„ „ west shaft to now shaft...	265·000	„
„ „ new shaft to well No 4....	659·150	„
„ „ well No. 4 to pier	1,522·825	„
„ „ east end to pier ...	25,031·825	„

The following are the lengths of the headings at the various points of the work, December 2, 1867:—

Length of east end heading	4,608·000	feet.
„ „ west shaft, east heading...	1,262·000	„
„ „ „ „ west heading	611·000	„
„ „ west end heading	617·000	„
Total length of headings	7,098·000	„
Leaving	...17,933·341	„

or 3·396 miles of heading yet to be made, of which 1,218·975ft. are between the west end and the west shaft, and 16,714·366ft. between the west shaft and east end of the tunnel. The central shaft is down 583ft., and well No. 4 is down 150ft. The progress for the month of November, 1867, was as follows:—

East end heading...	126·00	feet.
West shaft, east heading	33·00	„
„ „ west heading	5·00	„
West end	20·00	„
Total for the month of November ...	184·00	„

Thfrty feot of brick arch were completed during the month at the west end, making a total of 516ft. of brick arch completed to date.

The progress for the last six months has been as follows:—

East end	711·00	feet
West shaft, east heading	216·00	„
„ „ west heading	288·00	„
West end	180·00	„
Total, from June 1 to Dec. 2 ...	...1,395·00	„
„ for the previous six months...	632·00	„
„ „ „ year ending Dec. 2, 1867...	...2,027·00	„

The new shaft has been sunk, and at its foot are the pumps which, together with those at the west shaft, are now throwing out between 900 and 1,000 gallons of water per minute. During the last month great quantities of water were struck at both headings of the west shaft (70 gallons per minute at the east heading in one day), and the work was stopped in consequence, which accounts for the small progress at this point. Well No. 4 is an artesian well, which is now being carried down as a shaft to afford two more faces to work from. Its depth will be, when finished, 215ft., its dimensions 8ft. by 8ft.

Mr. Beardsley reports that at the rate of progress for the past year it will require but eight years and ten months to pierce through the mountain, and at the rate for the past six months it will require but six years and five months. But when the central shaft and well No. 4 are sunk to grade the number of faces to work from will be doubled, and the time of completion thereby greatly diminished. At present, drilling machines are employed only at the east end, but in a few weeks they will be used at the west shaft, and also at the central shaft as soon as the buildings and machinery are again in place, and this again will hasten the completion of the work. At the west shaft buildings are already erected for the manufacture of nitro-glycerine, and the use of this powerful explosive will be adopted. Every means that will hasten the work will be employed, and Mr. Beardsley anticipates that within seven years, trains loaded with freights and passengers will pass and repass through the great heart of the Hoosac Mountain as an hourly occurrence.

CONCRETE STONE FOUNTAIN.

THE company which is now carrying out, on a large scale, at East Greenwich, the invention perfected, after so much patient labour, by Mr. Frederick Ransome, have recently sent out to Hong Kong for the public garden there a very handsome fountain made of the patent concrete stone produced by the company. The fountain is about 18ft. in height, and of about the same dimensions in internal diameter. It has ground, middle, and top basins. The ground basin is a quarterfoil, with square projections, it faces enriched by panels with a scroll ornament. The middle basin is also a quarterfoil supported on four columns round a central pier. The shaft is a pointed quarterfoil with tufts of ferns at its base. The cap is formed of a collection of water plants enriched on the under side with models of shells and leaves of water plants. The water from the jet falls into this basin. There are also jets in the middle and lower basins; the four in the lower flash off the water in a smooth uniform sheet without splashing. All the ornaments which are profusely introduced are designed from wild or cultivated water plants—beautifully sharp in their outlines, and true to nature in the curves. The fountain, which is to Government order, was designed by Mr. Thomas Blashill, to whom and the manufacturers much credit is due for this chaste and elaborate work.

DR. LIVINGSTONE.

WE are glad to observe that circumstances continue to strengthen our hopes for the safety of this eminent explorer. Mr. Reuter has just received the following telegram from Alexandria, dated yesterday:—"Zanzibar, Dec. 1.—Intelligence from Keelwa states that Dr. Livingstone, or a person resembling him, was seen travelling towards the west of Lake Tanganyika." In transmitting it to the press Mr. Reuter observes that although the news is similar to that already published by Her Majesty's Government on the 22d of November last, the date of the above message is Zanzibar, December 1. Supposing the latter date is correct, Dr. Livingstone must have again been seen west of Lake Tanganyika, which increases the hopes of his safety. It must be remembered that the Lake Tanganyika is upwards of 300 miles long.

NEW GRAVING DOCK FOR GLASGOW.

AT a meeting of Clyde Trustees held in Glasgow on Tuesday, it was resolved to ask for borrowing powers to the extent of £600,000 in the Bill for the formation of a new graving dock which the trustees intend to bring before Parliament. The new dock is to be 500ft. long, 100ft. wide, and 30ft. deep. The width at the entrance-gate will be 83ft., and the depth 20ft. 6in. at spring, and 19ft. 6in. at neap tides. The cost of the ground is estimated at £86,000. The unexhausted borrowing powers of the trust amount to £236,000, and coupling with this the £600,000 asked for in the Bill, there will be created a capital of £836,000 with which to undertake and complete the erection of the graving dock and other necessary works in the river and harbour. From the annual report of the harbour-master it appears that during last year there were 49 steamers built and engined on the Clyde, having an aggregate tonnage of 20,327, as compared with 64 steamers and an aggregate tonnage of 28,548 in 1866, the decrease in 1867 being 15 vessels and 8,221 tons.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

THE fifteenth annual meeting of members of this society took place on the 4th inst., at its rooms, Aldermanbury. The auditors presented their report and the balance-sheet for the past year. Both documents were of a highly satisfactory nature. The number of ordinary and honorary members on the books is 163, and the funds invested for all purposes £1,264 10s. After the reception of these papers by the meeting, the president, Mr. Joseph Newton, proceeded to deliver his annual address. He reviewed at much length the progress of mechanical engineering at home and abroad during 1867, and contrasted the educational machinery of the Continent with that of this country. The comparison was not flattering to our national pride, and it went to account for the superiority of foreign workmen in certain branches of manufacturing industry over those of Great Britain. The evil was patent, and the remedy should be speedily applied. Comprehensive systems of technical schools for each branch of science and art must be established forthwith. Defective legislation had impeded national progress, at all events in regard to manufacturing industry, and we had now to cure a disease which ought never to have existed. If it were possible to estimate the value of the waste brains of this kingdom as the average of waste land has been measured, we should be appalled by its magnitude. Waste brain, like waste land, brought forth weeds; and these were seen in the form of idleness and criminality. Had the soil been fertilized, the flowers and fruits of industry would have flourished upon it. After an energetic appeal to the associated foremen to persevere in their own especial studies and pursuits, Mr. Newton concluded his address, and, in accordance with rule, resigned his office. His re-election, however, followed immediately, on the motion of Mr. Keyte. After completing the arrangements for the establishment of a widow and orphans' fund, and appointing the date (15th February) for the anniversary festival of the society, the members separated.

PROGRESS OF THE HARTLEY INSTITUTION.

WE congratulate the Council of the Hartley Institution upon the establishment of classes for engineering students. This important and thoroughly progressive step has resulted from an offer for that purpose, which was made by several gentlemen. The Town Council of Southampton unanimously adopted this offer, and it will be seen from our advertisement columns that arrangements have been made for commencing the classes without delay. The numerous resources of an engineering character which Southampton possesses, as well in her large steam fleet as in the factories connected with it, and in the important engineering works which are being carried on in connection with the borough, cannot fail to show that it offers unusual advantages to the engineering student for acquiring a practical acquaintance with every branch of his profession. Besides these special classes, the Hartley Institute will afford a thorough course of scientific instruction, which will be carried on by gentlemen in every way qualified for the task. We thus anticipate for the future engineering school of Southampton a high reputation; and we are glad to find, amidst so much talk about technical education, that something practical is here being done.

THE First Commissioner of Works has decided on increasing the bathing lake in Victoria Park to nearly double its present size. The works will be commenced immediately, and following the best precedents of the public works carried on in Lancashire during the cotton distress, will be done by task work. In this way, while employment will be given to many in the east of London willing, but at this time unable, to find work, a permanent public improvement will be effected with economy and despatch.

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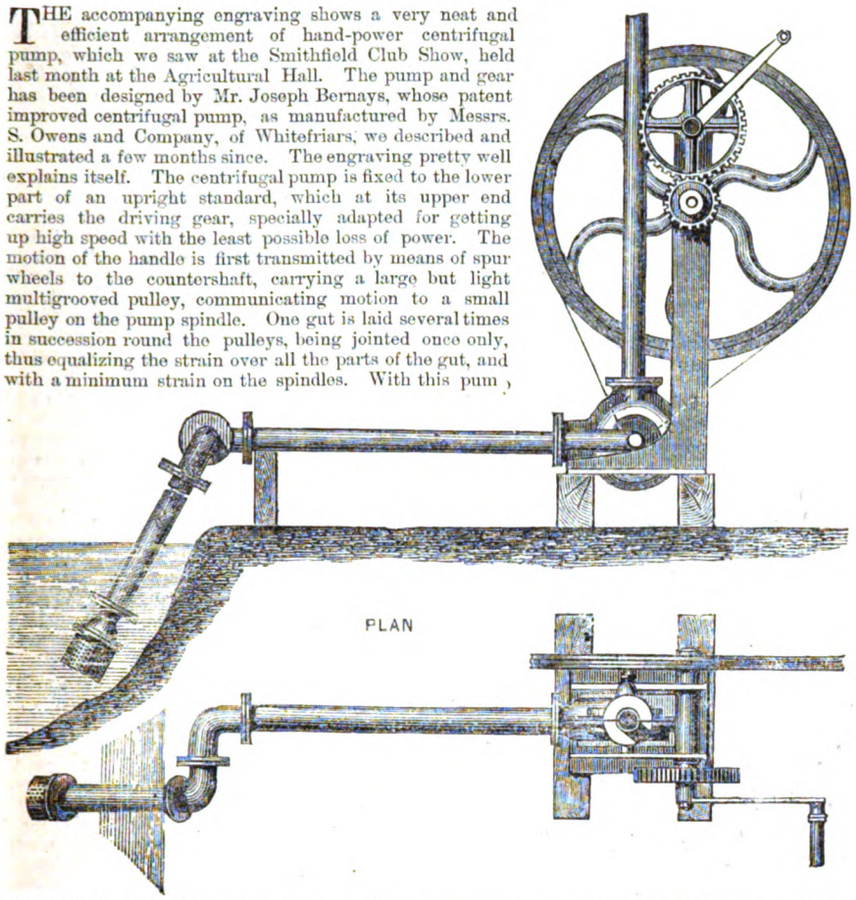
HAND-POWER CENTRIFUGAL PUMP.

BY MR. JOSEPH BERNAYS.

THE accompanying engraving shows a very neat and efficient arrangement of hand-power centrifugal pump, which we saw at the Smithfield Club Show, held last month at the Agricultural Hall. The pump and gear has been designed by Mr. Joseph Bernays, whose patent improved centrifugal pump, as manufactured by Messrs. S. Owens and Company, of Whitefriars, we described and illustrated a few months since. The engraving pretty well explains itself. The centrifugal pump is fixed to the lower part of an upright standard, which at its upper end carries the driving gear, specially adapted for getting up high speed with the least possible loss of power. The motion of the handle is first transmitted by means of spur wheels to the countershaft, carrying a large but light multigrooved pulley, communicating motion to a small pulley on the pump spindle. One gut is laid several times in succession round the pulleys, being jointed once only, thus equalizing the strain over all the parts of the gut, and with a minimum strain on the spindles. With this pump one man is enabled to raise sixteen gallons per minute to a height of 20ft. In some of the arrangements of this pump, the handle is dispensed with, and a pair of strap pulleys are put in its place, which enables the pump to be worked from any existing shafting. In the latter case, and if desired, the dimensions of the pump are altered so as to give either more water, or to raise it to greater height than stated above.



VOLCANIC ERUPTIONS IN CENTRAL AMERICA.

THE citizens of Leon, Nicaragua, have recently been startled by the sudden and almost simultaneous breaking out of a number of volcanic vents on the Western or Pacific slope, near the base of the long extinct twin volcano of Rota, the middle one of the chain of volcanic cones which follow each other in close succession from the northern extremity of the Lake of Managua to the Volcan el Viejo, the most prominent of either, and a landmark for strangers desiring to enter the port of Realejo. The first intimation of the eruption to the inhabitants of Leon, only ten miles distant in a direct line from the scene of the eruption, was a low rumbling sound like distant thunder, shortly followed by quick, sharp, and continuous reports, resembling the roar of a not far distant battery of heavy artillery. On one particular night two large volcanic fires, with several smaller ones scattered about on the plain, shed their lights on the surrounding country, and even lit up with a warm glow the towers of the cathedral in the plaza of Leon. The eruptive matter consists only of large masses of molten lava, scoria, and ashes, unaccompanied by any lava stream. The latest information states that a cone of about 20ft. of elevation had been formed round the principal orifice, but whether caused by upheaval or by the deposition of scoria and ashes was not stated.

MALTA WATER SUPPLY.

THE late prolonged drought at Malta induced the Government to make extensive explorations for water in different parts of the island, especially in the sandstone at the Marsa Valley, and in the marly districts beyond the ancient city of Medina, now called Citta Vecchia. These experiments have been attended with a very considerable amount of success. Numerous shafts have been sunk at the Marsa, which already yields upwards of 400,000 gallons a day, and it is calculated that the whole supply from these sources will be upwards of 900,000 gallons a day, or more than double that given by the two principal aqueducts, upon which the cities before chiefly depended. For the purpose of boring through the rock, and exploring laterally from the sides of the shafts, a boring apparatus, which will cost £240, has been ordered from England. With reference to the important discoveries of water made in the marl on the other side of the Citta Vecchia hill, the exact quantity they will afford has not been yet ascertained, but it is confidently believed they will double the supply at present obtained from the Wignacourt and Fanara aqueducts.

LOCOMOTIVES IN THEIR DAILY WORKINGS.

THE locomotive rushing along at a speed of 20, 40, 60 miles an hour, is practically a huge projectile, and is subject to exactly the same laws as a cannon-shot; the damage it does is by concussion upon the rails, the force of which is divided between the permanent—or in another sense unpermanent—way and itself. This force, like that of the cannon-shot, is estimable as the weight of the body multiplied by the square of its velocity, and the blow which the oscillations of an engine cause to be given to the rails are comparable with the impact of a rifle bolt upon an iron target. In gunnery practice the tests are generally applied direct, in railway battering the blows are indirect. The gun-shot hitting on an incline does not penetrate, but makes a more or less deep scoop, and travels on deflected from its former course. The blow is just as hard whether the thing that gives it has travelled 60 miles, 60 yards, or 1-60th of an inch, the actual force of impact is always given by the actual velocity of the moving body at the instant of collision. Every vertical oscillation, every lateral oscillation of a locomotive then is calculated to make the engine hit the rails with a terrible force equalling, or exceeding the tremendous blows of the largest steam hammers. Every oscillation, then, means destruction—every jolt and jar that the passenger feels means damage done to rail and engine, means so much loss to shareholders. If the blows due to velocity of impact were given direct, the rails might be often smashed outright, but the main weight of the locomotive is borne on springs, and carried on wheels. This, however, only modifies the evil, it does not get rid of it. The momentum is still there, and when the blow is given, although much of the violence is taken off by the springs, yet those springs give off again the force they have absorbed, and thus, although a smash is avoided, the full force of that smashing power is only distributed over such a sufficient amount of area or length of road as shall be capable of enduring it without giving way, but still, not without sustaining a considerable percentage of injury. The oscillation of the boiler is evidently thus one source of destruction, and every vibration of the springs is mischievous. For the normal load of an engine upon its wheels, ten tons upon each axle are what is generally allowed in locomotives as at present constructed, and the deflection of a bare 1-4th inch in a spring being (on the average) equal to a load of one ton, a depression by oscillation of 1in. would be equal to an additional weight of over four tons. This extra weight, then, is, by the vibration of the springs, thrown over from side to side of the engine in travelling, gradually diminishing until the vibrations have died out. But as one set of vibrations have not ceased before another set begin, it follows that these vibrations add the equivalent of a permanent useless load upon the engine, the steam power used up in overcoming which might be usefully employed in hauling in an engine made to run perfectly stable. It is also certain that the grind upon the road must be increased by this useless swaying weight, and that bruising of the rails from end to end of the line must be done by it.

The direct force of impact of such an engine as the Stephenson's express shown at Paris travelling respectively at the rates of 7½, 15, 30, and 60 miles an hour (88 feet a second) would be in the proportions of 3,630, 14,520, 58,080, and 232,320 foot tons, less a definite allowance in each case for gravitation, or, as it would become in this case, friction, according to the actual weight of the travelling engine. In railway accidents we never see these terrific forces exerted; steam is shut off, and suction in the cylinder induced, and brakes are put on; or the blow is indirect; or the buffer-springs yield; or in some way or other the momentum is seriously diminished before actual collision takes place. Now, we do not contend for a moment that every oscillation absorbs the full amount of impact force, but there is in every oscillation a force taken up out of the momentum in the yielding parts of the engine equal to the balance between the work of locomotion done and the full power of the engine, or, in other words, equal to the amount of resistance or impediments offered. Considering the enormous force contained in the total momentum of a locomotive, every small percentage even that is brought to act upon either rail or engine is a quantity whose capacity for evil needs the closest consideration from engineers; and especially as the various actions of momentum are the main source of damage to engine and rail alike, and therefore the main cause of the heavy expenses of working locomotives, and which, it is well known, now costs about 22 per cent. or nearly a quarter of the gross receipts of every line. This question of damage done by neglect of steadiness in the engine—or, in other words, the cost of permitting this waste of momentum, which ought all to be employed in drawing the train, and instead goes into destruction of rails and wear and tear of engine—is one which ought to be thoroughly understood by shareholders. It is the main cause of ruin to them. Another lesson obviously comes out of the same consideration, namely, that light engines and high speeds are suitable for express trains, whilst heavy engines and slow speeds are right for heavy loads, or, in other words, great tractive power is the proper thing for goods traffic and long passenger trains. Hence, too, we see in these rough calculations of the accelerated rates of momentum gained by speeds how it is that express trains are so destructive to the roads; and one can very well understand how the practical effects discovered in railway management should have produced two schools of engineers, one advocating light loads and quickly succeeding dispatches of trains, the other long trains at long intervals carried at slow speeds; the one thinking the fetch-and-carry system best, the other the drag-along system the most economic. A due study of the destructive action of the wasted momentum now transferred into oscillations, concussions, bruises, and friction by practical locomotive engineers will in all probability give the public the advantage of two classes of engines equally able to ply upon the

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same road, and equally innocuous to the permanent way; but to obtain this, steadiness of the engine must be first looked to.

The question of steadiness leads at once to the consideration of how the frame and boiler are set upon the wheels—the boiler being the main mass of the engine. Set upon a pair of leading and a pair of trailing wheels, with axles rigid, except in a small amount of direct vertical play, and with large driving wheels in the centre of the frame, the highest forward speed compatible with the present fashionable systems of construction may be obtained; but the capability of turning sharp curves is limited in exact proportion to the length of wheel base—a long engine like a long dog cannot run round in a small space, and short engines cannot have effective furnaces, without which effective motive power cannot be got. This difficulty bifurcates in existing locomotives in two distinct directions—long engines and coupled wheels. A long engine must be set upon a short wheel-base, or it will not turn curves; a long engine on a short wheel-base must have a lot of overhang, and must therefore be a jumpy one in the direction of its onward motion. If set upon three sets of wheels, the tendency to longitudinal oscillation must be facilitated, because if the centre one be a trifle too large—and can it ever be a trifle too small?—the body of the engine will swing upon this fulcrum like the scale beam in its hanger. Even if the adjustments be made on perfect planes in the workshop, be as exquisite as the best of Stephenson's best work, there is not a yard of any railway that is absolutely level, and a hummocky rail will form a fulcrum for an engine to sway upon as well as the axle of a wheel. It is even worse, because the fulcrum being on one side, the throw of the engine will be diagonal and not direct. In the like manner, the coupling of driving wheels stiffens either the whole or a large portion of the rolling gear, and the bracing of wheels together not only seriously increases friction in the proportion of the square of the number of parts coupled, but the coupling up of numbers of wheels acts against the separate play of the springs, and by increasing the rigidity of the machine accelerates the destructive action of oscillation in running, in proportion as a sledge hammer blow character is given to the concussions. Our present six-wheel coupled goods engines, with their enormous size and weight, must batter the roads fearfully in direct travelling if the wheel-base be short, and, if long, the lateral oscillations will be as great in their forward effects as the vertical ones with the short base; added to which the grind and friction must be enormous in passing curves. Now, nothing runs so easy as a thing upon four wheels, especially if the thing carried be, like a carriage, borne upon two points. If, then, we must have engines, which, for the sake of tractive power, or for any other reason, must have more than four wheels, the number of wheels employed should be divided into two portions, and the bearings of each portion combined at one point; the boiler, or greatest mass of the engine, should then have free play upon these two points—in fact, should be pivoted on the bearings of the leading and trailing sets of driving wheels.

It is evident that if an engine run upon four wheels the whole number of wheels must always be in contact with the rails, and even if the engine were fixed together perfectly rigid, and the wheels without springs, there could be neither longitudinal nor lateral free lift of the wheels away from the rails. With a properly supported and properly balanced engine, therefore, although the permanent way was up and down, like the waves of the sea, there could be no sledge hammer batter, and all the oscillations of the boiler on the springs of the wheels could only transfer the amounts of arrested momentum into additional weight brought upon the springs, and consequently grind upon the road. But the very pivoting of the greatest mass of the engine upon two points would give steadiness by its influence in preserving the centre of gravity of the boiler or principal mass from being disturbed. Another equally important object would also be thus gained, the utmost facility of passing the sharpest curves without grind against the rails; for the two spindles fitted to each end of the frame which supports the boiler, on which the bogies would pivot, would be, in fact, practically two engines, and the connecting link or boiler frame would act as a rope or rod to pull the wheels of the leading bogie inwards from the outer rail, against which its natural tendency would be to grind; in the same manner the drag of the train itself would exert the like useful influence on the trailing bogie. And the value of this curbing of the centrifrugal force of the locomotive being inherently structural, will be always in exact degree to the requirements of the occasion, and will be always in effect at the right moment of time. In this way there would be the most ready adaptation of the sets of wheels at either end of the curves, and engines so made would be able to pass the sharpest ever put down on any line as yet constructed, at high speed, without danger. It will thus be seen that we distinctly prefer eight-wheeled engines, with the wheels coupled in two sets of four each, to any six-wheeled coupled engines which have been, or it is at all probable, can ever be designed. We have no objection to 12-wheeled engines, if the wheels are coupled in sets of six, each set presenting the smallest practicable wheel-base, and respectively attached to freely-moving leading and trailing bogies, pivoting under each end of the boiler; each set also having its own pair of steam cylinders.

There is another important matter to which shareholders should give attention—tenders. The duty of a locomotive is to pull trains of goods or passengers; and its capability of pulling is exactly estimable by its weight and speed. It is the momentum that does the motive work, and this momentum is the weight of the engine multiplied by its velocity. With great steam power great momentum may be worked up in a light weight by extreme velocity, and excessive speed obtained; but the train-load must be light, because without weight of engine there is not sufficient bite upon the rail to draw, or in other words, the gravitation of the engine is overcome, and the wheels slip. It is to prevent this slip that engineers have introduced coupled driving wheels. They put them on to passenger engines to get grip in going up inclines; they put them on to goods engines to get tractive power for hauling so many more tons of coals, stone, or merchandise. Now the tenders are so many tons weight hauled about to no purpose whatever; in short, the tender is not only a hindrance but a drawback, whilst the fuel and water it has to carry would be doing additional momentum if put upon the engine, doing in other words so much more hauling of goods or passengers along the line at no additional cost whatever. No excessive weight need be put upon the wheels in consequence of the fuel load on the engine; for if to an eight-wheeled one the four wheels of the tender were added, forming a twelve-wheeled engine with two sets of six wheels coupled, the weights upon each axle might be even diminished, while the whole tractive power would be increased directly by the, say, ten tons of coke and water, and indirectly by the getting quit of at least ten tons of load to haul in the abandonment of the useless tender itself. Still, further, another subject comes up in these considerations, which is briefly this. That if, under the adoption of the views we have advocated it be found necessary, as it undoubtedly would be, to lengthen the boiler, this lengthening would not be detrimental to the running of the engine, the wear of the road, nor the passing of curves, whilst the advantages would be greater generation of steam, and less liability of burning the fire-box or tubes in the boiler.

The direct advantages to be looked for in the improved locomotive of the future are:—That it should carry its own fuel and water, increasing thereby its hauling power without any additional expense whatever; that in so doing the weight of the engine would be better distributed over the wheels by the coupling of separate sets connected with separate leading and trailing platforms, upon the centre of which the boiler should rest, longitudinal and lateral oscillation and grind in passing curves being thus reduced to a minimum, and the present excessive wear and tear of engine and permanent way being at the same time as much as possible prevented. The incidental advantages would be:—No tenders to construct and maintain; no turn-tables to build, as such engines could run either way; less necessity in making lines of road, of reducing inclines approaching to levels; less expense in maintaining the permanent way; less interruption and less danger to the traffic in consequence of less frequency of repairs of road; less cost of maintenance of engine; and a general reduction of expenses throughout the whole of the rolling-stock and factory departments.

There was a model and plans of what seems to be such a desirable engine in the Paris Exhibition—Mr. Fairlie's. But nobody noticed them, not even those particular eminent men who have written letters to the "Times," and had letters printed in the government report, giving their own—fortunately not the general—opinion of the advances of foreigners, and the necessity of introducing continental schools into England for the education of English engineers. The eminent foreigners who instructed them on the superior (?) abilities of foreign mechanics would not have been likely to have asked their polite attention to an Englishman's plan: though possibly at some future international exhibition we may see a French Prussian, or Belgian engine in the aspect of continental modifications of it, and we may expect that the Playfairs of that day will then appreciate, after the explanations of their foreign friends, its especial excellences and merits. We should regret very much being obliged to pass over the numerous models and plans shown at Paris if we thought there was anything amongst them at all approaching Mr. Fairlie's in merit. One plan by M. Thouvenot was very like it. We do not know which was first in the field, but that is little matter, as the two plans are essentially different, that shown by M. Thouvenot being impracticable—leaving out of the question the Fell complication—while Mr. Fairlie's is thoroughly practical in all its details, and, what is more, is actually at work, and therefore not problematical. M. Thouvenot's plan is still only on paper. A Fairlie engine was constructed and successfully run, in 1865, upon the Neath and Brecon Line, during the construction of which it passed curves of 2¼ chains radius at the rate of 12 miles an hour, and to this exploit Captain Tyler has given the highest encomium, after personal experience. That gentlemen has again during the present month testified to the value and advantages of the Fairlie system, in his Report upon the Condition and Prospects of the Grand Trunk Railway of Canada. We had taken our notes of the Paris model before we knew what opinion Captain Tyler retained, and indeed, as the date will show, at that time the report we have alluded to was unpublished. It is gratifying, however, to find these views so strongly supported by one so able and so experienced in railway construction and management.

The sum total of all we have to say about the Fairlie engine may be briefly enough put. It is calculated to save wear and tear of line, to haul more load at much less cost, to possess more steadiness and safety in running, to yield by its savings a considerable dividend to shareholders, to double the carrying power of every railway in the kingdom, and to reduce station expenses by doing away with costly turntables and their sites. Finally, whether the Fairlie plan or any other plan in existence, or not yet in being, shall hereafter come into general practice, the point we have had at heart in these elaborate essays will have been fully attained if we can get shareholders themselves to go into the consideration of the savings to be effected by improvements in the designs of locomotives. Raising additional capital in any way must increase existing burdens; and although in some cases to capitalise floating debts may be productive of temporary and even substantial benefit, yet no permanent relief from difficulties can be afforded by any other means than increased earnings upon the lines themselves. All modifications of capital arrangements can be but shuffling the conditions like the shuffling of cards, the pack of real evils remaining constantly the same. To make the engines of every line save in their daily working a dividend upon the outlaid capital is the one requirement to bring existing railways, despite their enormous debts, again into a healthy and prosperous state.

[The foregoing remarks are upon an important subject, and are well worthy the attention of engineers and the public at the present time when railways are taxing the energies of officials to keep them going. The article is one of a series upon Locomotives and Railway Dividends now appearing in the "Standard," and which contain some wholesome truths and sound advice.]

THE "Cronique des Arts" tells a curious story which shows to what perfection the art of manufacturing antiquities has attained in Italy. In 1864 M. de Nolivos, a French art collector, bought at Florence a bust of Girolamo Benivieni. It was exhibited in the following year in Paris, where it was pronounced by connoisseurs to be the work of either Mino da Fiesole or Benedetto da Majano (1490-1510). M. de Nolivos' collection was sold by auction in Paris last year when the bust was secured by Government at a large price for the Louvre. It now appears that the bust was the work of a living artist, Giovanni Freppa, residing at Florence. This statement is supported by certificates from Freppa himself, from a sculptor of Florence who saw him model the bust, and from a workman in a tobacco manufactory, who declares the bust to be an excellent likeness of a comrade who sat to the sculptor as his model.

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Obituary.

WE regret to announce the sudden death of Mr. Claudet, the veteran photographer and distinguished artist. Among the earliest and most successful followers of Daguerre, Mr. Claudet was almost the last to abandon the use of metal plates for the more modern and improved processes of photography, and it was in some degree due to his skill and knowledge that daguerreotype at first made such progress in this country, while the inventor's own countrymen were as eagerly bent upon developing the new art in the direction traced by our Fox Talbot. Mr. Claudet's nice discrimination and manipulative dexterity gave to the productions of his camera an extraordinary refinement. He was a Fellow of the Royal Society and other learned bodies.

Correspondence.

ON DEFENSIVE MEASURES AGAINST HURRICANES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—We ought to bear in mind that the West Indies and Central America are most probably as yet in an embryo state as regards their commercial, political, and military importance. In a few years hence the main current of a vast world traffic will have to pass through those regions, and then the Central American isthmus will have been bridged over by numerous railways, and may possibly, also, be traversed by a ship canal. Increased facilities of transit across that isthmus will, in their turn, tend to stimulate industrial and commercial enterprise on the Pacific coasts; and whether or not the increasing growth of volcanic and coralline reefs* and islands in Oceania may in the course of time cause such a deviation of sea currents as at some future time to render milder the climate of the northernmost parts of the Pacific coasts, there can remain little doubt but that the vast traffic, with the growing communities of the west coast of America, of Oceania, Australia, and the Asiatic coasts, will pass *via* the West Indies. Hence a discussion of defensive measures against the ravages of hurricanes can do no harm, and may result in the devising of further efficient and practical measures for the protection of life and property. With this view I beg to submit to you some diagrams, illustrative of a system of dwelling-houses, stores, arsenals, &c., which I consider especially applicable for hilly countries, exposed to violent hurricanes; and, also, of a framework structure, consisting of iron, which may be, in combination with wooden beams, wire ropes, chains, &c. (just as the constructing engineer may deem best), which framework or "hurricane-frame," if erected across the lower ridges, valleys, plains—in fact, across any parts along which the hurricanes are known to sweep with intensified violence, would act as a fitter and local mollifier or "brake" to the hurricane, and thus afford great protection to the warehouses, wharves, docks, harbour, and ships which lie to the leeward of such a hurricane frame, against the most violent hurricanes. The houses, stores, &c., are to be arranged along, and partly excavated in, the sides of the hills, so as to expose as little surface as possible to the force of the hurricane—the streets passing along the fronts of the houses, and ascending the hill in gentle inclines, other inclines and stairs connecting directly the various terraces at right angles.

The diagrams are all sections, made only to roughly indicate the nature of my propositions. In fig. 1, *a a* are sections of the terrace buildings; *b*, section across the street; *c*, drains for leading off the rainwater;† *d*, balustrade walls lining the streets, built with an unusually broad base, so as to resist better the pressure of the hurricane; *e*, railings on the top of such walls; *f*, the natural rock composing the hill. I am under the impression that if the towns of the West Indies, in any localities not protected by the hurricane frames I am about to describe, were laid out in a manner similar to what I have indicated, they would effectually resist the most violent hurricane. The line *h h* in those sections indicate that the horizontal distance between the respective terraces might be greater, and that between the parts of the slopes *g*—gardens, plantations, &c., may be arranged. In the same manner, in section, fig. 2, the protected terra firma space *b b* may be larger, as that section indicates.

Fig. 3 is the section of a hurricane proof lighthouse of masonry, and it may interest some of your readers to be informed that this shape of a broad-based conical lighthouse suggested itself to my mind in December, 1858, when on board the Royal Mail Steamer "Atrato," then commanded by Captain Woolley, whose tall figure and kindly countenance I fancy I see before me now (he perished during the late hurricane, in the "Rhone," off Peter Island). I need not waste your space with a

FIG. 1.

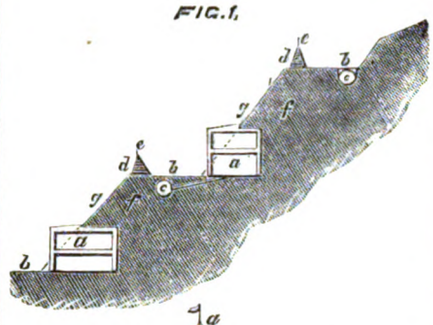


FIG. 2.

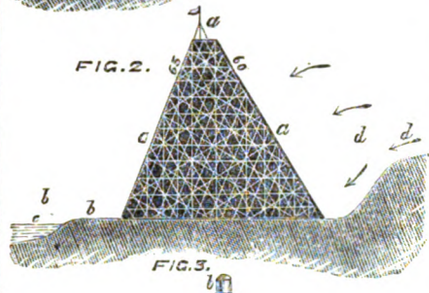
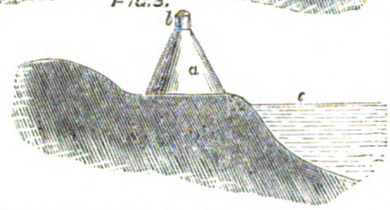


FIG. 3.



detail description of the hurricane frame, of which a section is shown in fig. 2, because the details of its construction are dependent on local features and resources, and have to be left to the discretion of the constructing engineer, its width, its height, and length, having, of course, to be determined by the area of land and harbour surface it is destined to protect. In fig. 2, *d* indicates the space to the windward of the hurricane frame, the arrows pointing the direction of the hurricane. Let your readers call to mind the Crystal Palace in Sydenham, minus the glass, and with the iron framework much stronger, by means of additional diagonals and girders, and they will then be able to realize the construction of my hurricane brake.—I am, Sir, yours, &c.,

GUSTAV JULIUS GUNTHER.

London, December 31, 1867.

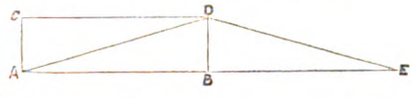
* It is well known that the Torres Straits are being closed up by that growth; and Professor Richter predicts that when the Florida peninsula will have annexed the Bahamas—thus, of course, stopping the Gulf Stream—the northermal line of perennial ice now passing near "Cape Farewell," will probably have to be shifted down to the Lizard or Cape Lao Vicente. Let us hope that that period—when Macaulay's New Zealander will look for walruses at the mouth of the Jajo—be as yet a few thousand years ahead of us.

† Travelling and residing many years in the torrid zone has almost convinced me that a great many diseases, fevers, &c., could be prevented if all non-liquid wastes were at once deodorized by absorption, by means of earth or ashes, &c.; and the invention of the Rev. Mr. ———, of earth-closets, ought to be adopted without delay in all tropical countries. Indeed, in the Old Testament, in the laws of Moses, we find indicated a most profound acquaintance with sanitary science.

SQUARING THE CIRCLE.

LETTER I.

SIR,—Permit me to add a proposition to this interesting discussion. I shall begin by describing a square as two straight parallel lines crossing each other at the shortest distance, and a circle as a line bent parallel to and round a point having an area completely contained, greater in proportion to its circumference than any other figure, and to prove that this area is equal to that contained between two straight parallel lines, the sum of which together is equal to the circumference of the circle, the distance from each other being that of the radius of the circle. Thus, let B D = C D, and together in



length equal the circumference of the circle with D B for its radius. Join C A and B D; the area of fig. A B C D will equal that of the circle; take C D away, and add it to A B, making A B E join A D and E D; the triangle A D E will also equal the area of the circle, and so any intermediate quantity of the line C D taken away and added to A B, and the extremities joined will give a figure, the area of which will be equal to that of the circle.

In my next, I propose to prove the proposition.—I am, Sir, yours, &c.,

JOSEPH A. NICHOLSON.

3, Adelaide-place, London-bridge, E.C.,
January 7.

PETROLEUM AS A FUEL.

SIR,—We have perused with much interest an excellent article in your last issue in which you say, "One concluding suggestion, however, it occurs to us to offer, and that is, that the question of using petroleum as a fuel for generating steam under marine boilers should be practically solved." On this point we may remark that arrangements are now in progress for thoroughly testing, in one of H. M.'s steam launches, the only system by which the perfect combustion of liquid fuel for steam generating purposes has yet been effected. Further on, you say "Field's principle, as applied to Cornish boilers, is perfection, and we believe it would prove equally successful if adapted to marine boilers. And this, notwithstanding the circumstance that the Americans have virtually given its application up as a bad job. The Secretary of the American navy reports that after an elaborate series of experiments, the conclusion arrived at is that the convenience, comfort, health, and safety are against the use of petroleum in steam vessels." Now, in the first place, we beg to observe that the system referred to is known as the Aydon system, patented by Wise, Field, and Aydon. You have, doubtless, been led to infer that it is known as Field's system, from the fact that the first experiments made by the patentees were carried on at the works of Messrs. Field. In the next place, it might be inferred from your observations that this particular system has been tried by the Americans and pronounced a failure. This is not so, because they have never tried it, nor have the patentees as yet been in communication with the American authorities on the subject. We may, however, remark that the Aydon system has been seen in operation and approved of by many of our most eminent scientific gentlemen, and also by gentlemen interested in the American plan, who owned themselves beaten. In conclusion, permit us to state that the fuel used by preference is not petroleum, but merely refuse material, which is perfectly safe, convenient, and cheap (having hitherto been considered a worthless drug in the market), and that by the Aydon system such fuels are perfectly consumed without smoke.—I am, Sir, yours, &c.,

FRANCIS WISE AND CO.

Chandos Chambers, Adelphi, W.C., January 9.

[If Messrs. Wise had read two lines more of our article they could not have drawn the inference they have attempted to draw. We had already spoken favourably of the Field—or rather the Aydon—system, as we were enabled to do from personal observation of its working, and after referring to the American Naval Secretary's report (as quoted above) we especially added, "All we can say is, that they have not gone the right way to work to use it." There is not the shadow of a reason for inferring that the Aydon system has been tried in the American navy and pronounced a failure. We were writing of the use of petroleum as a steam fuel, and not specially of the Aydon method of using it. If our meaning appeared at all ambiguous, it ought to be made clear enough by the Naval Secretary's conclusions, which were "against the use of petroleum in steam vessels," and not against any special system of burning it.—ED. M. M.]

Meetings for the Week.

MON.—Royal Geographical Society.—At 8.30 p.m., papers on "Explorations in the Isthmus of Darien," by M. Lucien de Puyott; and on "The Physical Geography of the Belize River," by T. Cockburn, Esq.

TUES.—The Institution of Civil Engineers.—At 8 p.m., inaugural address of Mr. Charles Hutton Gregory, president, and renewed discussion upon the papers on "The Victoria Bridge," and on New Railways at Battersea, etc.

FRI.—Royal Institution.—At 8 p.m.—Professor Tyndall on "Faraday as a Discoverer."

Royal United Service Institution.—Lecture at 3 p.m., by Captain E. A. Sloane, on "The Utilization of the Soldiers' Unemployed Time, with a Proposed Scheme independent of Government Aid.

ANOTHER remarkable meteor appeared on the morning of New Year's day, at twenty minutes past seven, and was seen in Kent, travelling slowly through the sky from east to west. In diameter it was about eight inches, a globe of fire, followed by a bright light, and leaving a line of white smoke behind it that could be seen for fifteen minutes. The meteor, which was accompanied by a fizzing sound, appeared about 45 deg. above the horizon, traversed more than a third of the heavens, and then burst into three pieces near the earth. This was probably the same meteor as seen at Havre.

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TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10s. half-yearly, payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later tqan 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—J. C.—Messrs. E. and Co.—E. W.—Messrs. H. and R.—P. M. P.—S. E.—G. L. W.—R. D.—F. H.—T. E.—P. C.—G. W. H.—J. M.—C. B.—Messrs. C. M. and Co.—J. W.—C. D. A.—G. E. P.—G. J. G.—T. S. T.—W. H. H.—J. B.—F. W.—R. G. S.—S. H.—R. N.—A. M. B.—J. C.—C. F. R.

Naval, Military, and Gunnery Items.

IT is announced that Rear-Admiral Halsted has resigned the secretaryship of Lloyds. It was understood to have been accepted by the committee.

ACCORDING to the report of the Naval Secretary, the American navy has been reduced since last year by 40 vessels, carrying 482 guns, and consists at present of 238 vessels, carrying 1,869 guns o which however, only 103 ships, carrying 898 guns, are in use, the rest being laid up. The *personnel* of the force has not been quite 12,000 men.

SOME iron plates coated with zinc, on Mr. Daft's plan, have been taken out of the water alongside Portsmouth dockyard for examination, after having been submerged for nearly three years. All the nail heads were found to be perfect, and the surface of the zinc, with the exception of a thin deposit of muddy slime, was found to be perfectly clean. They will be partially taken to pieces and further examined and reported upon.

THE Chilian gun now being made at Pittsburgh, U.S., is 22½ feet in length, being two feet longer than the Rodman gun at Fort Hamilton, but of exactly the same bore, twenty inches. Its greatest diameter is 5 feet 4 inches, its least diameter, 2 feet 9 inches. The gun is designed for garrison or naval service.

ON the 31st of December, 1867, 85 ships were building on the Wear. Thirty-three of the number were sold, and 52 unsold. Fifteen of the vessels in course of construction are of iron, five composite, of wood and iron, and the remainder of timber. The largest iron vessel is a steamer of 1,100 tons, and the second in point of tonnage is a composite ship of 1,040 tons. Of the 15 iron vessels in course of construction, nine are screws.

THE entire mercantile navy of Europe, according to the latest statistical returns, consists of 100,000 vessels, representing a total tonnage of 12 millions and employing 600,000 men. This amount of shipping is thus distributed :—Bremen, 294 vessels; Hamburg, 539; Lubeck, 45; Hanover, 906; Mecklenburg Schwerin, 424; Oldenburg, 610; Prussia, 1,443; Austria, 9,491; Belgium, 107; Spain, 4,359; France, 15,259; Greece, 4,452; Holland, 2,227; Italy, 13,223; Portugal, 591; Great Britain, 27,868; Russia, 1,416; Denmark, 2,740; the Elbe Duchies, 2,552; Norway, 5,678; Sweden, 2,236; Turkey, 2,300.

LIEUTENANT-COLONEL Weyde, a Russian officer, has invented an apparatus for throwing light on objects under water. It is not expensive, and experiments made with it by the Russian and Prussian Governments in the sea near Cronstadt, and in the river Spree, are stated to have produced very satisfactory results. A very important use of this invention is, that it enables the officers of a ship of war to discover any submarine mines or torpedoes sunk under it by the enemy. It must, of course, also greatly facilitate the recovery of sunken ships and other objects at the bottom of the sea.

SHIPBUILDING in Scotland, which for the past two years has been much depressed, begins to show renewed vitality; the number of vessels contracted for compares favorably with that of last year. There were built in 1867, 181 iron vessels of 97,500 tons, against 188 of 116,996 tons in 1866, and 229 of 146,700 tons in 1865; and there are now building 113, of 112,360 tons, against 84 of 70,000 tons in 1866, and 152 of 129,700 tons in 1865.

THE American press is devoting some space to the discussion of the "Alabama" claims controversy. Some papers allege that Secretary Seward's unskilfulness has got it into its present unfortunate tangle. Upon the general character of Seward's diplomatic writings, the "Philadelphia Age" prints the following :—"2,102. Such is the ominous number of Mr. Seward's last despatch to Mr. Adams. These 2,100 despatches to one Minister cover the space of about six years, or 350 a year, or one—long ones, too—for every working day. If we suppose Great Britain to be one-fourth of Mr. Seward's diplomatic world, then we have 8,400 despatches in six years, or 4½ for every day. Surely no country ever had so prolific a Secretary. We remember to have heard an eminent man—once Secretary of State himself—say that he believed Seward had written more in quantity than all the previous Secretaries, 25 in number, from 1789 to 1861."

DURING the past year 6,334 vessels arrived in the Tyne from over sea, and 1,294 foreign vessels coastwise, against 5,587 from over sea, and 1,574 foreign vessels from coastwise in 1866; 1,377 vessels arrived with cargoes in 1867 from foreign, and 1,311 foreign vessels arrived with cargoes from foreign and coastwise. In all 2,688 vessels were cleared by the Custom House in 1867, against 2,566 in 1866. There were about 1,000 sail of either vessels less in 1867 than in 1866, showing the rapid progress that steam colliers are making in driving sailing vessels out of the coal trade. The increase in the number of vessels of large tonnage trading from the Tyne is very remarkable. In 1854 no vessels of 1,000 tons sailed from the Tyne. In 1864 43 above 1,000 tons sailed; in 1865, 72; in 1866, 58; and up to the 21st of December, 1867, 106. Nine of the number were of registered tonnage exceeding 1,500.

IMMEDIATELY on the completion of the "Hercules," which is expected to be ready for floating out of the dock in about a couple of months from the present time, it is intended to commence the construction of another new ironclad armour-plated ship of the "Hercules" class; the drawings and plans are now in course of preparation. The name by which the new ship will be designated has not yet been officially announced. In the designs for the new frigate care will be taken to adapt the new ship, by giving her increased tonnage and length, to the latest improvements in artillery by enabling her to mount guns of the heaviest description.

Miscellanea.

DURING the past year there have appeared 4,144 new books and new editions.

ENGLISH pheasants and hares were in the Montreal Christmas market, carried across the Atlantic in the icehouses of ocean steamers.

A TERRIBLE fire has destroyed the workings of the St. John del Rey Mines. Eighteen lives were lost. The fire is supposed to have been the work of an incendiary.

THE obituary of the "Times" of Wednesday records the death of seven ladies who attained the great ages of 95, 90, 86, 85, 84, 82, and 80 years; and of one gentleman aged 96.

THE present winter will form an epoch in the meteorological annals of Florence. Early in October the Apennines were thickly covered with snow, a rare occurrence at that season.

THE Warsaw official "Dziennik" publishes a ukase, in which the kingdom of Poland is no longer accorded the name it has held so long, but designated as the Vistula Province.

FROM lack of economy, in reduction of ores, it is estimated that the aggregate loss on the production of bullion in the United States for the past year will reach the sum of 25,000,000 dollars.

ACCORDING to a table prepared by Messrs. Pixley, Abell, and Langley, the export of silver from Southampton to India, China, and the Straits, which in the previous year amounted to £2,365,626, and for many years back has run up from £3,000,000 to £14,000,000, was in 1867 only £642,912.

AT the South Kensington Museum the visitors during the week ending January 4 were :—On Monday, Tuesday, Wednesday, and Saturday, free from 10 a.m. to 10 p.m., 11,010; on Thursday and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,060—total, 12,070. Average of corresponding week in former years, 8,084. Total from the opening of the Museum, 7,136,824.

CAPTAIN Shaw's annual report respecting the state of the fire brigade shows the number of fires in the course of the last year. In 1865 there were 1,500 fires, of which 1,205 were serious; in 1866 there were 1,300 fires, of which 326 were serious; and in 1867 there were 1,397, of which 245 were serious, the decrease in the number of serious fires showing the effectiveness of the fire brigade.

ON Tuesday evening next the 14th inst., at the Institution of Civil Engineers, Mr. Charles Hutton Gregory will deliver an inaugural address, on assuming the chair for the first time after his election as president. It is understood that Mr. Gregory proposes to refer principally to the assistance rendered by civil engineers in constructions for defence from hostile attack, and to improvements of weapons of war.

A HIGHLY interesting lecture, the main feature of which consisted in tracing to physiological phenomena the principles of the most approved and important mechanical and chemical inventions of modern times, was delivered at the Jews' College, Finsbury-square, a few evenings since by the principal, Dr. Friendlander. The learned lecturer explained how even familiar engineering contrivances were based on ordinary arrangements of natural origin. Various amusing illustrations were given in the course of the remarks.

A METEOR was observed about a week since in the neighbourhood of Havre, at about half-past seven in the morning. The nucleus of a crimson red colour, about the size of a star of the first magnitude, was followed by a luminous train which lasted some seconds, and which was succeeded by a white cloud, which continued for twenty-five minutes before it disappeared. The luminous body in its flight cast off a great number of sparks resembling small stars. Near Pont-Audemer (Eure), the meteor disappeared with a loud report.

MOST of the north country ploughing matches take place during the winter months. Among the most important meetings are the two which have just been held—one at Roxdale, on the last day of 1867, and the other at Brancepeth, on January 2. There was a large attendance at both meetings, and the contests for the All England champion prizes were watched with great interest. These were both won with Ransome's ploughs, and the work was considered extremely good.

IT is stated that the gold mines of Nova Scotia, taking their magnitude into account, are among the most productive in the world. The yield in 1866 was 25,464 ounces, and this year it is expected to reach thirty thousand ounces. The quartz-crushing has been especially successful, and the earnings of individual miners averaged upwards of three hundred pounds per annum. These facts will serve to make Nova Scotia a more attractive field of emigration than it has hitherto been.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—1463, 1467, 1494, 1495, 1517
BUILDINGS AND BUILDING MATERIALS—1458
CHEMISTRY AND PHOTOGRAPHY—1465, 1472, 1478, 1487
CULTIVATION OF THE SOIL, including agricultural implements and machines—1452, 1497, 1499
ELECTRICAL APPARATUS—None
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—1455, 1457, 1466, 1468, 1477, 1488, 1501, 1502, 1507, 1510
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1485, 1492, 1493
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1519
GENERAL MACHINERY—1447, 1451, 1453, 1454, 1456, 1460, 1462, 1479, 1480, 1481, 1482, 1483, 1516, 1518
LIGHTING, HEATING, AND VENTILATING—1448
METALS, including apparatus for their manufacture—1461, 1498, 1515, 1520
MISCELLANEOUS—1450, 1459, 1464, 1470, 1474, 1475, 1490, 1491, 1504, 1506, 1508, 1509, 1512, 1513
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1471, 1476, 1500, 1505, 1511
SHIPS AND BOATS, including their fittings—1469, 1473, 1496, 1503
STEAM ENGINES—None
WARFARE—1449, 1484, 1489, 1514

1447 J. M. NAPIER. *Improvements in printing machinery.* Dated May 16, 1867.

The patentee claims the arranging intaglio printing machinery in such manner that printing plates may be carried round in a circuit with the faces of the plates uppermost, such plates passing under pressure apparatus, and being inked and wiped at suitable places in the circuit. The arranging intaglio printing machines so as to cross-ink the printing plate, or in such manner that the printing plate is inked by rollers traversing the plate both longitudinally and transversely. The employing in intaglio printing machines, wiping rollers, and other wiping surfaces having a leather surface based upon india-rubber. In intaglio printing the use of hard rollers or surfaces to receive the ink taken off the plates by wiping rollers or surfaces, and the use of doctors, scrapers, or rubbers to gather the ink from such hard rollers or surfaces, as set forth. The arranging intaglio printing machines in such manner that as the plate passes through the machine it may be wiped by an endless chain of wiping surfaces, in the manner set forth.—Patent completed.

1448 G. T. BOUSFIELD. *A new and useful method of manufacturing illuminating gases.* (A communication.) Dated May 16, 1867.

The patentee claims, first, the combination of the gas-making retort with a supply valve (for the introduction of the gas material), and with a slide (to move the said material forward in the retort), substantially as set forth. Second, the combination of the gas-making retort with a discharge tube terminating in a reservoir of liquid which prevents the entrance of air or the escape of gas, and per

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mits the residuum of the gas material to be removed without opening the retort, substantially as set forth. Third, the progressive method or process of manufacturing gas substantially as set forth, consisting in moving the gas material forward at intervals in the retort. Fourth, the method or process substantially as set forth of decomposing the gas material in a heated retort in the presence of a current of electricity. Fifth, the combination of the gas-making retort with a battery in such manner that a current of electricity is caused to operate upon the gaseous matter evolved in the retort from the gas material, substantially as set forth.—Patent completed.

1449 J. H. JOHNSON. *Improvements in breech-loading fire-arms.* (A communication.) Dated May 16, 1867.

This invention is not described apart from the drawings. —Patent completed.

1450 G. F. HARRINGTON. *Improvements in the construction of marine baths.* Dated May 16, 1867.

This invention has reference to baths subject to the rise and fall of the tide, and consists in so constructing and arranging the baths that in lieu of the dressing rooms floating with the baths they are fixtures, being constructed upon piles fixed or driven into the bed of the sea, the baths being allowed to rise and fall with the tide, being guided and kept in position by or between the piles on which the dressing rooms are built.—Patent abandoned.

1451 C. E. BROOMAN. *Improvements in sewing machines.* (A communication.) Dated May 16, 1867.

This invention refers to sewing machines for producing what is known as the shuttle or double lock stitch. The improvements consist, first, in the employment of an upright oscillating or vibrating shuttle carrier when operated by an eccentric, or its equivalent, for the purposes explained. Second, in the employment of a spring clamp for holding the shuttle in place while in operation, for the purpose explained; and, third, in the general arrangement or combination of parts of shuttle machines, as described. —Patent completed.

1452 J. G. GRIFFITHS. *A new or improved combined apparatus for sowing seeds, hoeing, raking, and other horticultural purposes.* Dated May 16, 1867.

This invention relates to the construction of a new or combined apparatus or instrument for the purpose of sowing seeds, hoeing, raking, drilling, potting, cutting, and other gardening or horticultural purposes, and consists of a wooden handle and stock, at the end of which a hoe is fixed by means of a metal socket; the top of the hoe blade being formed of a triangular shape with two points serves as a crocking or potting iron; a female screw is cut in the centre of the hoe and potting iron, into which the stem of a rake and drill is screwed, the rake and drill being formed on curved arms diverging from each other at the end of the stem. The seed box is placed on the top of the stock on a bridge, and is secured by a pin passing through metallic flanges of the seed box, and through the stock, the pin being attached to a short length of chain from the handle. The seed box is provided with seed sifters perforated with different sizes of holes, according to the seed used, and the bottom of the box is likewise perforated with apertures for the seed to fall through; these apertures are closed by sliding plates, in such manner that the rows of seed may be regulated to the width required; a small hammer or pricker is fixed by a shoe and screws to the under part of the handle; and under the stock a Turkish saw blade is carried by inserting one end (which is a screw) in a cavity in the stock, and the point of the blade under a leather strap. The knife may take the place of the rake and drill by screwing it into the centre of the hoe and potting iron.—Patent abandoned.

1453 J. SADLER. *An improved nail-cutting machine.* Dated May 16, 1867.

This invention consists in the application of a shaft rotating at one half the speed the main shaft of the machine rotates at, which main shaft gives motion to the cutting blade by means of a crank and lever. Upon the slower rotating shaft the inventor places an eccentric, from which eccentric, by means of a band and rod, he communicates an oscillating motion to a lever fixed upon a vertical shaft, to this lever he connects a guide which moves the nail plate from side to side of the cutting blade, from which plate the blank for the nail is cut. From this lever he also carries a rod to another lever of somewhat similar construction to the last, communicating an oscillating motion to this second lever which carries the plate from which the nail blank is made. This second lever is constructed with means of regulating the angle at which the nail plate is required to be to the face of the cutting blade at the moment the nail blank is cut off, so that the blank may be of the proper size and shape requisite for the nail. And the nature of the invention further consists in the employment of two nippers operating each in combination with one pair of holding dies. He communicates motion to these by tappets upon the slower rotating shaft referred to above, or upon another shaft rotating at one-half the speed of the main shaft used for giving motion to the cutting blade. And the nature of the invention further consists in the combination of a shaft (rotating at half the speed the shaft referred to in this specification as the main shaft) with two tappets upon it, each acting upon separate levers; the oscillating motion thus given to the levers moves forward the heading bolts which head the nails.—Patent abandoned.

1454 J. M. STANLEY. *Improvements in producing and increasing combustion in blast and other furnaces, and also for generating steam and for other similar or analogous purposes.* Dated May 16, 1867.

The patentee claims the use and application of highly superheated or decomposed steam combined with heated air, so as to produce increased and more complete combustion for the several purposes, and by the various means described and illustrated in the drawings accompanying the specification.—Patent completed.

1455 J. DENIS. *Improvements in the treatment and preparation of fibrous substances or vegetable matters as pulp for the manufacture of paper, and in apparatus for the same.* Dated May 17, 1867.

We cannot here give space to the details of this invention.—Patent completed.

1456 F. P. WARREN. *Improvements in tobacco pipes.* Dated May 17, 1867.

The patentee claims the construction and arrangement of tobacco pipes in such manner as that the smoke after passing down through the interior of the bowl or chamber containing the tobacco is caused to come in contact with the outer surface of such bowl or chamber, or to pass through or along a suitable passage or channel, or passages or channels (continued to the top of the bowl and closed by a plug or plugs), in such manner as to be acted upon and dried or deprived of its essential oil and other moisture by the heat emanating from the bowl or chamber in which the tobacco is being burnt.—Patent completed.

1457 H. PEEL. *Improvements in looms for weaving lastings and serge-de-berries, applicable also for weaving other fabrics.* Dated May 17, 1867.

This invention relates to means or apparatus for working or operating the heulds or heddles in the looms above named, and consists in the employment of treading tappets having side grooves and treading levers with friction pulleys to run in the grooves. These levers are connected to ordinary jack-reds to which the top parts of the heulds or heddles are attached by usual connecting rods, and are also connected with the bottom part of the heulds or heddles by other levers, by which means both up and down motion is given to the heulds, thus dispensing with the weights or springs now used —Patent completed.

1458 P. M. PARSONS. *Improvements in the manufacture of artificial granite and other artificial bricks and blocks suitable for buildings, engineering, structures, pavements, and other similar purposes.* (A communication.) Dated May 17, 1867.

We cannot here give space to the details of this invention.—Patent abandoned.

1459 A. ANGOT. *An improved spring petticoat termed "The Empress."* Dated May 17, 1867.

This invention is not described apart from the drawings. —Patent completed.

1460 H. HOLLINGSWORTH. *An improved shoe for piles* Dated May 17, 1867.

The objects of this invention are, first, to get a more certain foundation where piles are used for that purpose. Second, a great saving of time, labour, and power in driving. These objects are attained in the following manner, that is to say:—The shoe is made longer than the ordinary shoe, and upon the upper part thereof is a projection or swelling larger than the body of the pile, which projection or swelling clears the way for the pile as it is driven, thereby greatly reducing the friction on the sides of the same, and allowing it to be driven home with greater ease than hitherto, and more certainty of its resting on a solid foundation. The shape and size of the swelling or projection depends to a great extent upon the nature of the ground it may be used upon. It is estimated that the use of piles with these shoes will effect a saving of more than 50 per cent. in time, power, and labour required to drive the ordinary pile. The foot of the pile is fitted into the shoe and secured with one or more bolts or pins passing through the pile and riveted to the shoe.—Patent abandoned.

1461 A. L. DOWIE. *Improvements in treating iron to obtain metallic compounds for various uses.* Dated May 17, 1867.

Iron treated according to the first part of these processes, that is to say, with marine shells, or their equivalent, or according to that and other parts of the processes, but without having other metals alloyed therewith, forms what may be termed varieties of improved cast iron (that is, a compound consisting, principally, of iron and carbon, or of iron and a substance or substances replacing the carbon) which may be used like ordinary cast iron or otherwise. The details of the invention are too voluminous to be produced here.—Patent completed.

1462 J. SMITH. *Improvements in driving sewing machines and in apparatus employed therefor.* Dated May 17, 1867.

This invention consists in the application of the motive power of clockwork to drive the ordinary sewing machine, and in the arrangements for carrying the same into effect. To drive the ordinary sewing machine the inventor applies thereto, in any suitable position, according to the construction of the machine, an arrangement of clockwork consisting of a frame containing an ordinary barrel furnished with a proper clock spring, with arbor, cog-wheel, ratchet, and click complete. This barrel is also furnished with a maintaining spring. The cog-wheel of the barrel drives a pinion, the arbor of which is furnished with a large driving wheel, over which passes an endless band or belt communicating motion to the driving shaft of the sewing machine by means o a pulley fitted thereon. In lieu of a band or belt suitable gearing may be employed. On the arbor of the above-said pinion he fixes a bevil wheel which moves an endless screw furnished with a fan or fly, by which a regular motion is obtained, and which also serves for stopping the machine. The clockwork is wound up for action by means of a key applied on the barrel arbor, or by means of an arrangement of levers. Instead of one barrel two may be employed.—Patent abandoned.

1463 W. R. LAKE. *Improvements in water gauges for steam boilers.* (A communication.) Dated May 17, 1867.

This invention consists, chiefly, in constructing a water gauge with one or more sides or faces formed of transparent mica, which is secured in a metal frame or case provided with suitable means for attachment to a steam boiler.—Patent completed.

1464 W. R. LAKE. *Improvements in the manufacture of white lead.* (A communication.) Dated May 17, 1867.

Sulphate of lead and carbonate of baryta, in the proportion of 100 parts by weight of carbonate of baryta to every 152 parts of sulphate of lead, are placed in a vessel, to which is added water, the mixture being stirred until it is all reduced to a thin paste. After it has been well combined by thorough stirring, the said mixture is heated for three or four hours to a temperature of about 160 deg. Fah., though this temperature may be considerably reduced, or may be raised to nearly the boiling point without materially affecting the result. The stirring is continued during this part of the process. This treatment will cause the following interchange of elements to take place, namely, the sulphuric acid of the sulphate of lead combined with the baryta forming sulphate of baryta, and thus liberating carbonic acid, which unites with the lead, forming carbonate of lead. This is then dried in the ordinary way.—Patent completed,

1465 W. R. LAKE. *An improved mode of producing chloride or oxy-chloride of lead, and treating the same for manufacturing white lead.* (A communication.) Dated May 17, 1867.

This invention consists, first, in the treatment of oxide of lead with the chloride of sodium, or its equivalent, substantially as described, for producing a superior chloride or oxy-chloride of lead. Second, in the production of a chloro-sulphate or white lead from a chloride or oxy-chloride of lead for the purpose, substantially as described. Third, in the production of a carbonate of lead from a chloride or oxy-chloride of lead for the purpose, substantially as described.—Patent completed.

1466 G. BERNHARDT. *Improvements in or applicable to throstle and doubling frames and machines of like character for spinning, twisting, and doubling fibrous materials.* Dated May 17, 1867.

This invention consists, first, in the use in that description of machines mentioned in the title of bobbins with bevilled ends, instead of the square-ended bobbins hitherto used, by which there is less breakage of yarn in unwinding the thread, and the "ends" are more readily found when broken. Second, the invention relates to a modification of the ordinary traverse or copping motion for distributing the thread upon the bobbins, so that the extent of traverse will gradually increase as the bobbins fill with thread to suit the taper or bevilled ends of the bobbins used according to the first part of this invention. —Patent completed.

1467 S. REGAN. *Improvements in marine and land boilers and their furnaces, and also other furnaces used for the manufacture of iron and other purposes.* Dated May 17, 1867.

One part of this invention has reference to an improved arrangement of steam boilers, whether for marine or land purposes, and consists of three vertical cylinders placed concentrically, at suitable distances apart, dependent upon the size of the boiler required. The inner cylinder (which forms part of the water space) is egg-ended, its lower extremity being connected to a "blow-off" pipe which passes through the fire-grate into the ashpit. This inner cylinder is connected by means of tubes placed at suitable intervals around its circumference, and in an angular position with the middle or intermediate cylinder, and is thus connected with the water space between such intermediate and outer cylinder. The lower part of the intermediate cylinder bulges outwards, and thus forms the area for the fire-grates, which are placed within the bottom. The patentee also connects the upper portion of the inner cylinder above the water level by means of tubes with the intermediate cylinder for the escape of steam, which may be discharged into the main or outer steam chamber. The upper ends of both the intermediate and outer cylinders are of egg-end formation, having a chimney passing through them which communicates with the space between the inner and intermediate cylinders. The heat from the fire passes up this space into the chimney, enveloping the tubes on its passage, as well as acting upon the surfaces of the intermediate and inner cylinders, thus rapidly generating steam, the tubes (which are of conical or parallel formation, the ends being flanged for riveting, or they may be caulked or drifted in the usual manner) acting as an efficient stay between the two cylinders. The chimney he builds up from the top of the intermediate cylinder, and passes it through the outer one, securing the same by angle iron in the usual way. Upon the top of the outer cylinder he also places a dome or steam chamber which surrounds the chimney. From the bottom of the inner cylinder depends a blow-off pipe passing through the centre of the furnace. Two or more pipes opposite to each other, and connected to the water space of the bottom of the boiler, also communicate with the blow-off pipe, aiding it in such operation; and when the blow-off cock is turned off, they aid each other in causing free circulation. Ordinary boiler fittings are of course used. The fire-bars may be rotary, and fed from a hopper, or they may be stationary.—Patent completed.

1468 E. WEBB. *Improvements in looms for weaving hair cloth and other analogous fabrics.* Dated May 17, 1867.

This invention is not described apart from the drawings. —Patent completed.

1469 A. V. NEWTON. *Improved apparatus for lowering detaching, and picking up ships' boats.* (A communication.) Dated May 17, 1867.

For the purpose of overcoming the dangers incident to the raising, lowering, and casting off of ships' boats, and to render the access to and from a boat safe, the first part of this invention consists in so constructing the davits, and so applying them to a vessel or ship, that they shall have a swinging motion towards and from the water, and at the same time admit of being turned around like cranes when they are in an upright position, so that a boat can be swung inward over the vessel. The second part of the invention consists in providing for raising and lowering a boat, and swinging the davits by means of ropes applied to drums upon a shaft, which is provided with a friction brake and hand wheel, and otherwise constructed and arranged in such manner that a single person can conveniently and safely effect the swinging of the davits, and the lowering and raising of a boat. The third part of the invention consists in combining springs or weights with vertically swinging davits in such manner that the tendency of the latter shall always be to assume an upright position when unrestrained by the weight of the boat, so that when a boat which is launched, but moored to the davits, rises upon a wave, the davits shall also rise, and thus prevent collision and injury to passengers in the boat. The fourth part of the invention consists in providing for a safe communication for persons between a boat which has been lowered into the water and the vessel by the application of ladders and hand rails to the vertically swinging davits. The fifth part of the invention relates to the employment of certain mechanical devices in conjunction with vertically swinging boats-davits for allowing of the raising and lowering of a boat upon an even or level keel, for preventing fouling of the ropes, for facilitating the attachment of a boat to and its detachment from the davits, or hoisting and lowering ropes, and also for preventing severe and injurious jars and concussions of the apparatus in manipulating it in a storm, or during very rough seas.—Patent completed.

1470 C. E. FROEMAN. *Improvements in reckoning, counting, or calculating apparatus.* (A communication.) Dated May 17, 1867.

This invention cannot be described apart from the drawings.—Patent abandoned.

1471 J. L. CLARK. *Improvements in apparatus for communicating between the passengers, guards, and engine drivers of a railway train.* Dated May 17, 1867.

This invention consists in the application of a pneumatic tube running the whole length of the train, with suitable means for making connection between the carriages and break vans when coupled together, so as to form a train. A pump or bellows is fixed on the engine, and upon or beneath every guard's van, which is kept in constant action by the motion of the train, and continually exhausts the air from this pipe, all the bellows acting on the pipes simultaneously under ordinary circumstances; the pipe being closed, no air can be ejected by the bellows, and no effect will be produced in the guard's van, or engine; but if an opening be intentionally made into any part of the pipe by the passengers or guards, or by the accidental

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separation of the train into two parts, the air will be freely admitted into the pipe, and all the bellows will come into action, and will begin to eject air violently. Thus, air is ejected through a powerful whistle, or other sounding apparatus, and by the noise it occasions, it immediately attracts the attention of all the guards in the train, and also that of the engine driver. Flexible tubes of vulcanized india-rubber, with spigot and faucet joints, are employed for making the connections between the carriages.—Patent completed.

1472 T. RICHARDSON. *Improvements in the extraction of oils from vegetable substances.* Dated May 18, 1867.

This invention relates to the extraction or separation of oils contained in vegetable substances, such for example as cotton seed, linseed, rape seed, and the cakes made from these or other oil-producing seeds, and consists in impregnating or mixing such seeds, either in their natural state, or when crushed, with a solvent of such oils as may be therein contained, and which solvent shall have a lower boiling point, and be more volatile than the oil to be extracted.—Patent abandoned.

1473 J. SLOAN. *Improvements in the construction of ships' water-closets.* Dated May 18, 1867.

The object of this invention is to provide a ship's water-closet of simple construction, which shall not be liable to get out of working order, shall allow the soil to flow freely away, and shall entirely prevent that back passage and splashing of water which takes place in closets as at present arranged, and is the cause of much discomfort, especially in ships of "light draught" of water. For these purposes the inventor employs the part hereinafter mentioned arranged as follows:—He takes an ordinary pan, and leads the soil pipe connected thereto in a curved or bent manner into a vessel of cylindrical or other shape placed alongside the pan. To the bottom of the said vessel which opens to the sea he fits a flap, or hinged, or other valve. The said valve is connected by a rod and links, or a chain to a weighted lever, coupled to a hand-pull or lift, placed adjacent to the seat. The weighted lever holds the valve up to its seating. To flush the closet the weighted lever is raised or moved by force applied to the hand-pull or lift, and when this is done, the weight of the soil on the valve causes it to open outwards. Should the ship roll or pitch at this time, or should she be struck by a sea, the valve being free, will close against its seating, and prevent back passage and splashing.—Patent abandoned.

1474 J. T. BLAND and E. J. BLAND. *More effectually regulating the supply of water or other fluids to cisterns or other receptacles, and for economizing the trouble and expense connected therewith by means of an apparatus to be called "Bland's improved ball-cock.* Dated May 18, 1867.

This invention cannot be described apart from the drawings.—Patent completed.

1475 C. P. BUTTON. *Improvements in hernia trusses, abdominal supporters, and surgical bands.* (A communication.) Dated May 18, 1867.

This invention has for its object improvements in hernia trusses, abdominal supporters, and surgical bands, by which an upward and inward pressure may be given to the pad, and the tension of the body spring, and the position of the pressure pad, may be regulated and adjusted at pleasure. These improvements consist, first, in the combination of a shoulder and adjustable bearing with a jointed body spring. Second, a rotating slide or arm to which the pressure pad is attached, fitted to a tubular socket, and secured in its place when adjusted by a set screw. Third, in the construction of a separate pad spring, and its combination with the pressure pad and body spring. Fourth, a cut or slit at the end of the rotating arm or slide, in which the end of the pad spring is placed, and may be turned, and is secured or clamped when adjusted by a set screw.—Patent abandoned.

1476 B. SHEIL. *Improved paving for roads and ways.* Dated May 18, 1867.

This invention consists in cementing together small stones into slabs, iron or wooden frames or moulds being employed for the purpose.—Patent abandoned.

1477 A. H. BRANDON. *Improvements in machinery for washing wool, the said improvements being also applicable to other purposes.* (A communication.) Dated May 18, 1867.

This invention relates to the endless apron or feeding mechanism which the patentee constructs of a series of horizontal and parallel rollers, revolving in the same direction in such a manner that the wool or other material charged upon the same is conducted towards the compressing rollers, the speed of these feeding rollers being alike as regards their revolutions in a given time, but, in order that the wool or other material should not accumulate unduly at different parts, he gives to them a gradually increasing circumferential speed by making each successive roller of a larger diameter as they approach the compressing cylinders.—Patent completed.

1478 H. A. DUFRENE. *An apparatus for transferring heat from one current of gas to another.* (A communication.) Dated May 18, 1867.

The objects of this invention are to collect the caloric contained in a current of hot gases for the purpose of heating a current of cold gases (and, in practice also, for heating cold gases or cooling hot gases), and to obtain this double action in a continuous manner; and the invention consists in the construction of apparatus by which these objects may be effected. This object may be obtained by means of a receiver containing metallic gauze or plates forming large absorbent and repelling surfaces, and through each part of which the two currents successively pass in opposite directions. When the hot current passes through, the metal surfaces are heated by contact with the gases, which are thereby gradually cooled, and which at their outlet are relatively cold. The cold current acting inversely will cool such metal surfaces, the caloric of which will heat the cold gases, which at their egress will be relatively hot, so that the caloric abstracted from the hot will be transferred to the cold gases. The apparatus may be constructed in various ways.—Patent abandoned.

1479 C. W. DIXON. *Improvements in slide-valves.* Dated May 18, 1867.

Consists of a rotating slide valve. The exhaust port may or may not be cast in one piece with the cylinder, as is usual in ordinary engines. The exhaust port is brought to the surface of a circular plane or convex face along with the steam ports, but is placed in the centre, and made of a circular form. The two steam ports are placed on opposite sides of it, leaving space for a rib of metal between them. The two steam ports are made of the following shape, but their size is to be regulated by the ordinary rules for finding the areas of steam and exhaust ports, and also having their outer and inner sides arcs of two concentric circles, and their ends parts of radius lines from the same centre. The valve is to have a circular face of the same size, and to cover the face on which the steam and exhaust ports are placed, and is to have two openings in it bounded by the same arcs as the steam ports are, but the other dimensions are to be regulated by the engineer, so as to give whatever cut-off of steam or exhaust he thinks proper. One of these two orifices opens direct into the steam chest through the back of the valve, but the other opening is connected by a covered passage on the back of the valve with the exhaust port in the centre, so that when the steam is entering at one port, it is exhausting at the other. The back of the valve is made cylindrical, and brought through a stuffing box at the back of the steam chest, and made of the same diameter as the exhaust port: or if liked smaller, or if expansion is used in the cylinder, it would be an advantage to be made larger. The valve may be worked by eccentrics from the crank shaft, or direct from the piston rod by a small connecting rod turned backwards, or in any other way at the option of the engineer.—Patent abandoned.

1480 J. SMITH and J. L. IRBOTSON. *Improvements in raising and lowering revolving shutters.* Dated May 18, 1867.

This invention consists in the use of a crank handle, whereby motion is given to toothed wheels, causing a drum or pulley to revolve. Round the said drum or pulley, and over a similar one at the top of the window, is drawn tightly a steel belt or band. The top pulley or drum is attached to a roller on which the shutter is coiled when wound up. A pawl works in the teeth of the toothed wheels, by which means the shutter can be stopped at any point. The said pawl is fitted with a handle, by pulling which the toothed wheels are released, and the weight of the shutters causes them to descend. To ease the dead drag on the rollers, and to cause the shutters to coil up more smoothly, a small friction roller is so fitted behind the shutter that it will pass over it on to the main roller. Instead of a friction roller, two loose pulleys may be employed, one at each end, which will serve the same purpose.—Patent abandoned.

1481 J. WHITE. *An improved binder for sewing machines.* Dated May 18, 1867.

This improved binder (which can be used for all kinds of sewing machines) consists of a curved plate of brass or other metal, having its edges turned over, and is tapered to a narrow part which curves near to the needle. The binding slips through between the slit formed by the curved edges, and the cloth or fabric passes between the curved parts. It rests flat on the plate of the sewing machine, and has an extended portion furnished with a slot, whereby it may be clamped by means of a screw or other means in any required position on the plate of the machine.—Patent abandoned.

1482 E. O. HALLETT and W. T. HALLETT. *An improved book-rest.* Dated May 18, 1867.

This book-rest consists of a small piece of wood or metal so curved or shaped as to fit across the knee comfortably. To this is attached a small tubular pedestal, which contains a spiral spring at its lower end, and receives a rod capable of being raised or lowered upon the spring. The top of the rod carries a small shelf, on which a book or paper can rest. The height of the shelf is regulated by raising or lowering the rod in the tube, and securing it by a set screw, while the spiral spring compensates for the oscillation when used in a railway carriage, or under other circumstances. The whole article is composed of several pieces, so as to render it portable, which may be screwed together when required.—Patent abandoned.

1483 G. HAYNES. *An improved apparatus for cleaning or brushing boots and shoes.* Dated May 18, 1867.

This apparatus consists of a frame of wood carrying a small crank shaft worked by a treadle, and communicating by cords and pulleys a revolving motion to a spindle on which are placed circular brushes, secured in blocks so that they may be removed if required, and also permit the operator to apply any part of a boot or shoe to the brush. Three brushes, forming a set, or more if required, may be placed on the same spindle at a small distance apart, so that the whole operation may be completed without removing the brushes, or causing any inconvenience.—Patent abandoned.

1484 W. E. GEDGE. *A novel system of cartridge for le fauchoux and other guns.* (A communication.) Dated May 18, 1867.

This invention is not described apart from the drawings.—Patent abandoned.

1485 J. L. NORTON. *Improvements in drying malt, and also tanners and distillers' grains and spent hops.* Dated May 18, 1867.

In performing this invention, the patentee passes the materials into a casing, by preference of a cylindrical form, and placed horizontally; a current of heated air is caused, usually by means of a fan or steam jet, to pass through the casing from end to end, and the casing is caused to revolve. The material is fed in at one end of the casing, and is discharged at the other, the material traversing the casing in the opposite direction to the current of heated air. The continuous motion of the material through the casing is produced by a number of shelves in the interior of the casing, which, as the casing revolves, raise the material from the bottom of the casing, and, when it gets nearly to the top, allows it to fall back, and, in falling, it comes against inclined directing plates mounted on an axis passing through the casing. The inclination of the directing plates is made adjustable to allow of the due regulation of the time during which the material is subjected to the drying operation.—Patent completed.

1486 J. L. NORTON. *Improvement in machinery for washing and drying wool and other materials.* Dated May 18, 1867.

The first part of these improvements relates to machines in which the wool is agitated and moved forward in the washing liquid by revolving inclined blades or screw propellers. Instead of making the blades of these propellers all inclined in one and the same direction, and making them all revolve in one direction, the patentee makes them as follows:—He uses a number of separate propellers placed on one common axis, and he makes the blade of every alternate propeller inclined in the reverse direction to the others, so that the blade of the first, third, and fifth propellers will be set in one direction, and the blades of the second, fourth, and sixth in the other direction, and all those the blades of which are inclined in one direction are made to revolve in such direction as to cause a tendency of a forward motion of the water in the trough. The other propellers are caused to revolve in the reverse direction to these, but as they also have their blades inclined in the reverse direction, they also cause a tendency to a forward movement in the water. The propellers may be revolved in various manners. The next part of the invention also relates to the agitating and moving forward of the material in the washing trough, and consists in arranging a number of forks or rakes to work in the trough, and suitably connecting these forks with mechanism so arranged that they shall have a swinging or rocking motion, and at the same time be moved forward in the trough until they shall have arrived at the end of the forward stroke, when they are lifted up partially or entirely out of the water during the return stroke, and as they arrive at the end of the backward stroke, they are again let down into the water, and the swinging action imparted to them as they again move forward. For lifting the wool out of the water after it has been washed, the patentee uses a fork, to which motion is imparted by a crank to which the fork is jointed; the fork is also connected to levers or instruments which govern its inclination, so that the fork shall be gradually inclined more and more towards a horizontal line as it moves forward, and, in going back, it is lifted by the crank out of the water. The invention comprises various other arrangements which we cannot produce here.—Patent completed.

1487 T. METCALF. *Improvements in burning all hydro-carbon oils, such as creosote, petroleum, paraffin oil, shale oil, gas tar, and other similar products capable of being used as fuel.* Dated May 20, 1867.

This invention consists in improved arrangements and apparatus for converting hydrocarbon oils and similar matters into gas before they are consumed, which arrangements and apparatus are applicable to stationary, marine, and locomotive boilers, retorts, stills, warming pans, and all purposes where heat is required. The patentee constructs a gas box of metal, or other material, of any suitable length, and transverse shape or section, according to the demand for heat, or the purpose to which the heat is to be applied. To the top of the gas box, near its front end, he attaches a feed pipe communicating with the reservoir containing the hydrocarbon, the pipe being provided with a tap for regulating the supply, or shutting the supply off. He also attaches to the top of the gas box a safety pipe with a tap or valve for preventing the danger of explosion, and at the opposite or back end of the box he drills small holes. The gas box is fitted into the front of the flue of the boiler, or other vessels, and the front end of the gas box is heated by ignited fuel in a small stove or grate, and when the tap of the feed pipe is opened, the hydrocarbon, after entering the gas box, is immediately converted into a large volume of gas, which rushes through the small holes into the flue, and then being ignited, gives out an immense body of flame with an intense heat, their being neither smoke nor smell when the supply is properly regulated. He prefers to employ a separate cover at the front of the gas box fixed by bolts or screws, and to have in the cover as many stuffing boxes as there are small holes at the back of the gas box, for holding rods in the pointed ends for cleaning the small holes, and closing them when required. There are modifications included.—Patent completed.

1488 J. BOTTOMLEY. *Improvements in looms for weaving.* Dated May 20, 1867.

The patentee claims, firstly, the use of horizontal weft forks or prongs in conjunction with revolving grates, in either single or double box looms, essentially in the manner shown and described. Secondly, the mode of keeping separate the various threads in box looms by having tables or traps open temporarily between the boxes and the shuttle board, whilst the boxes are being revolved or turned, as shown and described.—Patent completed.

1489 T. MCCOMAS. *Improvements in raising sunken vessels.* (A communication.) Dated May 20, 1867.

This invention has reference to facilitating the raising of sunken ships and vessels in deep or shallow waters by employing for the above purpose the generation and expansion of hydrogen or aeriform gases within any suitable apparatus, by the agency of which the said ships or vessels are raised.—Patent completed.

1490 H. A. DUFRENE. *Improvements in beer and other like engines.* (A communication.) Dated May 20, 1867.

This apparatus consists of three receivers, one for containing air compressed by any suitable means, the two others being wood or metal cylinders containing the beer or other liquid, one emptying while the other fills; each of these cylinders has a piston without a rod floating on the surface of the beer. Two pipes furnished with taps are adapted to the bottoms of the cylinders, and extend to the part at which the beer is to be delivered. The tops of the cylinders are put in communication with the receiver of compressed air by two other pipes also provided with taps. Thus, when a cylinder is full of beer, communication is opened between the receiver of compressed air, and the delivery pipe, the air being compressed causes the beer to rise in the delivery pipe, and the piston lowering with the liquid, keeps it from contact with the air. The apparatus being empty, fills alone. A barrel full of beer is placed at the top of the apparatus, the two communications above named are closed, and the barrel and the lower part of the cylinder put in communication; the beer then passes into the cylinders and raises the piston. The air escapes through a valve placed at the upper part, and which the piston closes, when, the cylinder being full, it comes near to the cover. The valve in closing prevents the air from escaping, and the flow ceases of itself.—Patent completed.

1491 A. M. CLARK. *An improved instrument for sharpening cutlery.* (A communication.) Dated May 20, 1867.

This invention is not described apart from the drawings.—Patent completed.

1492 C. D. ABEL. *A new or improved machine or apparatus for filling sacks with grain, flour, bran, sugar, and other granular or pulverous substances.* (A communication.) Dated May 20, 1867.

This invention has for its object to fill sacks easily and quickly with grain, flour, and other granular or pulverized substances, and more particularly bran, by the aid of one attendant only. For this purpose a hopper for containing the grain, or other substances, is mounted upon a framing, over the mouth of which hopper is fixed the sack to be filled, it being held firmly in that position by means of a strap. Inside the mouth of the hopper is a piston or ram, the upper end of which is connected by means of a rod to a lever, the fulcrum of which is carried by an arm fixed to the framing, while the free end thereof is provided with a handle, whereby the attendant imparts to it, and consequently, also to the piston or ram an up and down motion. To facilitate such motion the lever has a tail piece provided with a balance weight, and the free

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end thereof works between guides fixed to the framing. The piston or ram, the diameter of which is somewhat less than that of the sack, is caused by its weight and the reciprocating motion imparted to it to press the grain or other substance firmly into the sack.—Patent abandoned

1493 E. H. C. MONCKTON. *Improvements in preserving meat, fruit, and vegetables.* Dated May 20, 1867.

This invention consists in placing the articles to be preserved in cases hermetically sealed, into which either is poured, the orifice on the expulsion of the air by its vapour being immediately sealed up.—Patent abandoned.

1494 H. CHAMBERLAIN. *Improvements in steam boiler and other furnaces.* Dated May 20, 1867.

This invention relates to an improved mode of applying and economizing the heat of steam boiler and other furnaces, and consists in storing a large proportion of the heat which has hitherto been lost or wasted by being carried by the draught up the chimney before it has had time to become absorbed by the boiler-plates or other surface to be heated. According to this invention, as applied to marine and Cornish boilers, for example, the patentee proposes to pack or fill in the flue behind the furnace or fire-bridge with open brick-work of fire brick, fire tiles, or fire clay lumps, made either solid or hollow, the interstices being so displaced as to sift the current of hot air without stopping the draught. By this means the heat which is not immediately taken up by the boiler plates is stored in, or collected by the fire bricks, whence it radiates off to the boiler. These fire bricks soon attain a very elevated temperature throughout the entire portion or length of the flue on which they are placed, and impart a more uniform degree of heat throughout the length of such flue. An additional supply of air may, with this arrangement, be admitted to the fuel above the grate, and hence a more perfect combustion is obtained, and the prevention of smoke effected, with a corresponding economy of fuel.—Patent completed.

1495 J. G. TONGUE. *Improvements in the arrangement and construction of furnaces for steam boilers and various other useful purposes.* (A communication.) Dated May 20, 1867.

This invention is not described apart from the drawings. —Patent completed.

1496 E. BOND. *Improvements in the building or construction of ships' sail yards.* Dated May 20, 1867.

In performing this invention the inventor takes one or more flat longitudinal plates of steel of any given depth, and suspends the breadth thereof in a vertical position in order to take the strain of the sail and leech ropes thereof; to this longitudinal plate or plates erected in its edge, he secures in a suitable manner four or other suitable number of angular troughs or other sectional shaped plates of steel in a horizontal position, in order to take the strain of the yard braces and "clues" of the upper sail, and to give greater support to the vertical plates. By way of rendering the structure more firm and rigid, he bolts iron braces thereto, in order to secure the one horizontal plate or plates to another vertical plate or plates. To the horizontal plate of steel which stands out before the yard, he secures the jack stay of the yard by strong iron bolts, and the yard is suspended to the mast much in the ordinary manner of sail yards. By these means he secures facilities in sail furling, as instead of the sail being furled upon the yard, it is laid upon and made fast to the sides or centre thereof, thus being more secure from the force of the wind, and requiring a smaller amount of canvas when set.—Patent abandoned.

1497 V. BARFORD. *Improvements in boilers for boiling or steaming roots, and for heating water for other purposes.* Dated May 20, 1867.

The boiler for containing the water to be heated the patentees make of an upright cylinder closed at the bottom, and supported on suitable legs or wheels. The top of the cylinder is either closed over with a movable lid, or a "steamer" with a perforated bottom may be placed above it, when it is desired to employ the boiler for steaming roots. Projecting out from one side of the upright cylinder, and forming one vessel with it, is a cylinder or tube of other form, which is of smaller diameter than the first-named cylinder which is to contain the greater portion of the water to be heated. Passing up vertically through the centre of the smaller tube is again a still smaller tube forming a fire-box, so that an annular space is left around this tubular fire-box, and into this annular space water flows from the interior of the larger cylinder, so that the tube forming the fire-box is surrounded with water.—Patent completed.

1498 E. YOUNG. *Improvements in treating iron ores to remove phosphorus therefrom.* Dated May 20, 1867.

For this purpose the patentee roasts the iron ore in a gas furnace, by preference that known as Siemens' regenerative gas furnace. He employs in the gas producer or producers a fuel rich in sulphur, or he mixes sulphur, or substances containing sulphur with the fuel. The gas from the producer or producers is led into a chamber or furnace containing the wet, damp, or moist ore to be treated, and is there burnt in contact with the ore, by the admission of a quantity of ore insufficient to produce complete combustion, so that the ore may be submitted to the action of bisulphide of carbon, or other sulphur compounds. Under these circumstances, sulphur is found to replace the phosphorus in the ore. In order afterwards to separate the sulphur from the ore, the ore is submitted to a further roasting process in the presence of an excess of air, either in the same or other furnace or chamber. —Patent completed.

1499 W. M. CRANSTON. *Improvements in reaping and mowing machines.* (A communication.) Dated May 20, 1867.

This invention has for its object to improve the cutting apparatus of reaping and mowing machines, to enable them to cut closer to the ground, and also to cut the crop below the horizontal bar which carries the fingers and knife of the cutting apparatus, in order that at the top of the uncut stubble shall not come in contact with the underside of the bar, or not to such an extent as heretofore, and thus friction is avoided. For this purpose the fingers are bolted at intervals to the underside of the horizontal bar, whilst on the upper side of this bar is carried the bar to which the knives are attached, as is usual; but in place of the knives being parallel with the finger bar, as heretofore, the patentee causes them to incline downwards at an angle, so that their points shall become below and cut the crop on the underside of this bar; the slots in the points of the fingers, through which the knife works, are similarly shaped downwards.—Patent completed.

1500 D. THOMSON. *Improvements in steam rollers for rolling roads, and in pitch chains for working the same, and for other purposes.* Dated May 20, 1867.

In constructing rollers for rolling roads to be propelled by steam power, the patentee forms the roller in two halves lengthwise, the two halves being on the same axle, but driven separately by the steam power, in such a way that either half can be detached and move loosely on that axle, while the other is driven by the engine, and thus the turning of the machine on the road is made easier. He steers, turns, or guides the machine by two wheels, which work in separate frames, turning on perpendicular axes, but which are so connected by levers or screw wheels that the two wheels always revolve in parallel planes, and the steerage of the machine is effected by causing the said frames to turn to any required degree on their perpendicular axes. He forms the framing of wad rollers propelled by steam power of a box formed of wrought-iron plates and angle irons, completely enclosing the roller except on the underside, where it rests on the ground, so as to attain the greatest stiffness and rigidity in the framing, and the box is prolonged at each side to embrace the boiler, steam machinery, and the steering apparatus in the same rigid framework. He forms the rollers of wrought-iron plates and angle irons riveted together so as to make a complete and rigid roller, and he then adds plates of iron to the external circumference, and secures them by bolts, so as to be easily renewable when worn by contact with the road. In making the pitch chains that have been generally used for working road rollers and traction engines, he forms the said chains of cast iron, malleable cast iron, or other cast metal, by having each alternate link cast with an opening in the side to admit the next link which is cast whole or close all round, and he closes the said opening by a piece of metal inserted therein, and secured by one or more bolts or rivets. Pitch chains made in this way are equally applicable to chain pumps, grain hoists, or other machines which are worked with pitch chains passing over toothed wheels.—Patent completed.

1501 J. OWENS. *Improvements in the manufacture of pile and other fabrics.* Dated May 21, 1867.

This invention is applicable to those pile fabrics in which the pile is produced by floating the weft threads over the warp threads, and then cutting the weft threads, and it consists in an improved mode of weaving by which the whole of the pile weft appears on the face, and the back is a plain fabric.—Patent abandoned.

1502 J. DAVIES. *Improvements in machinery for folding sheets of paper or other fabric or material.* Dated May 21, 1867.

This invention is not described apart from the drawings. —Patent completed.

1503 E. H. C. MONCKTON. *Improvements in the construction of a steam vessel suitable for ferrying laden trains across the ocean complete, together with its landing places, breakwaters, and modes of protection from marine insects and fouling, which improvements are also generally applicable to other vessels, and to the protection of iron and wood exposed to the action of the sea water.* Dated May 21, 1867.

The specification of this invention is too voluminous (it consists of forty pages) to be quoted here at sufficient length for an intelligible abstract.—Patent abandoned.

1504 J. GOUGH. *Improvements in arming presses for producing devices on the covers of books and other articles.* Dated May 21, 1867.

This invention consists, first, in improvements in the gauges employed for the correct adjustment of the book cover or other article to be impressed underneath the die plate. To these gauges the patentee attaches springs, which rise above the level of their upper surface, and serve to prevent the edge of the book cover or other article from being pushed over the gauge, but which are flattened down on the gauge by the die plate when the impression is being given. The second improvement relates to the mechanism employed to force down the die plate on the substance to be impressed, the table which supports the said substance being a fixture above the heater box (to the underside of which the die plate is attached), and underneath the head frame of the machine a shaft is mounted in suitable bearings free to revolve therein; to this shaft a continuous rotary motion is imparted by suitable gearing. He forms an eccentric on this shaft, and supports the shaft immediately on each side of it by extra bearings formed in the head frame of the machine. This eccentric is made to bear against the circumference of a friction roller mounted in suitable bearings on the upper side of the said heater box; as the shaft revolves, the eccentric depresses the box together with the die plate. Balance weights are employed to raise the box again. When it is thought desirable to give two impressions for one revolution of the said shaft, he substitutes a double-acting cam for the eccentric, which cam, as the shaft revolves, serves to depress the said box and die plate once for each half turn of the shaft. When it is thought desirable to make the said heater box together with the die plate a fixture, and to force up the table against the die plate, he places the above described shaft, and the mechanism connected with it, underneath the table, which is then made free to rise and fall.—Patent completed.

1505 M. RUNKEL. *A new indicator for carriages.* Dated May 21, 1867.

The inventor claims, first, the application of the two instruments described—viz., the instrument (No. 1), which measures and marks the time by turning a dial, and the application of the moving hand provided with a pen or tracing needle, or any other equivalent, to mark on the dial; and the instrument (No. 2) which measures the distance by receiving its motion by the eccentric near the centre of the drawing wheel, and which transfers the mark of the distance to the dial of the time keeper, for the purpose and in the manner described. Second, the two instruments co-operating in connection with the outside signal and with the lever to be operated by the driver as described.—Patent completed.

1506 G. HURDMAN. *Improvements in charcoal box-irons.* Dated May 21, 1867.

This invention consists in making the lids or covers slide upon the bodies of the irons for the purpose of gaining access to the interior of the irons, or for closing the open tops thereof.—Patent completed.

1507 W. NICHOLS, J. BURNLEY, T. WILSON, and G. JACKSON. *Improvements in machinery for breaking or cutting flax, hemp, jute, and other fibrous materials.* Dated May 21, 1867.

The patentee claims the arrangements of machinery described for breaking or cutting flax, hemp, jute, or other fibrous materials in which the feeding and delivery of the material to and from the breaking wheels is rendered self-acting, thus increasing their production, reducing the amount of labour required, and rendering them safer to the persons employed in attending the same.—Patent completed.

1508 S. HOLT and G. HOLT. *Improvements in pickers and in the method of manufacture and apparatus employed therein.* Dated May 21, 1867.

This invention consists in using wire staples instead of the cramp wires now used in the manufacture of pickers, and which the inventors insert at the front and clench at the back part of the picker; and instead of boring the holes they stamp or press them. By this method there are no wire clenching at the front of the picker, as heretofore, which have been objectionable on account of the shuttle coming in contact therewith when the picker has become worn by the action of the shuttle tip.—Patent abandoned.

1509 C. H. SHURNHAM. *Improvements in the construction and application of certain mechanical arrangements to be adapted as a self-acting and ink supplying writing apparatus or fountain pen.* Dated May 21, 1867.

This invention consists of a combination of certain mechanical arrangements or parts to be adapted to the exterior of a hollow tube of a cylindrical, hexagonal, or other form, and which parts are capable of being taken to pieces and cleaned by any intelligent person, forming when put together again a self-acting and ink-supplying writing apparatus or fountain pen, furnishing a supply of ink greater or less according to the size of the tube. The invention is entirely free from any internal or external incumbrances, such as springs, plugs, pistons, syringes, valves, and other such obstructions to the free flowing of the writing fluid.—Patent completed.

1510 S. H. FOSTER and T. BUNNEY. *Improvements in means or apparatus for the manufacture of looped fabrics.* Dated May 21, 1867.

The object of this invention is to facilitate narrowing or widening of parts of looped fabrics during manufacture. For this purpose the hooks or needles employed are held together by screw or other pressures, and are capable of being independently removed or introduced at the parts desired, so that where narrowing is required the loops last formed in the needles or hooks to be removed may be lifted on to the adjoining hooks or needles, and when the holding pressure is relieved from the hooks or needles, those hooks or needles from which the loop or loops has or have been removed are withdrawn. The needles or hooks for the time withdrawn are placed at the end of the series of them, and then by screw or other pressure the whole are forced close together. To effect widening, the needles in use are at the part where the widening is to be effected, separated to the extent desired, and a hook or needle, or hooks or needles, are introduced, and so, until the desired widening is effected.—Patent completed.

1511 W. F. HENSON. *An improvement in rails for railways.* Dated May 21, 1867.

According to one arrangement the patentee forms double-headed rails for railways in a piece, with lateral or longitudinal webs or flanges, which may be plane, double bevilled, or corrugated. To secure rails made in this manner to the sleepers, he lays them in sleepers with longitudinal grooves, and passes bolts through the flanges into the sleepers; the rails can be turned by removing the bolts. According to another arrangement he forms flanges or webs to the rails by riveting on each side of the web of the rail pieces of [-iron, and then securing them in the sleepers as before described.—Patent completed.

1512 J. STENHOUSE and J. DUNCAN. *Improvements in the treatment of animal charcoal and in the apparatus employed therein.* Dated May 21, 1867.

This invention has for its object the cleansing of animal charcoal which has been used to decolorize syrups, &c., with the view to its re-use. The patentees take a quantity of this used charcoal, and wash it well with boiling water, and then introduce it into a suitable tank or cistern containing hot water slightly acidulated with nitric acid. When the charcoal and acid solution have been digested from half an hour to one hour, which is best effected by blowing steam into the mixture, the saline solution, consisting chiefly of nitrate of lime, is removed, and the charcoal repeatedly washed with either hot or cold water until all soluble impurities are removed. When dry it is ready to be re-burned and is again fit for use.—Patent completed.

1513 A. BARCLAY. *Improvements in apparatus for injecting and ejecting liquids and fluids.* Dated May 21, 1867.

This invention more especially consists in the construction of metallic packing applicable to the above-named apparatus, which may be employed to render steam-tight the moving or sliding joints in instruments of that class. Under one modification the packing consists of a metallic ring which is soldered or otherwise fixed to the tubular part; this ring is of a conical form, and several long narrow slits or openings are cut into it by a saw or otherwise. A second ring of corresponding shape is also soldered or otherwise fixed to the tubular part close to the first ring, the inner surface of the second ring being made to exactly correspond to the outer surface of the cut ring. This second ring is made by preference of thin brass, and its outer diameter is made slightly larger than the interior chamber of the outer part of the instrument, so that on being placed therein the rings are slightly compressed, and the outer ring is thus held against the inner side of the cylinder casing of the instrument to an extent sufficient to render the joint very effective and steam-tight, the inner ring acting as a spring forcing against the outer one. —Patent completed.

1514 A. V. NEWTON. *An improved central fire metallic cartridge, and apparatus for manufacturing the same.* (A communication.) Dated May 21, 1867.

This invention relates to a new and improved method of forming the shells or cases of metallic cartridges, and the invention consists in forming a chamber in the centre of the inner side of the cartridge head, in which the fulminate is securely fastened, and in the manner in which the fulminate is secured, and also in the tools or dies and punches by which the cartridge head is thus formed, and the fulminate secured. The invention is not described apart from the drawings.—Patent completed.

1515 O. WASSERMANN and J. H. HERBST. *A new method of refining the pig-lead scraped by means of rendline zinc, which is founded by the application for chemical apparatus.* Dated May 21, 1867.

This invention relates to the refining of lead which has been desilvered by means of zinc, in order to extract the zinc, and also the iron, antimony, or other metal which is

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contained in the lead, and consists in submitting the red hot desilvered lead containing zinc, iron, and antimony to the action and effects of chloride of lead, which combines with the zinc and iron, whilst the lead of the chloride of lead is combined with the lead to be refined.—Patent abandoned.

1516 J. MABSON. *Improvements in sewing machines.* Dated May 21, 1867.

This invention is not described in detail apart from the drawings.—Patent completed.

1517 D. ADAMSON. *Improvements in furnaces for heating the air stoves of blast furnaces, and for other purposes, and in utilizing the products of combustion from such stoves.* Dated May 22, 1867.

This invention consists in certain improved furnaces for heating the air stoves of blast furnaces for steam boilers, and for other purposes. These furnaces consist of diagonal grate bars placed in a fire brick or other chamber, or partly in the chamber, or partly in the stove or boiler to be heated, or entirely on the stove or boiler, and of a hopper to supply the fuel, and a swing frame or falling grid to discharge the clinkers. The invention also consists in utilizing the products of combustion from the air stoves of blast furnaces by drawing or forcing them through a series of flues or drying stoves, kilns, or ovens to evaporate moi sture from ironstone and other minerals, and for heating and drying purposes.—Patent completed.

1518 J. COLLINS and J. SMETHURST. *Improvements in machinery for dressing hides.* Dated May 22, 1867.

This invention relates to the dressing of hides of leather and is designed, principally, to facilitate the operations of "staking," "shaving," and "buffing," and is as follows:—At or about the centre of the machine an upright frame is fitted to slide in standards, or in the framing of the machine, and to the upper part of the said frame a suitably formed knife is attached over which the hide is to be drawn. The edges of the hide are temporarily fixed by means of jaws, or otherwise, to the upper part of two rocking levers, one of which is situated on each side of the knife, the lower ends of the levers being jointed to the opposite ends of a lever which may be situated under the bed of the machine, and which also has a rocking motion on a bearing at or near its centre to allow the side levers to rise and fall. The said vertical side levers are connected to one another at a point between their fulcrums and the points of attachment to the hide by means of rods or bars sliding one upon another, or by other suitable means, to admit of the upper ends of the vertical levers being separated less or more to suit the varying widths of the hides.—Patent abandoned.

1519 J. CARTLAND and H. BOLD. *Improvements in ornamenting certain kinds of bowls of castors for furniture.* Dated May 22, 1867.

This invention relates to castors made of china or earthenware, and consists in ornamenting them by giving to them a lustrous or metallic appearance, the lustre either being white and resembling silver, or having a yellow tint and resembling gold.—Patent completed.

1520 J. HARGREAVES and T. ROBINSON. *Improvements in the manufacture of steel and soft iron from cast iron.* Dated May 22, 1867.

This invention consists in the use of any of the salts which yield oxygen on the application of heat, such as the nitrates, chlorates, bromates, manganates and stannates mixed or in combination with any of the oxides of iron or manganese, or any other suitable powdery or granular substance, as agents to act on fused or molten cast iron, to burn out therefrom at any desired speed the excess of carbon in and at the same time to remove other impurities from the said cast iron, and thereby convert it at one operation into steel or soft iron.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated September 25, 1867.

2706 J. Kirk and J. Kirk, jun., The Park Side, Lenton, Nottinghamshire, lace manufacturers. Improvements in the manufacture or production of lace or weavings made on bobbin net or twist lace machines.

Dated October 24, 1867.

2999 E. M. Palliser, Newcastle-upon-Tyne. Improvements in magazines or reservoirs for containing explosive compounds or liquids, and gunpowder.

Dated November 13, 1867.

3215 U. P. Wurlein, Rue Christophe, Berne, Switzerland. Improvements in instruments for joining blind cords and other cords.

Dated November 27, 1867.

3359 E. Belknap, Mortimer-street, Cavendish-square. Improvements in the treatment of the solution of malt for brewing.

Dated December 6, 1867.

3471 S. Goldstein, Manchester, merchant. Improvements in various portions of ladies' and gentlemen's wearing apparel.

Dated December 9, 1867.

3495 E. Keirby, Rochdale, Lancashire, india-rubber merchant. Improvements in elastic packings for the pistons of steam engines and for other purposes, and in the machinery employed in the manufacture of such packings.

Dated December 13, 1867.

3545 G. Marson, Eagley, Bolton, Lancashire. Certain improvements in the method of and means for retaining the outer ends of tapes, ribbons, and other similar narrow fabrics and paper.

3547 W. Mellwraith and J. Bonner, Glasgow, Lanarkshire. Improvements in apparatus to be applied to looms for weaving.

3549 A. Bullough, Blackburn, Lancashire, cotton manufacturer. Improvements in looms for weaving.

3551 T. Pedardy, 22, Greville-street, Hatton-garden, surgical bandage and instrument maker. Improvements in surgical appendages, to consist of a corset and abdominal supporter combined, also to serve as a truss in cases of umbilical and ventral hernia.

Dated December 14, 1867.

3555 F. Berry, Calderdale Ironworks, Sowerby Bridge, engineer and tool-maker. A self-acting metal breaker.

3557 J. Sharples, shuttle-maker, and J. Schofield, cabinet-maker, Blackburn, Lancashire. Improvements in shuttles employed in weaving, and in bobbins used therewith.

3559 J. Hargreaves, Appleton-within-Widnes, Lancashire, analytical chemist. Improvements in the manufacture of soda and potassa.

3561 J. H. Kidd, Bangor Iscoyd, Flintshire. Improvements in brattice cloth and its manufacture.

3563 E. H. Bentall, Heybridge, Maldon, Essex, agricultural implement manufacturer. Improved apparatus for controlling the draught of water from constant supply pipes.

3565 O. Hollingworth, 69, Pilgrim-street, Newcastle-on-Tyne, civil engineer. Improvements in feeding furnaces for prevention of smoke and economizing fuel.

3567 E. and A. Tatham, Nottinghamshire, manufacturers. Improvements in the manufacture of sinkers for hosiery and other machines.

3569 L. A. W. Lund, Chandos-street, St. Martin's. Improvements in studs, stud-buttons, and solitaires.

Dated December 16, 1867.

3571 J., J., and J. Booth, Rodley, Leeds, engineers and millwrights. Improvements in means or apparatus for effecting the cutting or dressing of stone.

3572. J. E. A. Gwynne, Essex-street, Strand, engineer. Improvements in sinking tubes or cylinders for obtaining and raising water, and in the apparatus for effecting the same.

3573 W. Huskisson, jun., 76, Swinton-street, Gray's Inn-road, manufacturing chemist. Improvements in the manufacture of soda and other aerated waters, and in the manufacture of aerated bread.

3575 J. M. Shackleton, Accrington, Lancashire, cotton manufacturer. Improvements in the manufacture of umbrellas.

3577 W. H. Kerr, Clontarf, Dublin, china merchant. Improvements in the preparation of material to be used in the manufacture of porcelain and pottery.

3581 W. Huskisson, jun., 76, Swinton-street, Gray's Inn-road, manufacturing chemist. Improvements in the manufacture of bicarbonate of potash and soda.

Dated December 17, 1867.

3583 T. V. Macintosh, Port Glasgow. Improvements in machines for making drains or trenches.

3585 W. Simons and A. Carmichael, Renfrewshire. Improvements in moulding, and in the machinery or apparatus employed therefor.

3587 E. M. Du Boys, government engineer, Paris. Improvements in liquid meters or apparatus for measuring and registering the volume of water or other liquid flowing under pressure through pipes or ducts.

3589 F. L. and C. L. Hancock, Dudley, Worcestershire. Improvements in and connected with propellers, and in arrangements for propelling vessels.

3591 W. E. Newton, Chancery-lane, civil engineer. An improved method of and apparatus for the manufacture of tinned leaden pipes. (A communication.)

Dated December 18, 1867.

3595 J. Patterson, Hull, Yorkshire, engineer. Improvements in capstans.

3599 J. Hall, Barrhead, Renfrewshire. Improvements in furnace grates and casings. (A communication.)

3603. O. A. Hebert, New Millman-street, watch-maker. Improvements in musical boxes.

Dated December 21, 1867.

3628 E. Lord, Todmorden, Yorkshire, machine-maker. An improvod mode of reducing the friction of revolving and sliding surfaces.

3632 J. Hadley, City Flour Mills, Upper Thames-street. Improved apparatus for cleaning grain or seeds, and reducing the same to meal or flour.

3634 W. Hurst, Hamer Hall, Rochdale, Lancashire, cotton spinner, and J. H. Wilson, Cornholme Mill, Todmorden, Lancashire, bobbin manufacturer. Improvements in or applicable to flyer, throstle, and doubling frames and machines of like character.

3636 E. and A. Ludlow, manufacturers, Birmingham. Improvements in machinery for the manufacture of cartridge cases.

3638 I. Pick, 5, Falcon-square, City. Improvements in the construction of bags, portmanteaus, and other similar articles.

Dated December 23, 1867.

3640 J. Rowe, Wrexham, Denbighshire, civil engineer. Improvements in the construction of miners' safety lamps.

3642 C. W. Lancaster, New Bond-street, gun-maker. Improvements in the construction of cannon and other firearms.

3644 R. Crawshaw, Colne, Lancashire, shuttle peg-maker. Improvements in shuttles for looms for weaving.

3646 H. F. Bengough, Clifton, Gloucestershire. Improvements in tobacco pipes.

3648 S. Salter, Stroud, Gloucestershire. Improvements in the construction of rotary engines.

3650 W. H. Chase, jun., Brixton-hill, manufacturer. Improvements in the construction of couplings for driving belts.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated December 31, 1867.

3712 J. Novikow, Briansk, Orel, Russia. An improved apparatus for drawing and spinning hemp, flax, and other fibrous materials for making ropes and cables.

LIST OF SEALED PATENTS.

Sealed December 24, 1867.

1870 J. Gabbott
1871 W. Bullough
1884 W. Marshall
1886 C. O. Heyl
1892 C. Brown
1896 J. Holroyd and W. Fieldhouse
1897 C. O. Heyl
1898 P. Zaroubine
1899 P. Smith
1902 A. Hodge
1904 S., R., and W. Trulock
1905 W. H. Richardson
1906 A. Stewart
1910 C. Petit
1918 F. T. Pollard
1951 E. M. Brown
1959 F. Brady
1972 H. C. Carver
1974 W. C. Church
2007 W. Avery
2030 A. H. Brandon
2119 J. Sexty
2194 D. Hodge and R. C. Witty
2231 J. Birch
2435 A. H. Brandon

Sealed January 3, 1868.

1956 P. F. Tranchat
1968 E. O. Greening and S. Atkinson
2015 W. S. Andrews
2016 W. S. Andrews
2062 W. Drury
2091 T. W. Riddell-Webster
2133 H. Lea
2273 F. Ryland
2747 B. Dobson, and R. Halliwell

Sealed January 7, 1868.

1993 J. Johnson, E. Shinn, and G. Ragg
2000 M. P. W. Boulton
2001 N. Clayton and J. Shuttleworth
2018 J. E. Whiting
2019 J. S. Hood
2020 D. and J. Collinge
2021 H.B.Fox and J.T.Hall
2022 F. Holmes
2023 J. M. Paxman, and H. M. Davey
2033 J. S. Henderson and J. Macintosh
2034 J. H. Johnson
2035 J. H. Johnson
2046 J. Hargreaves
2049 G. Sinclair
2051 J. H. Johnson
2054 D. M. Henderson
2057 J. Laing
2058 E. B. Bigelow
2061 J. Walker
2066 H. Duke
2071 J. L. Norton
2184 T. Jones
3227 J. Combe

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," January 7, 1867.

2410 J. G. Marshall. Detergent processes.
2425 A. and E. Wigzell. Juckes' furnace.
2426 J. Phillips-Smith. Agricultural implements.
2431 W. R. Lake, Cartridges. (A communication.)
2435 W. C. Thurgar. Regulating the supply of gas.
2444 M. A. Soul. Fastening iron bands. (A communication.)
2450 W. Pedder. Brushes.
2461 J. Douglas. Ventilating and regulating the draft of close fire ranges.
2463 J. and G. W. Dyson and S. Martin. Cutting up iron and steel rails and rail ends.
2465 W. Muir. Starting, propelling, and stopping railway trains and ships.
2480 D. Nicoll. Electric telegraph conductors.
2486 H. Vallance. Window fastenings.
2493 P. F Lunde. Obtaining extracts from vegetables.
2496 E. T. Archer. Spring mattresses.
2522 F. Versmann. Manufacture of varnishes.
2537 D. Payn. Printing machinery.
2541 J. Whitham. Machinery for puddling.
2546 W. E. Gedge. Indigo colouring matter. (A communication.)
2549 F. Tolhausen. Disinfecting fecal and manuring matters. (A communication.)
2565 J. Whittome. Baling presses.
2575 J. Davies. Manufacture of salt.
2613 W. Brailsford and J. Gadsby. Manufacture of lace.
2640 W. W. Gibson. Decorticating and cleaning cereals.
2650 S. Dreyfous. Bread ovens. (A communication.)
2698 J. Musgrave. Stable fittings.
2749 T. Weston. Ornamental metallic tubes.
3003 G. J. Gunther. Plating ships of war.
3103 T. Wright and I. Fox. Plain and fancy weavings.
3322 S. Amphlet and J. B. Fenby. Ruling ornamental patterns.
3345 W. R. Lake. Fire arms. (A communication.)
3346 W. R. Lake. Electric telegraph apparatus. (A communication.)
3348 C. T. Higginbotham. Furnaces.
3384 J. Baylis. Chemical preparation for preparing mixed textile fabrics.
3469 P. G. L. G. Designolle and J. Casthelaz. Explosive and fulminating powders.
3490 J. Beatty. Candle dipping machine.
3500 W. R. Lake. Excavating machines.
3501 H. Bessemer. Firebricks, tiles, and other articles employed in building.
3526 J. R. Baillie. Caissons.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

19 E. Keirby
24 D. Vericchio
26 G. Kent
27 N. Thompson
34 J. Skelton
38 G. A. Buchholz
52 E. Tyer
65 J. Welsh
202 B. King
233 J. E. Massey
3244 E. Perce

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

53 W. Taylor
122 H. Sagar

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending January 4, 1867.

No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.	No.	Pr. s.	Pr. d.
1399	0	10	1487	0	10	1553	0	4	1583	0	4	1602	0	4	1614	1	4
1430	1	4	1488	0	8	1556	0	4	1586	0	4	1604	0	4	1615	0	4
1447	2	0	1489	0	8	1562	0	4	1587	0	4	1605	0	4	1617	0	4
1451	0	10	1494	0	10	1564	0	4	1588	0	4	1607	0	4	1618	0	4
1454	1	0	1495	1	0	1568	0	4	1591	0	4	1608	0	4	1619	0	4
1466	1	10	1497	0	8	1572	0	4	1592	0	4	1609	0	4	1627	0	4
1468	0	10	1520	0	8	1579	0	4	1593	0	4	1612	0	4	1628	0	2
1470	1	0	1532	1	4	1580	0	4	1601	0	4	1613	0	4	1631	0	2
1485	0	10	1535	1	2												

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JANUARY 17, 1868.

THE DISPOSAL OF SEWAGE.

LOCAL boards and provincial authorities have yet to solve the problem, involving, as the unknown quantity, the disposal of their sewage. Discharge it into the rivers they must not; utilize it they do not; get rid of it they must. The evil day may be put off for a time; in fact, procrastination is an essential adjunct to all corporate proceedings, except when they are characterized by an equally injurious rash and ill-judged celerity. It is not that they are puzzled to decide whether the scheme for utilization should be carried out upon the simple plan of gravitation, or whether their choice should rest upon that necessitating the more expensive accessories of engines and pumping stations. The place where the shoe pinches is "the place where they are to put it." Unless actuated by interested motives, no one, it will be at once conceded, would view with pleasurable feelings the irrigation of their fields with sewage matter. At the same time, upon the broad principle of the public welfare, which has been so scandalously abused by railway companies, private prejudices and individual antipathies must not weigh down the balance when the health of the community is placed in the descending scale. With the express purpose of obviating mere personal interests an Act was passed last session, somewhat similar to that governing the legislation of private bills, and authorizing the compulsory purchase of land that may be deemed the best adapted for carrying into execution a proposed scheme of utilization of sewage. So far, so good; but here, as will be presently seen, ends all similitude between the compulsory purchase of land for railway or other engineering purposes, and for the disposal of sewage. In the former instance, the claim to the land is made by one party, the opponents constituting the other. In the latter, the case bears a very different aspect, and it is easy to perceive how the best devised scheme might be rendered perfectly abortive if against the private interests of any influential local authority.

Although nothing, comparatively speaking, has been effected anywhere with respect to the real utilization of sewage, yet it is a problem that must be solved before long. True, that in the majority of instances, nothing short of a raging epidemic directs attention to any particular district, but as the population of the country increases, and sanitary measures continue to remain "in statu quo," the opportunities for observing what the results of a neglect of them inevitably tends to will become more frequent. The sewage of London is, at least, got rid of, although it is not yet utilized, and the Thames at last rolls its unpolluted waters through a granite-bound channel. What has been accomplished with respect to our principal river must be carried out with equal force with regard to its tributaries and our other national streams. Instead of discharging sewage matter into rivers by thousands of gallons, it has been decided that the proper disposal of it is to apply it in one of different ways to land, and the question at issue is where to procure the land requisite. We may assume as a rule liable to exceptions that until the population of a town reaches to 8,000 there is no absolute necessity for the execution of a regular scheme for the utilization of its sewage. Taking one acre of land as a minimum required for every 150 heads of the population, we should need 66 acres to utilize the sewage of a town containing 10,000 inhabitants. This, it will be perceived, is a very different matter to the contingencies attending the construction of a railway, which demands but a small strip of land throughout its general course, and only a slightly additional amount for the erection of its stations. A proprietor that would put up with the one would be inclined to wage war "a la outrance" with the other. Moreover, although at one time the locomotive was unjustly regarded in the light of an almost intolerable nuisance, yet it is now universally looked upon as the herald of peace and civilization. One feels, as it were, at home if, when visiting some out-of-the-way kind of place, the whistle of the engine can be heard, and the escaping steam seen in the distance. It is not too much to say that the irrigation of land by sewage may be justly termed a nuisance, not in a very grave degree, or by any means in an injurious sense, so far as health is concerned, but still, as we have before mentioned, no one except for interested motives would like to witness it meandering over his fields.

So soon as a town elects to place itself within the jurisdiction of the "Public Health Act," by virtue of the provisions in that Act, it proceeds to constitute from among the ratepayers a "local board," and vests in the members for the time being of that corporate body the authority in all matters connected with the arrangement of the drainage and the disposal of the sewage. These "local boards" retain in their constitution a strong element of Bumbledom, and are disposed to do everything in the cheapest manner possible, laying to their souls the flattering unction that they are bound to be as careful as possible of the money of the ratepayers, totally oblivious of the fact that these carefully-considered individuals are frequently mulcted to a large amount to make good the deficiencies and blunders of their representatives. Government has, in fact, only done the thing by halves. Once having recognized the necessity of abolishing the "ancien regime," and having set its face against the abominations of cesspools and the pollution of streams, it should have gone a step farther. It appears paradoxical to grant powers of compulsory purchase of land, in order that the best scheme for utilization of sewage might be carried out, and yet to leave it in the hands of local authorities to reject the best scheme, to carry out an inferior one, and to exercise the powers in a manner foreign to their original signification. Considering to what extent building operations are now everywhere progressing, and how enormously the bare possibility of such a contingency enhances the value of land, it is manifest that there is a fruitful source of litigation opened up in connection with the enforcement of compulsory powers. Nothing is easier than for a proprietor to allege, when his land is demanded for the disposal of sewage, that he has set it apart for building purposes, and it will probably require a jury to settle the amount that is to be paid to him. We are not aware, owing to the absence of all precedent in the matter, whether the law is the same with respect to sewage works as with those of a railway. In the latter case, the opponent is not permitted to show that the line might have been more advantageously laid out, so as not to affect his interests or to touch upon his property, but must oppose it "in situ," as it were, and deal with the injury as it stands. It remains to be seen whether, in the event of compulsory powers being exercised with regard to sewage works in behalf of an inferior scheme, it may not rest with the proprietor of the land to traverse the proceedings of the local authorities, and show proof that a more advantageous scheme might be projected, which would not entrench upon the property that had been scheduled. It is bad enough for a landed proprietor to be compelled to cede unnecessarily a portion of his territory to the caprices of a leviathan railway company, but the case becomes aggravated when instead of a few acres perhaps a hundred are seized upon for the disposal of so unpleasant a substance as sewage matter. A more satisfactory course of action would be for the surveyor to the Board, or whatever may be the constituted local authority, to prepare what he considers the best scheme, to submit it to the investigation of an officer of the Board of Trade, who, on approval of it, would order the proper steps to be taken to procure the land necessary, without the slightest regard whether that land was the property of a member of the Board or of any one else.

TELEGRAPHIC COMMUNICATION WITH ABYSSINIA.

WHATEVER difficulties we have on hand at home, there can be no doubt that the subject upon which at this moment the greatest interest is felt by the majority of Englishmen is the present state of affairs in Abyssinia; and the great want is to have from day to day intelligence without uncertainty or delay. It may justly be asked why we do not get this. We feel that the time has arrived when that agent, which has proved a most valuable auxiliary in war, as well as in peaceful and scientific pursuits, should be considered by those who have to calculate the expense of carrying on wars in foreign countries. Those who are responsible for the management of the war, which may now be at its height, in the comparatively unknown country of Abyssinia, ought at the present moment to be able to say, as Marshal Vaillant did, when asked for some particulars connected with the telegraph cable laid in the Black Sea during the Crimean war:—"I send my dispatch to the General, and I have an answer sooner than I should have if by letter from a town halfway from here (Paris) to Lyons, Bordeaux, or Strasburg. I have not yet recovered my amazement at this prodigy." The late Lord Lyons also, speaking on the same subject, gave it as his opinion, that the laying of the Black Sea telegraph lessened the duration of the war by two or three months, by affording a means of rapid communication with the Crimea.

With these facts on record, we are quite at a loss to understand why, when it was found absolutely necessary to go to war with Abyssinia, a submarine telegraph cable was not immediately ordered to be laid in the Red Sea from Suez to Aden, and thence to Bombay—bringing the Commander-in-Chief and forces in Abyssinia, and those in Bombay and Aden on one side, within twelve hours' communication with Suez, Alexandria, Malta, and London on the other. The importance of such a system must be thoroughly understood by everyone who regards the Abyssinian question with interest, and we feel that a grave responsibility rests upon those in authority, for not availing themselves of the opportunity of carrying out this desirable object; for it would not only have assisted materially in this present disastrous war, but it would have accomplished the long cherished idea of placing our Indian dependencies in direct communication with London by a telegraph cable, remaining a peaceful agent long after the Abyssinian war is forgotten.

We cannot think that the cost of such a line would for a moment be entertained as a bar to its adoption, and, therefore, we will at once dispense with that. There is an apparent cause for doubt and excuse, viz., that the scheme was tried about ten years ago, and then proved a decided failure. To those who at the present time put forth such a plea, all we can say is, that they have not followed the course of events since that time. It is true—to their credit be it spoken—the present Government did, at the time mentioned, make an attempt to establish direct communication between London and Calcutta, but the whole thing proved a failure, and why? Simply because necessary and proper precautions were not taken to ensure success. A private company made the same mistake about the same time, in their endeavour to complete telegraphic

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communication between this country and America; but, after praiseworthy perseverance they have at length overcome all difficulties, gained a glorious triumph, and are now receiving a well-deserved reward. What has been done in the Atlantic can as certainly be done in the Red Sea, and never was there a more fitting time for the work to be carried out. Previous to the laying of the Atlantic Telegraph Cable, there were those who were daily putting forth fabulous statements in order to frighten sanguine persons, and we do not doubt that at the present time there are many who use the same means to delay the carrying out of the line to India. But those who are thoroughly acquainted with the question—and, therefore more competent to give an opinion—are confident that there is no difficulty whatever, and that a direct line from London to Calcutta can be established and maintained with less difficulty than the present line from London to New York.

We believe an eminent firm has made very reasonable proposals for carrying out this much-desired work, and are ready to stake not only their well-earned reputation but also a large amount of capital on the result. It would be satisfactory to know that the Government was fully alive to the importance of such a line, and we hope soon to hear that they have arranged for the work to be carried out in such a way as will redound to their own credit and that of the nation.

PHOTOGRAPHY.

NEW BOOK ON PHOTOGRAPHIC OPTICS.—CEMENTING TRANSPARENCIES.

A NEW book on photographic optics, being a translation of the work by Dr. Van Monckhoven, has just been published by Mr. Hardwicke, of Piccadilly. Probably no branch of science exhibits so much poverty in standard works as photography, Hardwich's "Photographic Chemistry" standing almost alone in this field of research. The new optical book just mentioned, helps to fill up a very great blank, but does not do it in so complete a manner as desirable, for the original work was published two or three years ago, and new lenses of considerable photographic interest have been since introduced into the market, but are not noticed in this English translation. In issuing another edition, it will be more judicious to follow the subject down to the latest date. Nevertheless, it is pleasing to see, at last, a book devoted exclusively to photographic optics, for it is the first that has been printed in this country.

As it is known that collodion positives on glass, properly taken, and well varnished, are very permanent, some attention has of late been drawn to different methods of cementing a second sheet of glass over the picture by Canadian balsam. No reason is known why a picture thus embedded in resin between two plates of glass should not last for centuries; moreover, transparent positives on glass are the most delicate and beautiful pictures it is possible to produce by photography. Three methods of cementation are in vogue, but it is too early yet to speak of their comparative merits.

The first of these has been extensively practised by Mr. John Traill Taylor. He mixes any liquid hydrocarbon, preferably benzole, with Canadian balsam, till the latter is of about the consistency of castor oil. A few drops of this, free from air-bubbles, are allowed to fall upon the centre of the photograph, and then the second sheet of well-cleaned glass is gently let down on the lower picture. By pressure, the balsam is made to fill up the space between the two plates, and the superfluous liquid squeezes out at the edges, and falls upon a sheet of paper on which the lower glass is laid. The cemented picture is then placed for half an hour or more upon a warm iron plate, during which time it is subjected to pressure, which may be conveniently applied by means of a warm flat iron placed upon the upper sheet of glass. After being thus subjected to moderate heat under pressure, the two glasses will be found firmly cemented together, and the superfluous resin spread over the edges and faces of the glasses may be removed by rubbing with a little oil of turpentine.

Another method of cementing photographic transparencies is that practised by Mr. Warren De La Rue, F.R.S., to preserve the photographs of the moon, taken by the aid of his reflecting telescope at Cranford Observatory. The pictures are cemented by means of the force of capillary attraction. By his plan, a flat polished plate of brass, supported by four levelling screws below the corners, is heated by means of gas jets underneath. The plate is then fixed accurately in a horizontal position by means of the screws, aided by a spirit level. The collodion picture on glass is then laid face uppermost on the brass plate, and a second but smaller piece of clean glass is next laid face downwards over the picture. The upper plate touches the lower one at one of its edges only, because a piece of thin paper is pushed about 1-8th of an inch under the opposite edge. When this arrangement has been made, and both the plates are very warm, a few drops of clear Canadian balsam are allowed to fall on the lower plate, just where it is touched by the edge of the upper one. The balsam is at once further liquefied by the heat, and, by capillary attraction, begins slowly to travel between the two plates of glass, pushing the air away before it. In the course of ten minutes, if the plates are not very large, the balsam will have travelled over two-thirds the space between them; then the slip of paper can be removed, and in a very short time the whole space will be filled by the balsam. The two plates should then be left on the slab of brass for a little while to bake, that the heat may drive off some of the essential oils in the balsam. This process is slow, but very safe, because there is no danger of enclosing air bubbles, which are very unwelcome opponents of cementation manipulations.

A third method is that used by Mr. G. Wharton Simpson, and by many practical opticians. The essential oils in pure Canadian balsam are driven off by the long application of moderate heat, not much above that of boiling water. Balsam thus treated will solidify on cooling, but when wanted for use should be again liquefied by warming. To cement the picture, a flat sheet of thin iron, standing horizontally upon four legs, is heated underneath by little jets of gas. The picture is laid, collodion side uppermost, on the hot iron plate, and a few drops of the balsam are then allowed to fall upon the centre of the glass. The second piece of glass, previously warmed, is then placed on the lower one, and the balsam pressed out, as in the first process, till it fills all the space between the glasses, which are next allowed to cool. When cold, they will be found firmly cemented together, and a neat way of finishing off the picture is to send it to a glass-cutter, to grind down the edges, till the whole resembles a single sheet of glass with a picture embedded in its centre.

The shadows of photographic transparencies contain much more silver than the shadows of positives upon albumenized paper. Added to this fact, a good transparency may be taken without the film in any way coming in contact with its old enemy "sulphur." When, in addition, a picture of this kind is thoroughly sheltered from atmospheric influences by cementation between two plates of glass, there are strong reasons for confidence in the durability of such photographs. Yet, no pictures of this kind are on sale in London. Those stereoscopic transparencies on glass, sold by our leading photographers and opticians, will be found, on dissection by a penknife, to consist of two plates of glass, not cemented together in optical contact, but simply held together by means of paper pasted round the edges. Nevertheless, most of these are very permanent, more especially those which were taken without the application of any chemical containing sulphur, and which were well washed and dried before varnishing.

ON SOME RECENT IMPROVEMENTS IN ANALYTICAL CHEMISTRY.

1. A METHOD OF QUALITATIVE ANALYSIS WITHOUT THE USE OF SULPHURETTED HYDROGEN OR SULPHIDE OF AMMONIUM.

THE pursuit of analytical chemistry can never be a drawing-room amusement; but one of the greatest obstacles to its study in an ordinary dwelling-house has been removed by Zettnow, who has devised a scheme of examination for bases without the use of the offensive reagents named in our heading. We propose to give a short account of the author's plan, which, it will be seen, is applicable to the analysis of solutions containing all the most frequently occurring bases.

The first step is the usual one of adding hydrochloric acid to the solution. A precipitate on this addition will be either chloride of lead or silver or subchloride of mercury, which may be separated in the way directed in all books on analysis. Zetnow's next step is to add sulphuric acid to the filtrate, by which lead, strontia, and baryta are thrown down as sulphates with the lime, in part, if present. The mixed precipitate when washed with water will give up the sulphate of lime; sulphate of lead may be removed by a solution of tartrate of ammonia. Sulphates of strontia and baryta may remain. These will be found difficult to separate, and the experimenter, unless a practised analyst, must content himself with identifying the bases by their blow-pipe reactions.

About a quarter of the liquid separated from the sulphates is now precipitated with excess of baryta water and boiled; ammonia, if present, will be evolved, and may be recognized by the usual tests. The excess of baryta must afterwards be precipitated by carbonate of ammonia, the solution filtered, the filtrate evaporated to dryness, and the residue calcined. In this residue potash or soda may be found.

Another portion of this solution must be set aside for the examination for zinc, as described hereafter.

The remainder of the liquor separated from the sulphates (having, of course, an excess of sulphuric acid) is placed in a flask furnished with a drawn-out tube, and treated with metallic zinc. Arsenic and antimony will be detected in the hydrogen evolved; and, at the same time, tin, antimony, mercury, copper, cadmium, and bismuth will be thrown down by the zinc in the metallic state. This precipitation is facilitated by placing a strip of platinum with the zinc in the solution.

The metallic precipitate so obtained in the flask is treated with nitric acid, in which all but the tin and antimony will dissolve. These will remain in the form of stannic and antimonic acids, easy to recognize and separate by their respective reactions.

A portion of the nitric acid solution is specially examined for mercury with chloride of tin. The remainder is boiled with caustic soda; the precipitate so obtained is washed with ammonia and chloride of ammonium. Bismuth will be left undissolved in the form of hydrated oxide; cadmium and copper will be found in the ammoniacal solution. The latter will be recognized by the blue colour of the solution and the precipitate with yellow prussiate of potash; the former will be precipitated as white hydrated oxide by an excess of caustic soda.

The solution from which zinc precipitated the other metals is now oxidized by boiling with a few drops of nitric acid, and a portion of the solution is tested for iron with sulpho-

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cyanide of potassium. Another portion is neutralized with ammonia and shaken up with a little carbonate of baryta. Hydrated oxides of chromium and alumina are thus precipitated. The precipitate is boiled with caustic soda, permanganate of potash being added to further oxidize the chromium. Chromic acid and alumina will be found in the filtrate.*

The solution separated from the carbonate of baryta, together with the excess of baryta, may still contain manganese, lime, nickel, cobalt, and magnesia. It is first treated with sulphuric acid to eliminate the baryta; the filtrate is then treated with carbonate of ammonia, which will precipitate the manganese together with the lime. The filtered liquor may now contain magnesia, nickel, and cobalt. The first will be thrown down by the addition of phosphate of soda. The filtrate from the ammonio-magnesian phosphate is now evaporated to dryness, and the residue dissolved in hydrochloric acid. Cobalt is then sought for by nitrate of potash and acetic acid, and nickel by caustic soda after the cobalt, if present, has been separated.

Zinc is now the only common base which remains, and as this has been added to the solution in the course of the later operations, it must be sought for in a portion of the liquid set aside after the separation of the chloride and sulphates. The liquid is first boiled with caustic soda, then filtered, and the filtrate treated with carbonate of ammonia and chloride of ammonium, and boiled again until ammonia is no longer disengaged. Filter again, and test the filtrate for zinc with ferridcyanide of potassium.

The above is the systematic course of examination for bases proposed by Zettnow. It can hardly be considered perfect, but it possesses some features of interest, and may be commended to the notice of amateur chemists, and even to practical chemists, when sulphuretted hydrogen is not accessible.

2. A PROCESS FOR THE DETERMINATION OF PROTOXIDE OF IRON IN SILICATES NOT SOLUBLE IN ORDINARY ACIDS.

Professor J. P. Cooke has devised a method by which this determination can be effected with great accuracy. The novel feature in the process is the solution of the iron oxides by prolonged digestion of the silicate in sulphuric and hydrofluoric acids out of contact with the atmosphere. Ten or fifteen grains of the finely powdered mineral are mixed with some sulphuric acid (sp. gr. 1·5) and a little hydrofluoric acid in a platinum crucible, which is set on a copper water bath. This bath is provided, firstly, with a tube through which a supply of water can be kept up from a Marriotte's bottle, and so the water maintained at a constant level; secondly, with a tube to carry off waste water; and, thirdly, with another tube connected with a carbonic acid apparatus, by which a stream of this gas may be carried under an inverted glass funnel set on the cover of the bath. A groove is made in the cover to receive the rim of the funnel, and this groove being filled with water, an air-tight joint is made. A current of carbonic acid being started, the platinum crucible is set under the funnel and the gas lighted. As soon as the water boils the supply of carbonic acid may be stopped, since the atmosphere of steam will be sufficient to protect the iron solution from oxidation. In this manner the digestion may be continued until the decomposition of the mineral is complete. The current of carbonic acid must then be re-established and the contents of the crucible allowed to cool. The solution is now diluted with water to 500ccs., and the protoxide of iron is determined by a standard solution of permanganate of potash. This process may be applied to the assay of iron ores; and hydrofluoric acid may be usefully employed in a large number of analytical operations.

* If the liquid contains phosphoric or boracic acid, the author adds some perchloride of iron before precipitating with carbonate of baryta.

ELECTRICITY AND TELEGRAPHY.

THE Electric and International Telegraph Company have lately been trying some experiments with a small magneto-electric machine of Mr. Wilde, of Manchester. It is in construction similar to that which we have lately described. Twenty horse-shoe permanent magnets are attached to a "magnet cylinder," within which revolves an armature on Siemens' principle. At one end of the armature is a commutator for producing a uni-direction current, at the other end a small pulley driven by a strap from a larger pulley fixed on the shafting of the machinery used at Telegraph-street for the pneumatic apparatus. The induced electricity from the armature was applied to the working of several telegraphic circuits instead of the ordinary batteries. It has been tried for some days as an experiment, and then discontinued, we believe, from the result not having been quite as successful as was expected. The power obtained from it was sufficiently adequate for the work required, but the supply was not always regular and constant, probably due to the too great rapidity of the armature and the irregularity of the contacts of the commutator. With several alterations, we may fairly expect to see this machine become of some practical use.

The French Government have lately issued a series of telegraph stamps, their use dating from the first of the year. They are of the respective values of 25 and 50 centimes and 1 and 2 francs. Stamping despatches will enable the sender to leave his message or have it sent to the office as an ordinary letter, but in cases where the message is in a foreign language (other than French) it must be accompanied with a translation. No message can be forwarded in this manner when the charge is above ten francs; in that case the usual mode of payment over the counter must be adopted. We are glad to see that our neighbours have carried out a plan that has been received for so long a time with much favour in our country.

We lately noticed the working telegraphic circuits between Paris and Lyons on an automatic system. Experiments have been going on for some time at the Electric Telegraph Company's station, Telegraph-street, upon Professor Wheatstone's improved apparatus for sending messages automatically on the Morse system. His instruments have been used for working between London and Newcastle, and have been highly successful. The paper has to be prepared by punching holes in it; this paper passes through the transmitter, sending currents according to the position of the hole. The currents so sent act upon the polarized magnet of the receiving instrument, causing the armature to record upon ordinary paper by means of an ink marker the necessary Morse signals. The conventional signals are transmitted by an ordinary key and recorded upon the same receiving instrument. The speed can be varied at will, from about 40 words per minute upwards. As there are many points in this instrument of great interest and novelty, we simply allude to it briefly here, hoping shortly to place a full description of it before our readers.

We regret to announce that the large cable connecting Dunwich (Suffolk) and Zandvoort (Holland) has lately been broken. The fault is supposed to be about midsea. This is the first time this cable has been broken so far away from land. The Electric and International Company having their telegraph steamer always in readiness, we do not anticipate that there will be much delay.

In lately carrying out the repairs to one of the Submarine Company's cables off Cape Grinez, all the work that their engineer, Mr. France, had succeeded in doing was undone in a somewhat unusual manner. He had succeeded in buoying both ends, when a number of French mackerel boats cast their nets tideward of him. A strong tide flowing at the time soon brought them down upon his steamer, carrying away his buoys, and compelling him to weigh anchor and run for it. Now, this was done in broad daylight, and with a steamer carrying the usual Board of Trade signal for a telegraph steamer. Something should be done to make this signal more generally known, for with the number of submarine cables requiring now and then certain repairs, it is excessively annoying to find all one's work (particularly in the winter time) undone, and one compelled to postpone further work until the fishing was over.

We remember a previous case off Dover in the first repairs to the Calais cable, when the buoys were all swept away in a similar manner.

In confirmation of Gassiot's experiment, that electricity will not pass through a perfect vacuum, Messrs. Alvergniat have constructed a small apparatus which proves the same in an easy manner. M. Gassiot formed his vacuum by filling the tube with carbonic acid and gradually absorbing it by the agency of potash; they, however, produce a vacuum by means of their own mercury pneumatic machine. When by aid of this machine the vacuum is brought as high as possible in the tube, it is placed over a special lamp, and gradually heated until it is brought to a red heat. This is done slowly and gradually, so as to prevent any damage to the tube. The pneumatic machine is still applied, and the vacuum made more perfect. The vacuum in a tube so prepared is found so perfect that even with platinum wires placed at a distance of only ·078 inch from each other no discharge passes. These tubes, Messrs. Alvergniat claim, are prepared in an easier and more rapid manner than those on M. Gassiot's plan.

The electrical systems of communication between passengers and guards of trains are now being under a severe test, in order that they may be finally reported upon. The Exeter express fitted up with communication has now been running with success for several years, but to test it finally it has been determined to start the train entirely by means of this communication from all stopping stations, which will be done by the head guard in the hind van signalling on the bell fixed on the engine to the driver; special instructions are issued for the noting of any irregularity of the communication. The Midland Railway has had their Leeds express fitted up in a somewhat similar manner, but with a "look out" signal on the engine instead of a bell. This train is now running daily, and is regularly started by means of the communication. It is accompanied, we believe, by an extra guard, whose duty is to specially report upon the working of the communication. It has been running with the greatest success, and from an inspection of it we do not see why it should not continue to do so.

The Atlantic Company have issued a prospectus in order to obtain the necessary capital to buy back their cables from the Anglo-American Telegraph Company; they require for this purpose a sum of £1,300,000. Negotiations were set on foot for the amalgamation of the two companies: these, however, were unsuccessful; they look forward to a large business, "with a revival of trade a very large increase may be expected to take place in the receipts. The whole of the present business can be performed by a few hours' daily working of one cable only, thus leaving a very large margin of working capacity to meet the requirements of increasing trade."

Messrs. Siemens, who have for some time past been actively engaged in negotiating for permission to erect two wires through Europe and Persia to join on to the Government Indo-European, have already obtained concessions from the Prussian and Russian Governments, and we are glad to hear that intelligence has just been received that a satis-

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factory concession has been granted by the Persian authorities. We may, therefore, look forward to early and energetic measures for the carrying out of this most desirable project.

NOTICES OF BOOKS.

THE Society of Arts, it will be remembered, arranged for the visit of a body of skilled artizans to the Paris Exhibition last year. This highly commendable step has brought forth fruits which are not confined to the workmen themselves, nor to the Society of Arts, but which are capable of influencing in some degree the whole range of arts and manufactures. The Society, ever on the alert to promote the object for which it was formed—the encouragement of arts, manufactures, and commerce—made it a condition that each visitor should report to the Society what he observed during his stay in Paris, with reference to the special industry in which he was engaged. The result would be, of course, in the first place, to lead each workman to carefully investigate the details of his business, as seen at Paris, and to fix any new feature in his mind. In the next place, the manufacturing world would be informed of matters of special interest to itself by men from among its best workers. That is, of course, assuming that the Society of Arts published the reports. They have done so, and in the volume before us* we have a series of practical reports of the greatest value to art and manufacture. The work is divided into two general parts, the first of which comprises reports by artizans from London, Sheffield, Coventry, Bradford, &c., the second being devoted exclusively to the reports from Birmingham artizans. There are eighty-two reports on the various branches of trade and manufacture, from plastering to watch-making, and all the reporters deal with their subjects in a sensible and practical manner. There is much instruction, with occasional amusement, to be obtained from the reports, which are readably written, although they are for the most part by men who have never attempted such a thing before.

Besides the artificers' reports, there are two special reports by Mr. R. Coningsby and Mr. R. Whiteing, on the condition and habits of the French working classes, which are well worthy of perusal by all. Some of the artizans appear to have gone to France slightly impressed with the idea which has of late been gaining ground in some men's minds, that England was being surpassed in details of workmanship by continental nations. This illusion was decidedly dispelled by careful examination, which proved that although France may have improved upon herself in some details of manufacture in which we formerly took the lead, we have also made good progress in departments in which we once owned her superiority. Mr. Whiteing sums the matter up very properly in his report when he says:—"If France has made progress in the coarser arts—if she now manufactures machines which enter the English markets and compete advantageously with our own—we have made an advance not less marked in all those manufactures in which formerly the taste and skill of the art workmen of France gave them undisputed sway. For every French steam engine consigned to a foreign port, where once only English machinery was in demand, a hundred bales of textile fabrics from the English looms are now sent to cities which once only opened their gates to the productions of French skill; and English art manufacture, unheard of but a few years since, is beginning to be a power in the world." As a whole, the reports reflect the highest credit on a body of workmen, and we trust they will be read and well studied by their fellow workmen, to whom they will prove highly interesting and instructive. To enable them to do this, we would suggest a reprint of the reports, classified according to trade or manufacture, and sold separately to workmen only, at the lowest possible price. This would thoroughly enable the Society of Arts to carry out the important principle of advancing the arts and manufactures.

Our lonely traveller, Captain Macgreggor, has made a third vacation trip over deep and shallow waters in a "Rob Roy"—not the "Rob Roy" canoe of the previous trips, but a new vessel, a yawl. Captain Macgreggor has exchanged the paddle for the sail and helm, and in a capitally-arranged and judiciously-fitted sailing boat, made the water his home for a good portion of last summer. The incidents of this voyage form the subject of an interesting book* written and graphically illustrated in Captain Macgreggor's now well-known happy style. The new "Rob Roy" is a yawl-rig, double skinned and full decked; she has an iron keel and kelson, and is divided into four water-tight compartments. Her internal arrangements for cooking, reading, writing, provisions, stores, and cargo, are a perfect wonder in their way, and must have cost the Captain some close thinking. However, they proved very satisfactory, and enabled our author thoroughly to enjoy himself alone on the ocean. The earlier part of the voyage, along the dangerous coast of France, was, fortunately, performed in fine weather. The "Rob Roy" then sailed inland and visited Paris, after which she crossed the Channel to Cowes and attended the regattas. The Medway and the Thames were visited on the homeward route, the whole journey being performed by the author without any companion, but with evident enjoyment and satisfaction. Captain Macgreggor does not write for the mere sake of writing, but he has a practical aim and end; he shows how men possessed of a reasonable amount of nerve and energy may recruit health and strength in a most enjoyable manner. Hence, his narrative is instructive as well as interesting. Nor does he write for personal profit: he has a far higher and far more praiseworthy object in view. His profits are to be given in prizes to the "Chichester," the "Indefatigable," and the "Havannah" training ships for boys. May the profits be in proportion to the merits of our author's work, and those of his proposition; so shall the work of our training ships be promoted and our naval interests appreciably advanced.

The name of Thomas Telford is a watch-word among engineers; he stands out boldly in the early days of the profession, the founder of a race of men who look back with pride upon his works. There are few who have not learned something of this great man's life from Mr. Smiles' lives of the engineers, and there are few who would not be glad to learn more. This Mr. Smiles has enabled them to do in a revised and enlarged edition of Telford's life,† to which he has prefixed an interesting account of the early roads and modes of travelling in Britain. In the course of his life, Telford constructed highways in North Wales and in the Scotch Highlands through previously inaccessible districts. Mr. Smiles tells us, that while the construction of the Highland roads was in progress, the late Robert Southey, poet laureate, visited the Highlands in company of his friend, the engineer. The poet left on record an interesting account of his visit in a manuscript, now in the possession of Mr. Robert Rawlinson, C.E., and from which extracts are made in the volume before us. It needs no pen of ours to commend Mr. Smiles' works. He has taken his place as the biographer of engineers, and he continues to maintain his position with increasing interest, as regards his readers and the profession to which he has thus attached himself.

The sewage question had its share of discussion during the past year. Meetings were held, speeches were made, papers were read, and pamphlets were written, until the question seemed farther off its solution than ever. A leading man in the matter, and an authority, too, is Mr. Baldwin Latham, C.E., who has had considerable experience in the great work of dealing with sewage. This gentleman has lately penned a very useful pamphlet,* explanatory of what has been done for effecting the purity of our rivers, and the mode of applying sewage in a liquid form to land. Lithographed drawings of the Croydon irrigation fields are given, the plan here being to lead the sewage into open tanks, where the solid matters are strained from the liquid portion. The liquid is then conveyed, partly by covered and partly by open channels, to the irrigation land, which is laid out on the pane and gutter system. The results of irrigation here are really surprising, and testify to two things—the value of the sewage and the judicious method of its utilization. We have also received a lecture on the sewage difficulty (Spon) which was delivered by Mr. Latham at Maidenhead, before the local board of health, in reply to Mr. Pearce's paper. Our author makes out a satisfactory case for sewage irrigation, and throws a considerable amount of light upon the subject. All who may be in doubt or difficulty about their sewage should read this lecture, which will show them the way out of their troubles most clearly. Very closely allied to the subject of Mr. Latham's pamphlet is that of storage reservoirs, the designing and construction of which has been ably treated by Mr. Arthur Jacob, in a paper read before the Society of Engineers, and now published in a separate form (Spon). As the paper was given in our pages at the time of reading, we need not refer to it here further than to state that the Society awarded Mr. Jacob a premium for it, which circumstance indicates its practical value. It is accompanied by several sheets of lithographed drawings, and will be found useful to all who may be engaged on irrigation work.

The most important contribution lately made to meteorological science is undoubtedly Mr. Strachan's pamphlet on the principles of weather forecasts.† The author sets forth the principles upon which weather forecasts and storm warnings appear to have been based, and he certainly explains them in an original manner. He does this, too, more methodically and with greater exactness than has hitherto been attempted. Working upon data, scientifically and mathematically he arrives at principles in a legitimate way. Not content with assertions and vague references to facts, he makes facts speak for themselves. The author is evidently master of the whole question, and we regret he did not enter somewhat more into its many details, for which he has shown himself fully capable. He shows that the late Admiral Fitzroy acted on scientific principles, and that others besides himself were acquainted with them. The subject is of the greatest interest and importance at the present moment; its bearings are very wide, and stretch away far more widely still into the unseen future. There can be no doubt but that men are at present groping in the dark, and all who can throw a light upon the subject of storm warnings and weather forecasts will be doing science and his country good service. Mr. Strachan has begun to do this, and one who can say what he has, can say more; let him therefore take heart and proceed. As for the pamphlet before us, we heartily commend it to the notice of all who

* "Reports of Artizans on the Paris Exhibition, 1867." London: Society of Arts, and Bell and Daldy. 1867.

* "The Voyage Alone in the Yawl 'Rob Roy.'" By JOHN MACGREGGOR, M.A. London: Sampson Low and Marsden. 1867.

† "The Life of Thomas Telford, C.E." By SAMUEL SMILES, London: Murray, Albemarle-street. 1867.

* "The Purification and Utilization of Sewage." By BALDWIN LATHAM, C.E. London: E. and F. N. Spon, 48, Charing-cross.

† "Principles of Weather Forecasts and Storm Provisions." By R. STRACHAN, F.M.S. London: Williams and Strahan, 7, Lawrence-lane, Cheapside. 1868.

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are interested in the science of weather wisdom, which is deeper and more exact than many dream, and to which Mr. Strachan has done good service. and will, we hope, do yet more.

We are glad to renew our acquaintance with Mr. Symons, in a very useful little book on the subject of rain.* The author's labours in this department of meteorological science are well known and appreciated; he has now added another proof of his zeal in the cause by the production of a popular account of rainfall investigations. Rightly apprehending that there are many who would like to learn the interpretation and practical use of the records of rain, Mr. Symons explains the method and results of rainfall measurement in the most simple terms. Being thoroughly at home in his subject, he will be found to interest those who otherwise might be disposed to turn their backs upon the subject. He has succeeded admirably in embodying all the important facts connected with rainfall, illustrating the instruments used in its measurements, and giving ample instructions to those who desire to observe for themselves. Mr. Symons gives an interesting diagram showing the fluctuations in the fall of rain from the year 1726 to 1865, as well as tabular results of recent investigations. The utility of rainfall observations is so well recognized that we need not here insist on that point. Let those who admit and wish to promote this utility, obtain Mr. Symons' book, and the few simple utensils necessary, and let him then advance the interests of science by making his own observations, and forwarding the results to Mr. Symons.

No one can complain that there are no opportunities offered for the general pursuit of meteorological observations. And we are glad to see it, for it is a testimony to the value of this science which hitherto has not been much cared for, but which now appears to be increasing in the public estimation. In furtherance of this science, we have under the simple title of "A Companion to the Weather Glass,"† a useful little annual which teaches the practical use of the barometer. The book is designed to record numerically and graphically the natural phenomena presented by the barometer, thermometer, rain gauge, clouds, wind, &c. In short, it will be found a very useful "companion," to meteorological observers, and will render the weather-wise still wiser.

The engineering annuals are to hand. They present no new feature, but are as useful as ever. "The Engineers' Pocket-book for 1868" (Lockwood) has become a necessary book of reference to the engineer, the architect, and the contractor. It affords the usual amount of correct and reliable information upon the varied points of professional pratice. Side by side with this book, of coune, we always see "The Builders' and Contractors' Price Book" (Lockwood), which Mr. Burnell now so ably edits. To complete the trio, we have "The Engineers' and Contractors' Office Sheet Almanack" (Lockwood), which, in addition to the usual calendar, contains a number of formulæ and useful tables, which are seen at a glance, and when done with are folded up in a compact form within a cover. "The Railway and Commercial Almanack," edited by Mr. W. P. Smith (Simpkin), will be found very useful to bankers, mining men, insurance companies and others engaged in commercial pursuits. It contains some excellent articles on the various industrial productions, and a variety of information which will prove useful to the merchant, the manufacturer, and the general public, to whom we commend it.

*"Rain: How, When, Where, Why it is Measured." By G. J. SYMONS, F.M.S. London: Stanford, Charing-cross. 1867.

†"A Companion to the Weather Glass." By the REV. R. TYAS, M.A., F.M.S. Bedrose, Paternoster-row. 1868.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

A NEW ANILINE GREEN—ACTION OF WATER ON LEAD, AND ITS PREVENTION—RECOGNITION OF NITRATE OF SODA IN NITRATE OF POTASH MADE BY THE CONVERSION OF NITRATE OF SODA.

MANY attempts have been made to produce an aniline green dye, but they have been rewarded with but imperfect success. The blue colour which is produced when most aniline salts are treated with an oxidizing agent becomes green under the influence of an acid. A green colour is also developed by the action of chlorate of potash on a salt of aniline. This is Dr. Calvert's emeraldine. None of these greens, however, can be used as dyes. But a green dye has been patented by Keisser, of Lyons, which is applied to silk as easily as the red and blue aniline colours. It is a compound of picric acid with triethylrosaniline, the base of Hofmann's blue. The methyl, amyl, and phenyl compounds also lend themselves to the reaction, but the ethyl compound answers best. To prepare the base, Keisser dissolves one part of Hofmann's blue in three parts of alcohol of 90 per cent. strength, and adds one part of iodide of ethyl. This mixture he heats for half an hour in a close vessel, then adds one or two parts of caustic potash or soda, and heats again for three or four hours. The mass resulting is washed with boiling water, the washings being saved for the recovery of the iodine. A blackish doughy residue remains, which to prepare the picrate must be heated with 500 or 600 times its weight of water, in which it perfectly dissolves at 212deg. The solution must be filtered hot, and then a hot aqueous solution of picric acid is stirred in until the fluid acquires a distinct yellowish-green colour. It is now allowed to stand for twenty-four hours, when the picrate of triethylrosaniline will have been deposited. It has only to be separated by filtration or decantation and dried, and is then ready for commerce. For dyeing it has only to be dissolved in alcohol, the solution poured into the bath, proceeding exactly as with the other aniline dyes. The colour given is said to be a beautiful yellowish green.

Distilled water, as is well known, acts on lead and dissolves a small quantity of that metal. This is usually ascribed to the presence of air dissolved in the water, but Böttger states that it is due to the presence of carbonate of ammonia. Distilled water after active ebullition will not attack the lead until after a considerable exposure, when a reabsorption of ammonia and carbonic acid, which are always present in the air, may be supposed to have taken place. When water is examined for its action on lead, Böttger points out that pure lead must be used, for the presence of a small amount of tin will prevent any action from taking place. This fact suggests the employment of lead alloyed with a small amount of tin for water piping and cisterns.

Saltpetre, or nitrate of potash, is now made in large quantities by the double decomposition of chloride of potassium and nitrate of soda—Chili saltpetre, as it is called. In practice it is found extremely difficult to tell when the whole of the nitrate of soda has been converted into the potash salt, and manufacturers are apt to send out a saltpetre which is unfit for the manufacture of gunpowder. Most gunpowder makers, in fact, decline to use saltpetre made from nitrate of soda, although it has been said in a report on the subject to the Italian Government not to be objectionable. The presence of any nitrate of soda in a saltpetre is easily detected by its deliquescent property. Nitrate of potash remains dry in the air, but the presence of only one-fourth or one-eighth per cent. of nitrate of soda in saltpetre is shown by the fine powder becoming moist on exposure, and increasing in weight. Nöllner states that one washing will completely remove all nitrate of soda from such deliquesced saltpetre. He has determined, with no particular object, that we can see, the rate at which nitrate of soda attracts moisture:—One gramme exposed to the air in a cellar after 5 hours weighed 1·2grm.; after 24 hours, 1·5 grm.; after 48 hours, 1·87grm.; and after 72 hours, 2·387grms. The presence of nitrate of soda in a saltpetre is certainly shown by the deliquescent property communicated; and some idea of the amount can no doubt be gained from the weight of the water attracted; but Nöllner is careful to add that an accurate determination can only be made by estimating the amount of potash and nitric acid, and calculating the soda by difference as usual.

REMARKABLE PHENOMENON AT RANGOON.

BY DR. C. COLLINGWOOD, F.L.S.*

I ACCIDENTALLY heard mention by an eye-witness (a lady residing at Hong Kong) of a circumstance which struck me as so remarkable and interesting that I collected the particulars with care, allowing the narrator to tell her own story, and filling up important particulars by putting questions as little as possible calculated either to lead or mislead.

It was in the year 1846 that she was on board her husband's ship the "Manook" in the Rangoon River, and was walking up and down the poop, in company with the chief mate and a child four years old, the poop awning being at the time spread overhead. It was about half-past 7 in the evening, and then quite dark, when suddenly, without any warning, a tremendous sheet of light appeared to rush across the bows of the vessel in a horizontal direction. The light was not like lightning, but appeared to pass swiftly along, and had the aspect of a red thick flame, occupying the whole space left visible between the awning and the ship. The suddenness and terrific nature of the glare was such that she fell down upon the deck, believing, as she expresses it, that the world had come to an end, while the child screamed aloud with terror.

As this frightful luminous appearance rushed by the ship a considerable accession of heat was felt by both the adult persons, and a strong sulphurous smell also accompanied it, though how long this feature lasted cannot now be stated with any certainty. But the phenomenon was unaccompanied by any sound, and sped noiselessly on; nor could they see where it went or what finally became of it. The whole affair lasted but some seconds, the light having dashed past them with a speed only inferior to lightning. The captain of the ship, and Captain Brown, postmaster and only European resident at the time, were in the house of the latter, situated but a short distance from the shore and from the ship. They both averred that they felt a sudden and remarkable heat, although they saw no light; and when told of the circumstance afterwards, on comparing notes as to the time, they immediately exclaimed words to this effect, "Then that explains the sudden and unaccountable warmth we felt at that time." It is worthy of remark that my informant spontaneously stated that, as well as she could recollect from collateral circumstances, this must have occurred some time during the month of November.

The two gentlemen on shore are both dead; but the mate is believed to be still living. It was often a matter of wonder to them that an occurrence which to them appeared so extraordinary was never publicly noticed; but it seems they were the only Europeans who observed it, as I learn that, besides the natives of the place, the only other residents at that time were Armenians. The whole account which I have been able to gather of this phenomenon so closely agrees with the description given of that class of meteors known as silent fireballs or bolides, that I feel convinced that my informant must have witnessed one of these bodies in terrific proximity; and as I am not aware that any one has ever recorded such an experience, I have thought it worth while to draw up this *proces verbal*, to which my informant has attached her sanction. When at Dundee I was much struck by Mr. A. Herschel's concluding experiment, which represented a silent bolide, and considerably startled the audience by its noiseless flash across the back of the hall. The gliding light and the accompanying heat forcibly recalled to my recollection the particulars I had gleaned of the Rangoon phenomenon.

* "Philosophical Magazine."

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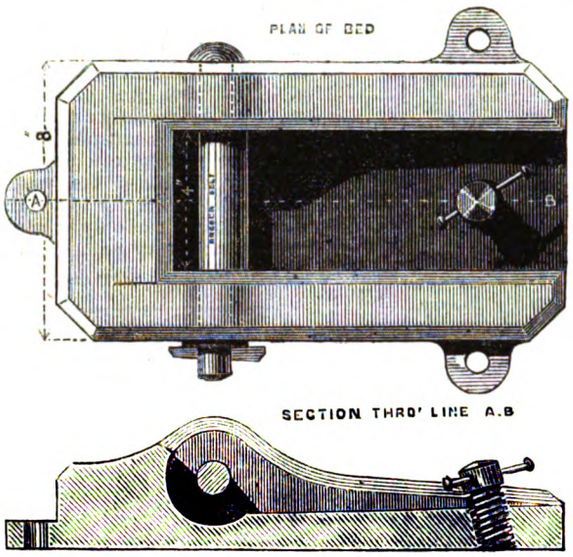
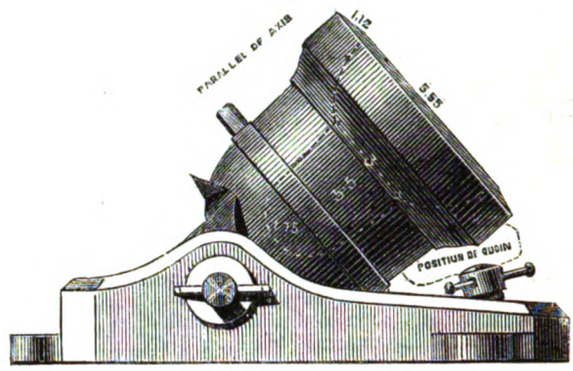
MORTARS FOR MOUNTAIN WARFARE.

By Captain G. R. Mann, R.E.





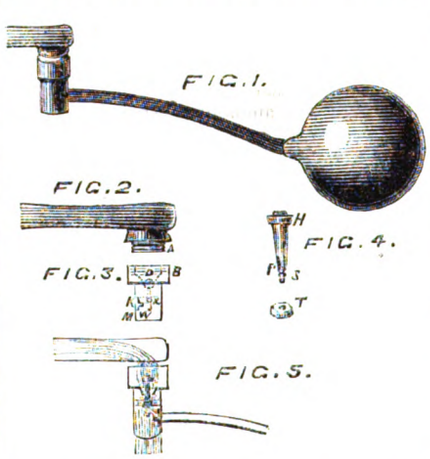
MOUNTAIN MORTARS.

AFTER all has been done to reduce the weight of mountain mortars to a minimum, it remains a fact that they are not portable in the highest degree, and it is not to be denied that in the endeavour to secure such portability as they possess much of their efficiency has been sacrificed. We believe that as a consequence of the existing prejudice against mortars a very valuable weapon has not been supplied to our Abyssinian troops, and, as none of the essentially military papers have called attention to the subject, we do so. About twenty-four years ago we carried on a war against certain of the aboriginal New Zealand tribes, and a very troublesome, and, in its way, expensive little war it proved to be. At that time we had no rifled mountain guns, but we had little howitzers, intended to answer much the same purpose, and probably not much less efficient. These howitzers, however, proved to be next to useless. The natives entrenched themselves within pahs, from whence they could not be dislodged, and into which our troops could not get without great loss of life. The pah consisted of spaces enclosed by walls made of piles driven in two rows about 4ft. asunder, the space between being filled with clay after the manner of a coffer-dam. The little howitzers in some cases could not be brought up to act against these pahs at all, and in others they could not breach the walls. "Toney Heckey," a native chief, constructed one of these pahs on the top of a hill, from which he could not be dislodged. In this emergency, Capt. G. R. Mann, R.E., proceeded to Sydney, and from his designs twelve little mortars, as illustrated in the accompanying engraving, were made by Mr. Russell, of Sydney.

Our engraving, for which, with this description, we are indebted to the "Engineer," prepared from the original tracing made twenty-four years ago, illustrates their construction so clearly that no special description is necessary. The cast iron base weighed but 28lb., and was fixed to a piece of two-inch plank 24 by 16. The mortar, of gun metal, weighed only 65lb. and was, of course, still more portable. The charge consisted of 8oz. of powder and a common 5in. shell. It may be thought that as there was no length of chase, only half the shell being contained in the mortar, the range would have been very small. In point of fact, however, the range was 550 yards, quite sufficient for the required purpose. These little mortars were carriad up by a few men within a few hundred feet of the pah to be attacked, and pitched their shells with ease into the very heart of the camp. They proved perfectly effectual, and infinitely more useful than the small guns, not only in attacking pahs, but in dislodging the enemy from jungle, as they could be put down at a moment's notice, and used while troops were on the march. They certainly exceed in power any other weapon of equal weight, for a 5in. shell, weighing some 12lb. or 14lb., and containing a heavy bursting charge, is no contemptible foe. The remarkable range of these little mortars is an excellent illustration of Lynall Thomas' theory of the percussive action of exploding gunpowder, and it is possible that with gun cotton the range would be still greater. Judging by the good service they have done, we cannot resist the conclusion that a few such mortars would prove a useful addition to our Abyssinian armaments.

WATER SUPPLY REGULATOR.

AN apparatus for regulating the supply of water, or any other fluid, has been patented by Messrs. Bland, of London-fields, Hackney, in conjunction with Mr. Brevetor. The apparatus is so constructed as to be when fixed without any opening whatever, except the one expressly intended for the outflow of the liquid, whereby the possibility of leakage is reduced to a minimum. The valve is made wholly of metal, without needing the aid of any other material, such as leather or india-rubber. By the construction of the apparatus the pressure of the liquid in the supply pipe aids in perfectly closing the valve, and therefore a proportionately much smaller lever and ball are required than usual. The connection of the spindle in the valve with the lever and ball is made beneath or beyond the point of outflow. It can be removed or replaced without trouble or necessity for plumbers' joints, rather a bad feature, we think, for the inventors, who are plumbers by trade. The construction or mode of action is such as to occasion the



least possibility and liability to get out of order by grit or sediment, as the flow of the liquid acts as a continuous lubricator, and washes away any obstruction that might be present.

In our engraving, fig. 1 represents the apparatus complete. Fig. 2 represents the arm Z to be fixed by a plumber's joint to the supply pipe, and furnished with a male screw A. Fig. 3 represents the valve case K furnished with a female screw B at the top, intended to receive A. D is the opening for the outflow of the water; the case has a bar or bridge X with an aperture W to guide the spindle, and also an opening; M is the side through which the lever or stem of the ball enters. Fig. 4 shows the spindle H with the shoulders V and a thread P. The nut T at at the bottom is to secure the lever or stress of the ball. Fig. 5 represents the action of the apparatus when open.

INSTITUTION OF CIVIL ENGINEERS.

AT the first meeting of the present session of the members of the Institute of Civil Engineers, held on Tuesday evening last, Mr Charles Hutton Gregory took the chair for the first time since his election as president, and delivered an address.

He remarked, that when the Institution was founded, fifty years ago, on the 2nd of January, 1818, the members were six in number. Two years later, Thomas Telford became the first president; and the Royal Charter of Incorporation was obtained on the 3rd of June, 1828, by which the Institution was firmly established as the recognized representative body of the engineering profession in the United Kingdom. There were now on the register 1,472 members of all classes, besides 95 students. The present condition and prospects of the profession were briefly alluded to, and it was observed, that the railway system of this country had, by economy of transport alone, been productive of direct saving to the public of 15 per cent. on the capital expended.

A reference to the past records of the Institution had brought to light one document which, Mr. Gregory believed, would be interesting to every engineer. This was a description of the nature and objects of civi engineering, by Thomas Tredgold, Hon. M. Inst. C.E., some of the expressions in which had been embodied in the charter; but as it had never yet been printed in a complete form, the president now gave it unabridged. After defining the duties required of the civil engineer, Mr. Tredgold concluded by saying that "the real exten to which civil engineering may be applied is limited only by the progress of science; its scope and utility will be increased with every discovery in philosophy, and its resources with every invention in mechanical or chemical art, since its bounds are unlimited, and equally so must be the researches of its professors." It could hardly, however, have been foreseen, that the attention of the civil engineer would have been directed to aid in constructions for defence from hostile attack, and even to the improvement of weapons of war. But as, more than two thousand years ago, Archimedes, distinguished first in mathematical science, after carrying out the great work of the embankment of the Nile, devoted the last efforts of his genius to engineering appliances for the defence of Syracuse against Marcellus, so now, less directly and less prominently, but with marked success, the combined labours of modern engineers had been applied to the purposes of national defence, and to this subject the president stated he proposed more particularly to allude.

The application of machinery to the manufacture of rotating fire-arms was first brought under the notice of the Institution, in the year 1851, by Colonel Samuel Colt, of the United States. In 1853, Mr. John Anderson, M.I.C.E., the engineer to the Board of Ordnance, suggested the construction and equipment of a Government manufactory, in which, by the use of complete machinery, all

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the processes for the production of small arms should be carried on successively to completion. This issued, after inquiry before a Select Committee of the House of Commons, in the establishment of the Small Arms Factory at Enfield, which was set to work in January, 1857, under the direction of Colonel Manley Dixon, R.A., the present superintendent, up to December 26, 1867, the total number of new arms made at Enfield was 616,828; while the number converted to breech-loaders on Snider's plan to the same date was 175,550. The long Enfield rifle consisted of 53 parts, and passed through about 740 processes of manufacture. The machines used were to a great extent varieties of copying machines, where a standard model was reproduced by a revolving cutter, in wood or metal, as might be required. The different pieces, as produced, were checked with templates and gauges, and, finally, the stock, lock, barrel, bands, bayonet, plates, screws, &c., found their way in numbers to an "assembler," who, furnished only with a screw-driver and a chisel, took up the pieces indiscriminately and fitted them together; and so entirely interchangeable were the parts found to be, that a payment of 3·29 pence for each rifle put together, gave the workman wages of about fifty shillings a week. It was stated that the average cost of the long Enfield rifles, made at the Government factory, including an allowance of 5 per cent. on the cost of buildings and machinery, for depreciation, had been about £2 each, and of the short Enfields complete £2 14s. each. The cost of converting to the Snider breech-loader, including £10,000 for the alteration of old machines and the supply of new ones, as well as 5 per cent. for depreciation on buildings and plant, was said to be about 16s. 3d. per arm. It was stated that, with the present machinery, the Enfield factory was capable of turning out about 130,000 new arms annually. It had been estimated, that the improvement arising from the accurate work produced by good machinery, coupled with better ammunition, had resulted in reducing by 50 per cent. the mean deviation in rifle shooting; while elements of precision and economy had been introduced, by the perfect convertibility of all the parts of small arms, which were previously almost entirely neglected by the English gun-making trade.

Mr. Gregory next referred to the production of heavy armour plates and large guns, with their consequent results. He said that while, prior to the Crimean war, suggestions had been made and partial experiments had been tried, with a view to the use of iron for defensive purposes, the credit of the first great trial of a practical nature was due to the Emperor of the French, who built three floating batteries cased with thick iron plates, which were engaged in the attack of the allies on Kinburn, on October 17th, 1855. From that date public attention was drawn more closely to the protection of ships of war by armour plating, and various experiments were made in this country. It soon, however, became apparent, that the subject of the use of iron for this novel purpose was so complicated by considerations of a purely technical character, that it was determined to submit the whole matter to the investigation of a mixed Special Committee, which was appointed in January, 1861. This Committee continued in existence for between three and four years, and their investigations and experiments, which were of great value, formed the best history of the application of engineering science and practice to this particular subject; and it was to be regretted that the four large volumes, containing a full record of all their proceedings, had not been published. The president was, however, enabled to give a brief epitome of the results that had been early arrived at, on points which had previously been uncertain. For example, out of many varieties of material, it was found that the best for resisting shot was wrought iron; that this should be of the softest and toughest quality, any hardness or steely character being prejudicial; that *cæteris paribus*, the resisting power, up to a certain limit, varied nearly as the square of the thickness; that corrugations, bosses, or irregularities of surface were disadvantageous, plain surfaces being best; and that the plates should be as large, and with as few joints, as possible. Various constructions of iron defences, both for ships and for land fortifications, were examined and tested on a thoroughly practical scale. The experience thus obtained had reference not only to the strength and capability of the material generally to resist shot from given guns, but also as to the modes of fastening, the effect of various kinds of backing, and the general principles which should guide iron defensive construction. But perhaps the most valuable result, in an engineering point of view, was the improvement effected in the production of iron in large masses. When the Committee began their labours, the manufacture of armour plates had only been attempted by one or two makers, and even in their hands it was little more than tentative. After three or four years' experience, many makers had come into the field, the general average of quality was much improved and more certain, and plates of 5 inches and 5½ inches in thickness could be produced with their full resisting power. During the last few years, the size and thickness of iron plates had greatly increased; and thoroughly sound and uniform plates of large size, 10 inches in thickness, might now be regarded as an accomplished fact. In the middle of 1864 the Iron Plate Committee was dissolved, a step which Mr. Gregory considered to have been injudicious; as the comparative question between guns and iron defences was at that time in a high degree progressive, and, if improvement was to go on, the technical treatment of the subject must still be necessary. Recent circumstances had led to the temporary re-appointment of a Government Committee to consider the question of the application of iron plates to land forts; and it was to be hoped that their labours might not be prematurely checked, nor until safe data were deduced from actual tests.

Concurrently with the production of iron plates, for purposes of protection, had been the increase in the size and destructive power of guns. For many years before the Crimean war, brass and iron guns had been made with very little change of form, although there were in existence compound or built-up guns of an early date. When public opinion was drawn to the application of mechanical improvements to the production of guns of great size and strength, many designs were brought forward, and the large wrought-iron gun of Mr. Horsfall, and the monster mortar of Mr. Mallet, M.I.C.E., were cited as examples. But the battle of the guns was chiefly between Sir W. G. Armstrong, C.B., M.I.C.E., and Mr. Whitworth, M.I.C.E. As far as the construction of the guns was then concerned, the leading points of difference were, that while the Armstrong gun was built up of several rings or tubes of coiled wrought iron shrunk over one another, and over a steel lining, with small grooves to take a soft-coated projectile, the Whitworth gun was built of tubes of mild steel, forced with a taper over one another, and over a steel lining, the bore being polygonal, with a mechanically-fitting projectile. The details of both systems were subsequently more or less changed, and in January, 1863, a committee was appointed to make full experiments and to investigate, with two calibres, viz., 12-pounders and 70-pounders, the comparative merits in construction, endurance, range, and accuracy, and, in fact, in all the qualities which a gun should possess. The information so collected showed, in both systems, results as to structural strength and efficacy, and accuracy of fire, which had not been previously attained; and while it was not in all respects conclusive as to the comparative merits of the guns, it brought out more prominently than ever the perfection to which artillery might be brought by the application of engineering skill. Irrespective of breech-loading, which had been abandoned for heavy guns in this country, and of rifling, in which the original mode had been to a great extent superseded by larger grooves cut in the chase of the gun to guide soft metal studs fixed on a hard metal projectile, the gun now generally manufactured for the service had undergone considerable structural changes. The most material were, the diminution of the number of parts, and the substitution of outer coils of fibrous Staffordshire iron, for coils of the best Yorkshire iron, tough steel being still maintained for the lining as best resisting surface wear. The pattern at present in use for all guns consisted of only four pieces:—1, the steel barrel or lining; 2, a coiled tube over the barrel, extending from the muzzle nearly to the trunnions; 3, the breech coil, of three coils in alternate directions, welded together, with a trunnion piece welded on, the whole being shrunk on over the breech of the barrel, and lapping over the front coil; and 4, the cascable. It was considered by the authorities, that guns of this pattern were less liable to injury by accident, and less dependent upon perfection in manufacture, and that practically an equal amount of strength was obtained; while it was held that a fibrous iron was to be preferred as more workable, and as giving out its greatest strain over a greater distance than the best Yorkshire iron, which, while stronger, statically considered, did not yield so far before fracture. It was said that this change had diminished the cost of production by 35 or 40 per cent. Prior to the mechanical improvements which had led up to the present rifled guns, the greatest distance to which a projectile was ever thrown from a small-bore gun was not much over 6,000 yards, and the limit of bombarding range, at high elevations, with the 13-inch mortar, was 4,500 yards. With the modern ordnance, projectiles had been thrown, with greater precision, to a range exceeding 10,000 yards; and the guns of the service made good practice at 6,600 yards; indeed, better practice than was formerly attainable at 3,000 yards. At 1,000 yards the rifled gun was eleven times, and at 2,000 yards, thirteen times more accurate than the smooth-bore. But these improvements would be of little avail in time of need, until smooth-bores were much more largely replaced by rifled guns; as, for all practical purposes, many of our defences, both at home and abroad, were, at present, almost unarmed.

While such important changes had been effected in ordnance, the advance recently made in naval construction was alike remarkable, and would have been equally impossible without the resources of modern engineering. Without attempting to trace the progress from wooden to iron ships, or all the steps by which naval architects had passed, from the earliest to the most recent types of armour-clad ships, Mr. Gregory illustrated the general results by some comparisons between the structures of the "Warrior" and the "Hercules," as ships of 1860 and of the present period respectively. The arrangement now adopted for the broadside ships of the Royal Navy, provided a protected battery amidships, shut in by armour-plated bulkheads, and a belt of armour for the whole length in the neighbourhood of the water line. By these means, in addition to the battery and the whole water line, protection was given to the engines and boilers, and to the rudder-head and steering apparatus. In the "Hercules," the sides of the ship were recessed before and abaft the central battery, so that by means of embrasures in the armour-plated bulkheads, the foremost and aftermost gun on each side could be traversed on a turn-table, and be fired at an angle of 15deg. with the line of the keel, while that line was commanded by the guns in the bow and stern batteries. The "Hercules" was 8in. wider in the beam than the "Warrior," but 55ft. shorter, and of 883 tons less burthen. She would carry a smaller number of heavier guns, and possessed the elements of greater power, both for offence and defence; but in the former quality she was, perhaps, inferior in some respects to a type of ship now on the stocks. The Royal Navy, at the present time, comprised thirty-one iron-clad ships, and eight more were building, four of the existing ships are being furnished with turrets, which were to be supplied to two of the new ones. Admitting that this number represented a formidable force, and that in structural qualities the vessels recently built were superior to those of other countries, it must be remembered that many were of doubtful strength, and that the sum devoted to the construction of new iron-clad ships for the current year, was less than one-twelfth of the vote for the navy, and was barely sufficient to build three iron-clad frigates—a fact meriting the gravest consideration.

The next point touched upon related to the important bearing of railways in modern warfare. They were acknowledged to have been of great use in the movement and concentration of troops during the war in Lombardy, in 1859. In the German War of 1866, the Prussian Government organized a special corps, consisting of workmen and railway servants to act under the direction of engineers and traffic officers, to repair damages effected by a retreating enemy, to work lines occupied by the army, and in case of retreat, to destroy lines in the rear. Mr. Hozier, in his admirable account of the Seven Weeks' War, though conceding the value of improved roads and railways in shortening the duration of campaigns, especially in facilitating the transport of provisions, stores, and a siege train, and in relieving soldiers of heavy loads; yet he considered that the power of railways for the transport of troops had been over-estimated. Mr. Gregory's opinion seemed to be at variance with these views; and reference was made to the number of volunteers transported by railway, on special occasions, within a given time, as not being consistent with the conclusions of Mr. Hozier. Again, in the American Civil War, railways and steamboats were found to be of inestimable advantage, of which several illustrations were given.

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MACHINE FOR BORING GUN BARRELS.

By Mr. Thomas Greenwood, of Leeds.

FIG. 3.

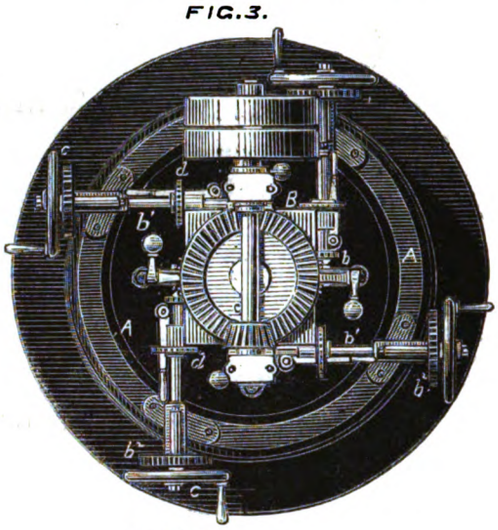


FIG. 1.

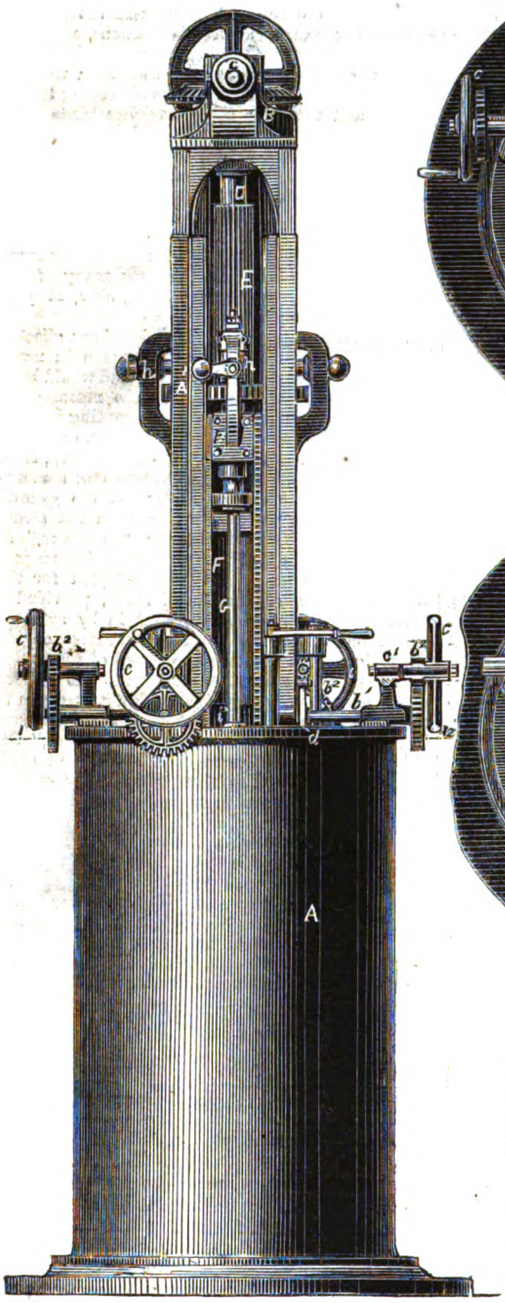


FIG. 2.

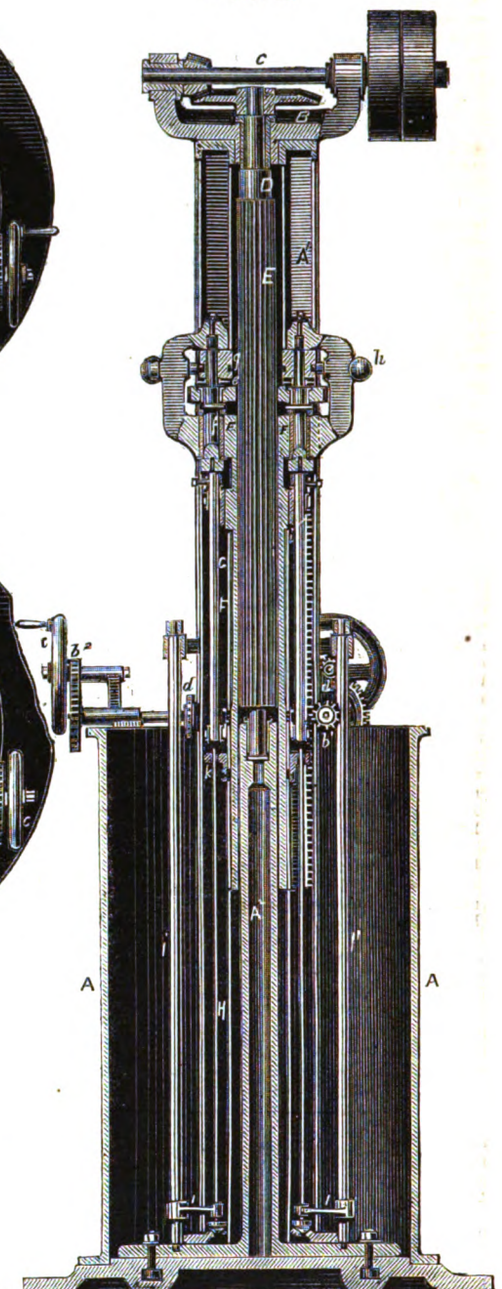


FIG. 4.

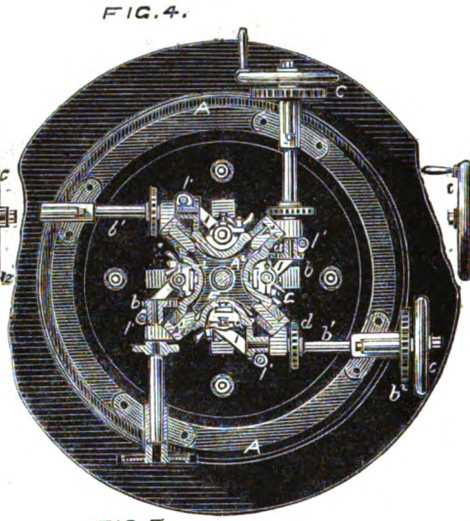
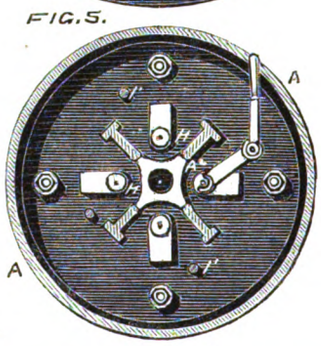


FIG. 5.



The railway system of this country was believed to be one of the greatest elements of strength for national defence; and it was mentioned that the confidential reports to the Government, by the officers of the "Engineer and Railway Volunteer Staff Corps," commanded by Mr. Bidder, Past President I.C.E., showed that the completeness and the resources of the railway system would enable the whole regular and irregular army to be moved upon any required lines of defence within a few days.

As a *resume*, Mr. Gregory submitted, that while it was advisable to maintain the efficiency of the Government establishments, yet that it would be a mistake to extend them so far as to cripple individual enterprise. In the next place he referred to the comparatively unprotected state of the Thames, the Mersey, the Clyde, the Tyne, and other rivers leading to rich towns, docks, and shipping; and he suggested the inquiry, whether if forts were thought to be desirable at such places, they might not be of small size, and capable simply of offering resistance to a sudden attack. And in regard to the navy, he thought the time had now arrived when the type of ship best suited for coast defence should be settled. The instinctive feelings of every Englishman called for the establishment and maintenance of a navy sufficiently strong, not only to defend our coasts, but also our colonies and our commerce; and if the Government would at once respond to that call, comfort would be brought to thousands at the present time suffering most grievous want.

In conclusion, the President expressed the earnest hope, that the future of the Institution of Civil Engineers might be as useful and as prosperous as its first fifty years had been; and that it would continue to supply men of character and intellect equal to every occasion, and who would join in the defence of their country, by contributing to her moral and material greatness, leaving England's future with confidence to the great source of all power and all intelligence.

MACHINE FOR BORING GUN BARRELS.

GREAT delay has hitherto been occasioned in clearing out the chips formed by the drill in boring solid metal, and defective drilling has often resulted from the accumulation of the borings. In order to avoid these inconveniences, and to insure perfect lubrication of the drills, Mr. Thomas Greenwood, of the firm of Greenwood and Batley, machinists, of Leeds, has contrived the arrangement of drilling machinery shown in the accompanying engraving. Here the work to be drilled is mounted vertically above a tank containing lubricating material, and bored upwards from its lower end by fixed drills mounted in the tank. Fig. 1 of our engraving shows in side elevation the improved drilling machinery arranged for boring gun barrels; fig. 2 is a central vertical section of the same; fig. 3 is a plan view; fig. 4 is a sectional plan taken in the line 1 2 of fig. 1; and fig. 5 is a plan partly in section of the tank and its fittings.

A is a cylindrical tank, to the bottom of which is bolted a central standard cast with a broad flange or base plate; this standard is composed of four flat-sided vertical members A^1 disposed radially around a short pillar A^2 and united together at top, as shown at fig. 1. On the top of the standards is fixed a casting B which forms the bearing for a driving shaft C; this shaft is fitted with loose and fast belt pulleys, and also a bevil pinion which gears into a bevil wheel keyed on to a vertical spindle D. The foot of this spindle is stepped into the top of the pillar A, which also carries a bearing for it to run in, and the upper end of the spindle is fitted with a bearing. Carried by the top of the standard keyed to the spindle D is an elongated spur pinion E into the

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teeth of which gear spur pinions *e* for the purpose we shall presently explain. F F are four slides fitted to the standard, as seen best at fig. 4, and capable of sliding up and down it independently in guides provided for them. These slides F each carry a vertical spindle *f* on which the pinions *e* are loosely mounted. Each spindle is provided with a clutch *g* which slides on a feather on the spindle, and engages with the boss of the pinion *e* when the rotary motion of the pinion is required to be communicated to the spindle. An eccentric stud projecting from a short rock shaft *h* and operated by a handle enters an annular groove in the clutch, and thus lifts it or depresses it as required. These spindles *f* are intended to rotate the barrels submitted to the action of the drills, and for this purpose they are fitted at their lower end with an eccentric stud, which, when the spindle is rotating, bears against a projection from the barrel and drives it round under the action of the drill.

The barrels to be drilled are shown at G; they are dropped into and steadied by bearings *i* i^* carried by the slides F, and by means of rings clamped to their upper ends they are suspended from the upper bearings *i*. The bearings *i* i^* are carried by their several slides F; the upper bearings are fixtures, but the lower bearings i^* are adjustable in guides to which they are clamped to suit different lengths of work. These guides are formed at the lower end of the slides F, and in them are also fixed adjustable bearings *k* for steadying the cutting edge of the drills H which stand up from the bottom of the tanks. These drills are stationary and they rest upon fixed coned seats, being provided with coned heads to rest in those seats. This arrangement allows of the drills being readily removed for grinding, or of being replaced by others to suit a different kind of work. The work is generally allowed to descend by its own weight and to slide over the drill until the slide which carries it is arrested by a stop, but in order to raise the work the provision shown best at fig. 1 is made. This consists of a vertical rack *a* cast on the slide F, into which gears a spur pinion *b* mounted on a short spindle b_1, which carries at its outer end a second spur pinion b_2. In gear with this is a spur pinion keyed to the boss of a hand-wheel *c*, which is carried by a stud axle c_1 supported on a bracket attached to the tank A. When, therefore, it is required to lift the work clear of the drill, it is only necessary to turn the hand-wheel *c* and the pinion *b* will raise the slide F and the work with it. To retain the slide in the elevated position a ratchet wheel *d* and pawl are provided, and to prevent the drill rising out of the tank with the work a forked arm I embraces the drill and offers an obstruction to the coned head of the drill passing upwards. This forked arm is keyed to a rock shaft I_1, which is turned by a handle (see fig. 5) to disengage the arm from the drill when the drill is required to be moved.

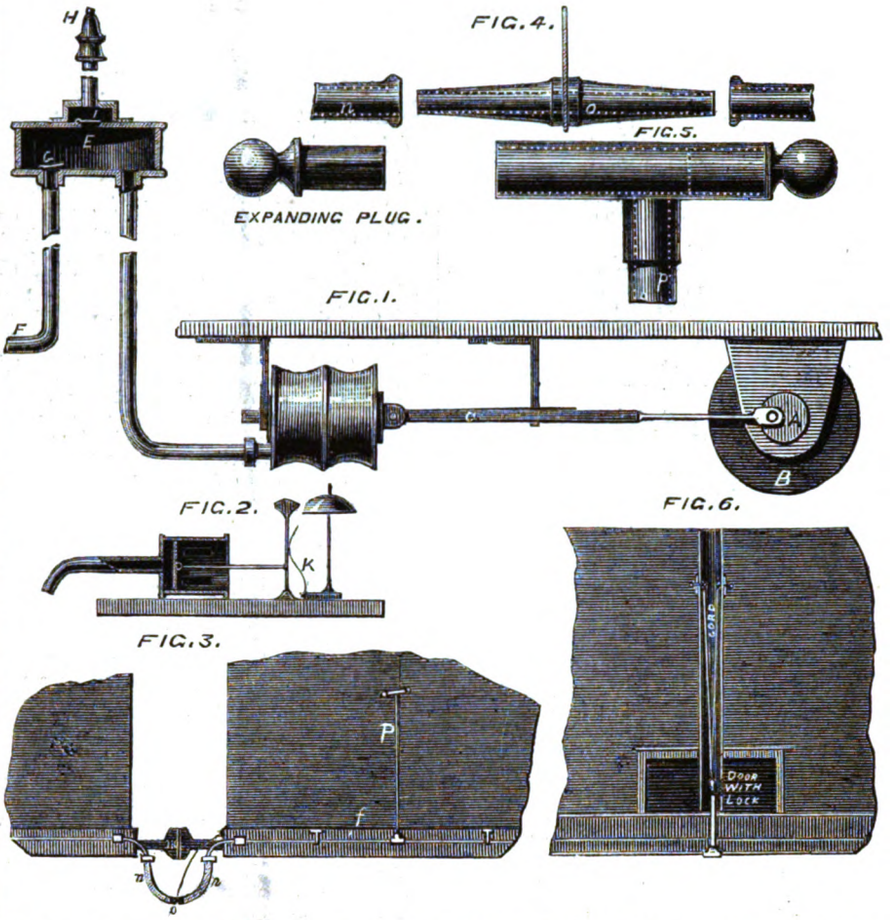
Mr. Greenwood proposes to charge the tank with water or other lubricant, keeping its level above the cutting edge of the drills, and the work will therefore be lowered down into the lubricant as the operation proceeds. When boring gun barrels or other light work, three, four, or more slides or carriers for receiving the work are arranged around the central standard. The carriers being capable of sliding in the vertical guides descend as the boring proceeds, or a self-acting motion may be applied to regulate the descent of the carriers when the machine is adapted for heavy work. Rotary motion being given to the central elongated pinion E, the pinions around and gearing into it will be driven, and they will thus rotate the work suspended below their respective spindles As, therefore, the work is fed to the drills the steady boring of the barrels will be insured. This operation may be continued without interruption until the boring is completed, as the chips or borings will fall by their own gravity, while the lubricant will have constant access to the drill. Of course this mechanism is modified to suit different kinds of work, but in all cases the work pendant in the lubricant will as the operation proceeds discharge the chips without the aid of the attendant, and thus render the boring operation continuous instead of intermittent as hitherto when solid metal has been bored.

PNEUMATIC APPARATUS FOR SIGNALLING ON RAILWAY TRAINS.

THE question of communication between guards and passengers of trains in motion attracted considerable attention last year, and is likely to do so again. Various plans of effecting the desired object are now under trial, and others continue to be proposed. Among the most recent and practical which have come under our notice, is that recently patented by Mr. Latimer Clark, the well-known telegraphic engineer, of No. 5, Westminster Chambers, Westminster. Mr. Clark's invention consists in the application of a pneumatic tube running the whole length of the train, with means for making connection between the carriages and the break vans when coupled together. A pump or bellows is fixed on the engine, and every guard's van, which is kept in constant action by the motion of the train, and continually exhausts the air from

PNEUMATIC APPARATUS FOR SIGNALLING IN RAILWAY TRAINS.

By Mr. Latimer Crark, C.E.



this pipe, all the bellows acting on the pipes simultaneously. Under ordinary circumstances, the pipe being closed, no air can be ejected by the bellows, and no effect will be produced in the guard's van or engine, but if an opening be intentionally made into any part of the pipe by the passengers or guards, or by the accidental separation of the train into two parts, the air will be freely admitted into the pipe, and all the bellows will come into action, and will begin to eject air violently. This air is ejected through a whistle, and by the noise it occasions it immediately attracts the attention of all the guards in the train, and also that of the engine driver. Flexible tubes of vulcanized india-rubber with spigot and faucet joints are employed for making the connections between the carriages.

In the accompanying engraving, fig. 1, *a* is an eccentric or crank fixed on the axis of a wheel *b*, which is driven by a strap passing round the axis of one of the wheels of the guard's van, and therefore revolves whenever the train is in motion; *c* is a rod working in guides, to which is attached the bellows *d*. A pipe leading from the bellows passes up into the guard's van, where it is in free communication with an air chamber *e e*; this air chamber is connected with the pneumatic pipe *f*, which runs the whole length of the train, and which communicates with the similar chambers and bellows on the engine and on the other vans. The pipe *f* where it enters this chamber is provided with a valve *g*, which freely permits the air to enter, but prevents its exit. The whistle *h* is also provided with a valve *i*, which allows the air to pass out from the chamber *e* through the whistle, but prevents its entry. As soon as the train is set in motion all the bellows commence to work, and at each stroke they exhaust a portion of air from the respective chambers *e e*, and and the pneumatic pipe *f*, and eject it out again through the valves *i* and whistles *h*, causing them all to sound. After a very few strokes, however, they have between them exhausted as much air from the main pipe as their construction permits, and have created a partial vacuum, and since no more air can enter at any part of the apparatus, the whistles necessarily cease to act, and become silent, and they continue so, however long the train may be in motion.

If, now, the passengers wish to make a signal to the guard and engine driver, or if either of the guards wishes to make a signal to the engine driver, it is only necessary for either of them to make an opening into the pipe (by means of a valve provided for the purpose), and immediately the air enters freely into all the bellows, and the whistles both in the guard's van and on the engine commence and continue to sound as long as the air is admitted to them. In the case of the passengers, the valve is of such construction that when once opened it cannot be closed again, and the signal is therefore a continuous one until the guard arrives, who has means of closing it. In the guard's van and on the engine a simpler valve is provided, which can be opened and closed at pleasure, by which means they can signal to each other as often as they find necessary. In the event of one part of the train becoming accidentally detached, of course all the whistles will commence instantly sounding. The object of the air chamber *e* is two-fold; one is, that of bringing the valves and whistles into a part of the van where they can be readily heard and attended to (in the event of their requiring attention); the whole apparatus is, in fact, readily removed bodily, and exchanged for a new one as often as requisite, all the connections being formed by short lengths of vulcanized india-rubber tubing. The other object is that of preventing too high a vacuum in the main tube, which would be objectionable, as tending to create a greater leakage, which, if very considerable, would be ejected through the whistles in sufficient quantity to cause them to give a constant sound, which might in an extreme case occasion some difficulty in distinguishing it from the intentional signals. Mr. Clark prefers to work with a vacuum of not more than 5 or 6 ounces on the square inch, the requisite degree of vacuum being obtained once for all by duly apportioning the relative sizes of the bellows, and of the air chamber *e*. Although in the engraving a bellows has been shown as the means of producing the vacuum, a pump is equally suitable for this purpose.

Fig. 2 shows an arrangement in which a small cylinder has a piston working loosely in it, and carrying a hammer, which at every stroke of the pump or bellows, strikes a gong or bell. The hammer is pressed home against its stop by a light spring *k*, and when in this position the piston closes the cylinder, and at every impulse of air from the bellows it is driven forward, and the hammer strikes the bell, at the same time it discloses slots *l* in the side of the cylinder which allow the air to escape, and the piston is pressed back again by the spring *k* to its normal position ready for another stroke As soon as the exhaustion of the main pipe is complete, no more air can be forced into the cylinder, and therefore the bell remains silent.

Fig. 3 shows a portion of a carriage with a part of

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the main pipe *f* fixed beneath it. This pipe is of ¾in. wrought-iron gas pipe, at each end of the carriage it is bent downwards, as shown at *m m*, and a short length of flexible india-rubber pipe *n* is attached to it by a union joint, and when out of use is allowed to hang loosely, or to lie over a hook conveniently placed to sustain it. When the carriages are coupled up, these pipes are connected by a joint *o*, which is shown separately in fig. 4. *p p*, fig. 3, show the means of communication for the passengers; a branch *p* is led up from the main pipe *f* between the divisions of the carriages, at the top is shown a T-piece which opens into either compartment. These openings are closed by metal plugs provided with handles, which, by the application of force, may be drawn out so as to admit air, and give signals to the guards' vans and the engine. The plugs when fixed have ornamentally printed discs of leather or paper glued over them, with instructions as to their use. The leather is permanently torn away when the plug is removed, so as to indicate the compartment in which any signal was given, the plugs are also provided with expanding spring edges, as shown in fig. 5, so that when once removed they cannot be re-inserted in the same hole.

Fig. 4 shows the method of coupling the carriages together. *n n* are flexible india-rubber tubes attached to the main pipe *f*; *o* is a hollow spigot of wood or metal hanging to the carriage by a chain or cord, and having both its ends tapered so as to fit the india-rubber tubes, which are enlarged and strengthened at their ends for this purpose. When the carriages are coupled together, it is only necessary to take the spigot in hand and thrust its two ends into the corresponding flexible tubes; they do not require uncoupling, but are allowed to draw out of themselves when the carriages are separated. All these effects may also be obtained with a slight modification of the apparatus by the use of compressed air instead of vacuum, the pump or bellows in this case being employed to draw air through a whistle, and to force it into the tube, arrangements being made for stopping the action of the pump when the pressure in the pipe arrives at any point determined on.

With regard to the practical application of these signals, we are glad to be able to state that the London, Chatham, and Dover Railway Company are now fitting up their London and Dover tidal trains with them. The Board of Trade authorities have inspected the system, and, we believe, highly approve of it. It appears to us to be the best plan yet proposed; it meets the case of a train separated accidentally into two halves, both halves receiving warning automatically. These signals also inform all the guards in the train at once of any mishap. They are constantly thoroughly tested, for they sound slightly every time the train starts, and if they are out of order their noise becomes continuous. We hope soon to report a practical trial of Mr. Clark's system of signalling.

MANCHESTER BOILER ASSOCIATION.

AT the last ordinary monthly meeting of the executive committee of this association, the President, Wm. Fairbairn, Esq., C.E., in the chair, Mr. L. E. Fletcher, chief engineer, presented his report, of which the following is an abstract:—During the past month 248 visits of inspection have been made, and 577 boilers examined, 454 externally, 13 internally, 2 in the flues, and 108 entirely, while in addition five have been tested by hydraulic pressure. In these boilers 167 defects have been discovered, 6 of them being dangerous. A case of fracture was met with in a boiler 6ft. 8in. in diameter, and 34ft. long, having two internal flue tubes 2ft. 3in. in diameter, running through it from end to end. The fires were not, however, placed in the tubes, as is usual in such boilers, but under the bottom. The fracture in question occurred at the bottom of the outer shell, and at the first seam of rivets behind the fire-bridge, where it extended from rivet hole to rivet hole through the outer overlap of the plates, for a length of about 4ft. 6in. The excessive leakage which resulted necessitated the drawing of the fires, but the boiler was not stirred from its place, and no injury was done either to persons or surrounding property. It is important to call attention to this result, in contrast with that of transverse seam rending in plain cylindrical boilers, which, under similar circumstances, severs them entirely asunder, when the two ends fly apart, and frequently cause considerable loss of life. No doubt this fracture was greatly due to the mode of introducing the feed, which, contrary to the repeated advice of the association, was carried down by means of an open-mouthed vertical pipe nearly to the bottom of the boiler, and shot directly on to the plates, instead of being diffused by a horizontal perforated pipe.

A case of external corrosion was met with at the top of an ordinary double-furnace mill boiler, 7ft. in diameter, 28ft. long, and worked at a pressure of 60lb. per square inch, the boiler in question being one of a series of four set side by side. All these boilers were covered with flags, which had not been removed for some years, but on their being enrolled with this association, the owners were persuaded to raise the flags for purposes of examination. There was no reason to suspect any corrosion, and the boilers were uncovered merely as a matter of precaution, when they were all found to be more or less attacked by corrosion, and the plates on one of them to be reduced from their original thickness of 7-16th to a quarter of an inch in one place, and 3-16th in another. The corrosion in some cases arose from leakage of the fittings, in others from the practice of playing a jet upon the flags through a hose pipe to wash them down, when the water found its way through the joints of the stonework, and lodged on the plates. It is by no means a judicious plan to bury boilers in this way, beneath flag stones. They entirely conceal any defects that may exist beneath them, and are expensive to remove for purposes of examination; hence steam users are adverse to having them lifted, and thus boilers too frequently lie buried for years. It is recommended that, instead of flagging boilers over, they should be covered with an arched course of brickwork fitting the sweep of the shell, a layer either of felt, cork shavings, or other suitable non-conducting material, being placed between the brickwork and the plates. The covering should be neatly worked in around the fittings with 'bull,' or round-nosed bricks, and finished off in the same way at the front. The brickwork, if neatly laid, presents a very satisfactory appearance, is easily swept down and kept clean, which cannot be the case where boilers are covered with felt merely, or loose sand, while the openings round the fittings afford an opportunity of detecting any leakage that may occur at those parts. This plan of covering boilers is very generally adopted, and found to give more satisfaction than any other.

An instance of deficiency of water is reported as having arisen through adopting a mushroom valve as a blow-out apparatus. On its being opened, a piece of scale lodged on the seating, in consequence of which the valve could not be screwed down again, although considerable force was employed, so that the escape of the water could not be prevented, and therefore, to save the furnace crowns, the fires had to be drawn and the engine stopped. This is no isolated instance; good brass gland taps are more reliable than these mushroom valves, and they are decidedly recommended in preference.

It may prove of service to address a word of caution on the subject of second-hand boilers, since experience shows that it is a most short-sighted economy to be tempted by the low price of second-hand boilers to purchase them, and that doing so constantly leads to expense and disappointment. Boilers are seldom pulled out unless there is good reason for condemning them, and there is no economy in working those of old-fashioned construction and equipment. Two illustrations in point may be given, which have been recently met with. One of the members of the association had three boilers, which were condemned as unfit for use, on account of malconstruction. These boilers had two furnaces running into an oval flue tube, which was made of light plate, and with sides of an irregular and very weak form. Several cases of explosion having occurred on account of this malconstruction, the owner was induced to pull out these three boilers, and lay down new ones in their places. It appears that one of these condemned boilers, if not all of them, was sold to a broker, who succeeded in passing it off upon another member of the association, representing the boiler to be nearly new, though sixteen years old, and that it had been taken out merely because it was too small for the work, and had to be replaced by a larger one. The association knew nothing whatever of this re-purchase, until it transpired, on the first examination of the boiler, after it was reset in its new position, when it was recognised as one of the old ones previously condemned on account of malconstruction, and it became the painful duty of the association to report to its recent purchaser the true history of the boiler, and inform him that it was unsafe at the pressure he required, and had better be at once removed.

Another steam user, not under inspection, suffered more severely. He purchased an old second-hand boiler, and had it set on his premises, when almost before it had got fairly to work, the boiler exploded, killing four men and laying the place in ruins. Cases of difficulty arising from the purchase of second-hand boilers are so constantly occurring that it is thought well to bring the above before the notice of the members, and at the same time strongly to urge upon them to have nothing to do with the purchase of second-hand boilers, except in those few cases where there has been a good reason for their previous removal, and they have been originally made by a boiler maker whose name is a sufficient guarantee for the quality of the plates and soundness of the workmanship.

The list of explosions for the past month is a heavy one, as many as six having occurred, by which fifteen persons have been killed, and fifteen others injured. Particulars of four of these have been already obtained, and it has been found as before, that there is no mystery whatever as to their cause. Not one of the boilers in question was under the inspection of this association. The following is a statement of explosions from October 26th, 1867, to November 22nd, 1867, inclusive;—No. 23, November 6, portable multitubular, wagon-shaped, internally fired, 2 persons killed, and 2 persons injured; No. 24, November 7, plain cylindrical, externally fired, no one injured; No. 25 November 11, plain cylindrical, egg ended, externally fired, 3 persons killed, and 8 persons injured No. 26, November 14, agricultural, 3 persons killed, and 2 persons injured; No. 27, November 14, double-furnace "breeches" internally fired, 4 persons killed, and 1 person injured; No. 28, November 21, particulars not yet fully ascertained, 3 persons killed, and 2 persons injured; total, 15 persons killed, and 15 persons injured.

No. 23 explosion occurred at a farm, at nine o'clock on the morning of Wednesday, November 6th, and resulted in the death of two persons, as well as in injury to two others. The boiler, which was a portable multitubular one, employed for driving a thrashing machine, was not of the locomotive type, as such boilers usually are, but of wagon shape, the bottom being arched up into a horse-shoe shape sufficiently high to contain the furnace within it, the flat sides being strengthened with seven stays, three-quarters of an inch diameter, passing through the water space, while the small flue tubes, eight in number, were placed above the furnace, the chimney being at the firing end of the boiler. Its size was very diminutive. It measured only 6ft. 5in. in length from end to end, including the smoke box, 3ft. in height, and 2ft. 4½in. in diameter at the wagon head, while the plates were thin, being only a quarter of an inch in the shell and furnace. The explosion occurred as the engine was at rest, which it had been for some ten minutes, to afford an opportunity of adjusting its position, the fire burning meanwhile, and no steam escaping from the safety-valve. The boiler gave way in the external shell, rending from end to end, immediately above the longitudinal seam of rivets at the bottom of the water leg on each side of the furnace, and also through the ring seam of rivets at each end of the boiler, so that the outer casing was completely stripped off from the furnace, smoke box, and flue tubes. The explosion was attributed at the inquest to the carelessness of the attendant, who, it was said, had worked the boiler with too little water, and too much steam, the coroner and jury contenting themselves with censuring the poor man, who had been killed by the explosion, while they hinted in addition that had he survived it would have been their duty to have brought him in guilty of manslaughter. Abuse of the poor fireman, however, is by no means an exhaustive treatment of this explosion: there are other points to be considered. The boiler was ill adapted to bear high pressure, though it had been warranted when purchased, as stated by the owner at the inquest, to work up to a pressure of 100lb., and to bear one of 200lb., while it had been worked at times up to 70lb. Also the complement of fittings was defective, since, although there should have been two safety-valves, there was but one, and that of a most dangerous construction, as frequently pointed out on previous occasions, since it was weighted with a spring balance, not fitted with any ferrule to prevent its being overscrewed, and is reported to have been found locked fast after explosion. Had this boiler been suitably constructed and equipped, the explosion would not have occurred, and the lesson to be drawn from it is not the carelessness of engine drivers, but the danger of turning out badly-made and badly-equipped portable agricultural boilers, and more especially so since they do not receive the most skilled attendance.

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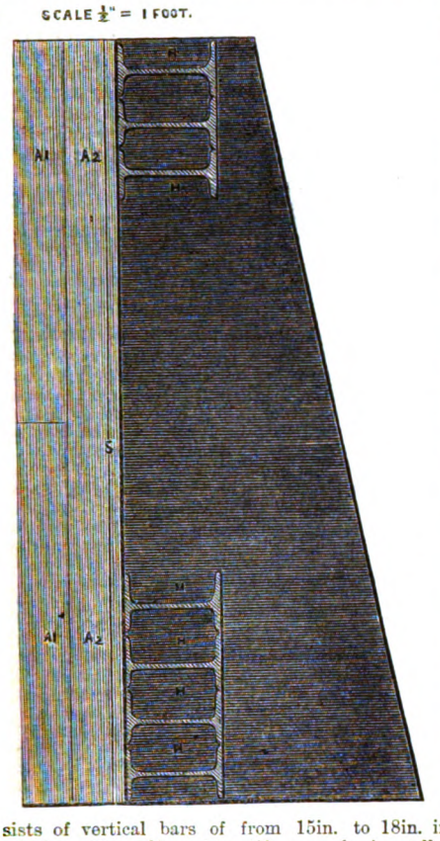
THE GIBRALTAR SHIELDS.

WE have occasionally noticed the Gibraltar shields, and in our article on Sir John Brown's 15in. armour-plate, we especially called attention to their faulty construction. It will appear incredible that in spite of their failure under trial these shields are being used for the defences of Malta and Gibraltar. The recent trials of these shields invest them with a new interest, so we give in the annexed engraving an accurate section of one of them. They are intended to protect the guns in the embrasures of the stone forts of the important works for which they were designed. The principal armour consists of the plate A_1, which is 5½in. thick, and of the plate A_2, which is 5in. thick. A_1, or the front plate, consists of two horizontal plates, 12ft. in length by 4ft. in width. The port-hole is cut out of one-half of each plate. The second plate of 5in. at the back con-



sists of vertical bars of from 15in. to 18in. in width. The 1½in. skin (S) runs horizontally, parallel with the outer plate, and in three widths; one above, one below, and one on each side of the porthole. The whole is stayed by two angular struts, as shown in outline. Between, and attached to these struts, as well as riveted to the inner skin, and the H-girders, indicated by the H's in the cut. These structures are bound together by a plentiful supply of Palliser bolts 3in. in diameter. As will be remembered, these so-called Palliser bolts are simply common bolts with the shanks diminished. The bolts were, in fact, formed as usual, that is to say, countersunk heads, reaching at the top of the frustrum of the cone to about the half of the thickness of the plate, were united to a shank, threaded at the other end, and secured at the inside by means of two nuts. It must also be noted that these Palliser bolts were themselves protected with the usual Admiralty india-rubber washers. It has also been denied that the bolts employed were on Major Palliser's plan, but we are able most distinctly to affirm the fact. Such are the Gibraltar and Malta shields as represented in the target lately tried at Shoeburyness.

The construction and proportioning of these shields being now clear, it will be interesting to note more particularly their practical performance under fire. It was intended by the authorities of the War Office that these shields should afford protection against the heaviest shot. But, perhaps, somewhat in the spirit that caused Don Quixote to refrain from trying his mended helmet, the only gun used at the first trial was the 9in. Woolwich gun, and that only with 37lb. charges: the regular service charge being, as will be remembered, 43lb. The firing was from seventy yards. The result may be told in a few words; the first shot struck at about the middle of the lower plate on the left side of the embrasure and broke nine of the Palliser bolts, sweeping the nuts, washers, and threaded portions, &c., right over the breach, with a clearing effect similar to that of canister shot. Almost every gunner behind the embrasure would have been disabled. The second shot struck fairly in the middle of the other side of the shield, carrying away ten bolts in a similar way. This constituted the first trial. It naturally proved so unsatisfactory that Sir John Pakington, extremely alarmed, called together a new Iron Plates Committee to inquire into the cause of the failure. In the meantime, this same shield was being prepared for a second trial.

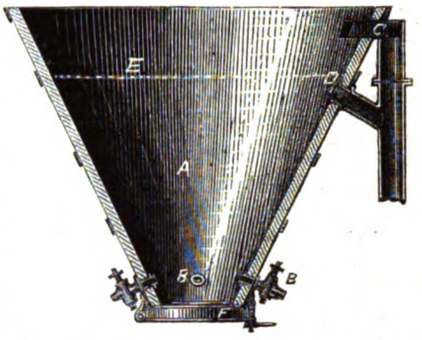
This took place on the 19th of December last. The preparations chiefly consisted in attempts to guard against the snapping of the bolts. The inner half of the outer plate at the boltholes was bevilled away to a diameter of 4in., which diameter was continued through the second plate and the inner skin. The 3in. bolt was then surrounded by a packing of ash wood. The conical heads of the bolts were smeared with emery (?) to prevent them from drawing! Behind the inner skin were fixed washers, underneath the nuts, and some 8in. square. These washers consisted of a patent cork material, already described in our pages. The second series of experiments, conducted on the 19th, consisted of four rounds from the Woolwich 9in. gun, one round from the 15in. Rodman—in all cases at seventy yards range. The first round from the 9in. gun, with a charge of 37lb., and with a Palliser shot of 248lb., hit the upper plate, creating a large gap in the 1½in. plate in the rear of the shield. The nut of one of the 3in. bolts was broken clean off. The second round, from the same gun and the same charge, with a similar projectile, hit on the opposite side of the embrasure. The depth of penetration in the shield was in this case 10in. Two of the H-girders were broken right through, and amongst the fragments lay several "bolt tails," as they are called at Shoebury. The two lower girders were also fractured.

The third round was from the 15in. Rodman gun, fired with 50lb. of L.G.R., or large-grained rifle powder, which is considered equal to 60lb. of American powder. The shot used was a cast-iron shot of 451lb. After grazing the ground for a distance of about 15ft., which of course much lessened its velocity, the shot hit on the lower plate near the left end, or the strongest part of the shield. It struck the head of a through bolt, the nut of which was consequently driven 60ft. to the rear. Large portions of the H-girders were carried away, one of the pieces measuring 2ft. 10in. by 7in., and another 22in. by 10in. Washers, nuts, bolt-tails, and rivets, were scattered around in one indiscriminate shower. The fourth round consisted of a Palliser shell, from the 9in. gun, propelled by the full service charge of 43lb. It struck fair in the middle of the shield and completely penetrated the target; a large triangular piece of the front plate being carried some 15ft. to the rear. Two bolts were broken at the threads, and a third twisted almost into a corkscrew. The rope mantlet in the rear, consisting of a matting of plaited ropes hung up to stop the fragments, was cut up by the pieces. The back skin (S) was thrown back and doubled out at right angles, and a piece of it, about 15in. square, was carried right away. The head of the shell was found some 15ft. to the rear of the target, together with fragments of the first and second plates, and several nuts and washers. The fifth and last round, similar in character to No. 4, hit the upper corner of the shield, one of the very strongest parts. It knocked out one of the Palliser bolts, but the shot stuck in the target.

IMPROVED METHOD OF TREATING ANIMAL CHARCOAL.

WHEN animal charcoal has been employed to decolorize syrups or saccharine solutions, it gradually absorbs lime and other earthy or alkaline substances, by which its decolorizing and absorbent powers are diminished. It then has to be cleansed preparatory to its re-use, and much care and skill are required in this operation, which is performed in various ways. The most recently-announced method is that patented by Mr. John Stenhouse, a chemist, of 17, Rodney-street, Pentonville, in conjunction with Mr. James Duncan, sugar refiner, of Clyde-wharf, West Ham, Essex.

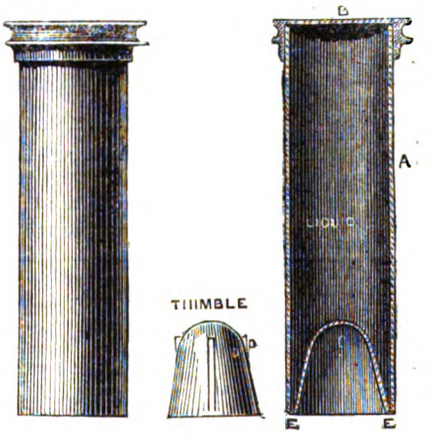
In carrying out their process the inventors take the used charcoal and wash it well with boiling water, and then introduce it into a suitable tank or cistern containing hot water slightly acidulated with nitric acid. The quantity of nitric acid used should not be more than sufficient to neutralize the lime and other earthy or alkaline substances present in the charcoal, as if an excess of the acid were employed it would di solve out a portion of the phosphate of lime, and thus injure the texture of the charcoal. It is necessary to ascertain by a preliminary experiment on a small scale the quantity of acid required in each case to neutralize the lime and other basic substances present in the charcoal, since their amount varies considerably. When the charcoal and acid solution have been digested from half an hour to one hour, which is best effected by blowing steam into the mixture, the saline solution, consisting chiefly of nitrate of lime, is removed, and the charcoal repeatedly washed with either hot or cold water until all soluble impurities are removed. When dry it is ready to be re-burned and is again fit for use. This process can also be advantageously applied to new animal charcoal before it has been used in sugar refining, as it removes impurities naturally present in the charcoal which diminish its discolorizing and absorbent properties.



The tank employed in washing the charcoal is shown in our engraving, which represents a sectional elevation of the tank and fittings. A is the vessel for holding the charcoal to be treated, which is constructed of wood, and is provided with sloping sides. In the sides of this tank near the bottom are fitted a series of cocks B B for the admission of steam or water under pressure. Near the upper edge of the tank is an overflow pipe C for the escape of the washings, and beneath this is a pipe and plug D for drawing off any excess of water from the surface of the charcoal, the level of which whilst under treatment is represented by the dotted line E; a flap door F is hinged to the bottom of the tank and secured by a fastening *a* for the purpose of discharging the charcoal after it has been cleansed.

CIRCLE MARKER.

THE present method of marking circles adopted by iron shipbuilders, boiler makers, &c., is clumsy, and is often the cause of bad and inaccurate punching. The annexed engraving shows an instrument recently invented by Messrs. Johnson and Woolley, and which gets over the above difficulty, and insures accuracy in marking circles for rivet holes on sheets, bars, &c., previous to being



punched. A is a piece of brass tubing, B is a brass top or lid screwed on to A, for the purpose of keeping the liquid in the tube, C is a brass thimble fitted into A by means of three ribs D D D cast on the thimble C. The tube A is filled with liquid whiting, which flows round the thimble C, and finds its way to the opening E E, and, when used, leaves the ring or circle required. By the use of this instrument the circles are clearly marked, and accurate and expeditious punching is so far insured.

As an illustration of the great amount of work done by screw colliers, it is stated that the "Haswell" (s.s.) made sixty voyages from Sunderland to London last year, forty-one of that number being made between the 20th of May and the end of December.

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A NEW SYSTEM OF LIGHTING.

A DISCOVERY has been made by a chemist of Paris which promises to supersede gas for illuminating purposes. The discoverer is an assistant to MM. Tessier du Mothay and Marechal, by whom a trial of the system has just been made in Paris with perfect success. The light produced is of the purest white, and admits of the most delicate shades being distinguished. The discoverer had no idea of inventing anything new as to the lighting of cities. He was merely experimentalising with the hope of discovering some means of taking photographs at night when he hit upon a new and magnificent light. The combustion of ordinary gas by oxygen is the principal secret of the process. A small cylinder of magnesium interposed in the centre of a jet in combustion becomes luminous, and produces a quantity of light measured at sixty times that which would be produced by ordinary gas, or about £2 3s. 2d. worth of gas for 7¼d. We have received from Paris the details of this invention, but only just as we were going to press, so that we are obliged to postpone their publication for a week.

PROPOSED CONFERENCE ON TECHNICAL EDUCATION.

IN the MECHANICS' MAGAZINE for December 20th last, we published a notice of a conference on Technical Education, which is proposed to be held at the House of the Society of Arts, in the Adelphi, on Thursday and Friday, the 23rd and 24th of the present month. The council propose the following programme of the topics for discussion at the meeting. As the council have reason to expect that the conference will be numerously attended, and it is only to sit for two days, it is thought desirable that it should deal rather with general principles than with details, and that the latter should be taken up more deliberately by the committee which it is proposed should be established:—

1. The necessity for improved national education for the working classes generally. (*a.*) Improved primary education, and the measures necessary for securing the same. (*b.*) Additional facilities in primary schools for affording the elder children the means of learning the elements of scientific knowledge.

2. The necessity for the establishment of schools for technical and industrial education in relation to science and art, in which pupils, after leaving the primary schools, may obtain instruction suited to the special industries with which they may be connected, as workmen, foremen, or managers.

3. The best measures for securing the foregoing object.

4. How far technical education can be promoted by the aid of existing educational endowments.

5. To request the council to appoint a standing committee of members of the Society of Arts and others, to take whatever steps may be required to advance the objects approved by the conference, and to send deputations to the Government, to support such applications as may seem desirable.

The chair will be taken each day at twelve o'clock, by William Hawes, Esq., F.G.S., chairman of the council.

Legal Intelligence.

COURT OF CHANCERY.

January 14.

(Before LORD JUSTICE LORD CAIRNS.)

BOVILL V. HITCHCOCK.

OUR readers are doubtless familiar with the numerous suits instituted by Mr. Bovill for the protection of his well-known patents for improvements in the manufacture of flour. The present application was an appeal from an order of the Master of the Rolls refusing an application by the defendant that the trial of certain issues of fact, in respect of which his Lordship had already ordered that the evidence in chief should be taken viva voce at the hearing, should take place before his Lordship with the assistance of a jury.

For the appellant, it was contended that, inasmuch as under the old practice of the Court of Chancery a patentee was always required to establish his patent at law, which involved a trial of questions of fact by a jury, notwithstanding the new Act (known as Sir J. Rolt's Act), which imposed on the Court of Chancery the duty of deciding questions at law, the defendant in a patentee's suit was entitled as a matter of right to have the questions of fact arising upon the patent tried by a jury. They also urged that there were questions of fact arising in the present case which, notwithstanding the frequent litigation which has taken place upon this patent, had never yet been submitted to a jury, and that the Master of the Rolls had in another case on the same patent expressed himself strongly in favour of the plaintiff.

Mr. Little and Mr. North appeared for the appellant, and Mr. Baggallay and Mr. F. Harrison for the plaintiff, but the latter gentlemen were not called upon.

Lord Justice Lord Cairns said that he thought that the effect of Sir J. Rolt's Act was to throw on the Court of Chancery the duty of deciding legal questions, but that that duty was to be discharged according to the ordinary practice of the Court. No abstract right was given to the parties to demand a jury. It appeared to his Lordship to be a fallacy to say that under the old practice the Court required in patent cases the verdict of a jury. What the Court did require was the judgment of a court of law upon a question of legal right, which the Court of Chancery had then no jurisdiction to determine. The verdict of a jury was merely an incident of the proceedings at law. It appeared, therefore, to his Lordship that under the present practice the question whether there should or should not be a jury must be determined upon the facts of each particular case. With regard to the argument that the Master of the Rolls had already expressed an opinion in favour of the patent, that would be an argument for the case not being heard by him at all, which, however, was not the present application. The Master of the Rolls' attention had been called to what he had said in favour of this patent in the previous case, and, notwithstanding that, his Lordship (the Master of the Rolls) thought that this case could be conveniently tried before himself without a jury. Except on this ground, it had not been argued that the case could be determined better with the aid of a jury than without. Though his Lordship entertained very great respect for the institution of the trial by jury, yet his experience in patent cases led him to think that many points in those cases could be better determined by a judge without the aid of a jury. His Lordship would always be unwilling to interfere with the discretion of a primary judge as to a trial to take place before himself unless there was a very strong reason for doing so. Appeal dismissed with costs.

COURT OF EXCHEQUER.

January 13.

(Sittings in Banco, before the LORD CHIEF BARON, MR. BARON MARTIN, MR. BARON CHANNELL, and MR. BARON PIGOTT.)

PLATT AND OTHERS V. HIGGINS.

THIS was a patent cause tried in June, 1865, when all the issues were found for the plaintiffs.

The plaintiffs are patentees of improvements in carding engines, relating to the use of clearing combs for clearing the working rollers of the machine.

The defendant moved for a new trial on the ground that carding engines constructed with rollers and clearing combs, like those patented by the plaintiffs, were described in the specification of a patent of a Mr. Birch, dated 1837, and the defendant contended that as he had only used Birch's improvements, there was no evidence of infringement, or of the novelty of the plaintiff's patent.

Mr. Grove, Q.C., and Mr. Aston showed cause against the rule, and Mr. Manisty, Q.C., and Mr. Macrory supported it.

COURT OF ADMIRALTY.

January 14.

(Before the RIGHT HON. SIR R. PHILLIMORE.)

THE "GREAT EASTERN."

TWO cases were heard in connection with this unfortunate vessel. The first was a suit for repairs and necessaries, and came before the Court upon a motion for leave to file an answer to the amended petition. The defendants, the owners of the "Great Eastern," contend, firstly, that, as a matter of law, they are not liable for the repairs and alterations in question; and, secondly, upon the facts, that such repairs and alterations were done in such an unworkmanlike manner as to be of no benefit to the ship. They, therefore, asked the Court to allow them to plead the whole case, so that if upon the hearing the question of law were decided against them they might upon the facts of the case raise the question of their liability. It was suggested by the Court and agreed to by counsel, that the defendants' answer should be filed, and that another application should be made to the Court for direction as to how the facts of the case should be dealt with.

The second cause heard was a wages suit, in which the pleadings had been filed, and annexed to the defendants' answer were two schedules, the first being a list of the seamen who had accepted sums of money in discharge of their claims, and the second those whose claims were still outstanding, and in respect of which a sum of money had been paid into court. Since the filing of the pleas certain of the persons on this list had accepted sums of money in discharge of their claims.

The Court was now moved to allow the defendants to remove the names of the persons in question from the second list, and to add them to the first. This was opposed on the ground that the men, being very needy, had, without the knowledge of their solicitor, consented to accept the defendants' offer, and that, although they had signed a release, they were not thereby debarred from continuing parties to the suit.

The Court allowed the transfer of the names without prejudice as to the sufficiency of the release.

Mr. V. Lushington appeared for the plaintiffs, and Mr. C. P. Butt for the defendants in both suits.

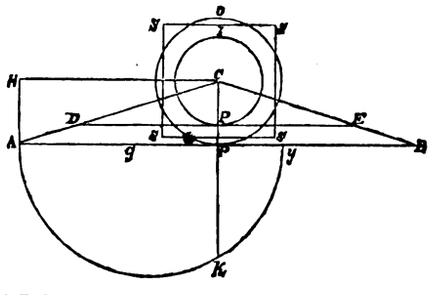
Correspondence.

SQUARING THE CIRCLE.

LETTER II.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The area of a circle is equal to that contained between two parallel lines whose joint length is equal to the length of the circumference and distance apart equal to that of the radius. Let the bases A B and D E of the triangles A B C and D E C equal the lengths of the circumferences of the circles O and I respectively. As A B is equal to O, and D E is equal to I, and being upon a common parallel P P; therefore, the area contained between the two bases is equal to that contained between the two circles (equal areas are contained between equal parallels of the same length), and the same would be true of any other circles described within I until terminated in a central point; therefore, the circle O and the triangle A B C have equal areas. Again, the circle O has the same relative proportion to I which the base A B has to D E, but the areas contained between them are equal; therefore, the remainders are equal, i.e., the circle I is equal to the triangle D E C. Then the circle O contains an area equal to the triangle A B C, and is equal to fig



A P C H, which is two straight parallel lines of a joint length equal to the circumference of the circle O, their distance apart being that of its radius C P P. The proportional line K is formed by taking the mean of length and height, and with it G as a centre describing the semicircle A K Y. A line let fall from P to K gives the side of the square S S S S, which is the square of the circle O, and as far as I can see geometrically proved. But upon that point I shall reserve my felicitations, seeing the fate of Mr. Harvey, until it has received the sanction of some of your able correspondents, and gone through the public mill. In my next I propose to approach the circumference.—I am, Sir, yours, &c.

JOSEPH A. NICHOLSON.

3, Adelaide-place, London-bridge,
January 14.

SQUARING THE CIRCLE.

SIR,—I have been both interested in and amused by the discussion in the MECHANICS' MAGAZINE upon the question of Circle Squaring. I do not propose to enter upon the matter at any length, but simply to observe that I think Mr. Harvey has more or less muddled the matter. The strongest arguments against him, to my mind, is summed up in the following question—What would be the worth of our "Nautical Almanac" if he were correct?—Yours, &c. R. N.

Pembroke, January 12.

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Meetings for the Week.

MON.—Royal United Service Institution.—At 8.30 p.m. Major G. B. Fosbery, V.C., H.M. Bengal Staff Corps, on "Explosive Bullets, and their Application to Military Purposes."

Society of Engineers.—Presentation of Premiums for 1867, and President's Inaugural Address, at 7.30; also a Special General Meeting for Consideration of Rules, at 8.30.

Royal Institute of British Architects.—At 8.—Mr. Edward I'Anson on "The Architecture of Moscow."

TUES.—The Institution of Civil Engineers.—At 8 p.m.—Renewed discussion upon the papers on "The Victoria Bridge," and on "New Railways at Battersea, etc."

FRI.—Royal Institution.—At 8 p.m.—Professor Tyndall on "Faraday as a Discoverer."

SAT.—Royal Institution.—At 3.—Professor Roscoe on "The Non-Metallic Elements."

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10s. half-yearly, payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—Messrs. S. Bros.—G. W. H.—T. J. T.—J. N.—J. B.—D. V.—F. N.—H. S.—A. G. S.—R. J.—R. F. F.—M. J.—P. T.—F. H.—H. W. D.—R. F.—J. B. T.—T. C.—G. E. P.—C. W. S.—W. A.—Messrs. C. and C.—A. W.—B. R.—P. E. C.—C. H.—S. N.R.—M. B.—W. P. M.—J. B. P.—R. G. S.—S. A.—W. P. N.—Messrs. L. H. and Co.—J. M.—L. C.—W. W. K.—J. G. A.

Want of space obliges us to defer the publication of a long letter from Mr. Harvey, as well as several other communications, until our next.

Naval, Military, and Gunnery Items.

THE next examination for direct commissions will begin on the 1st of April.

THE "Arrogan," recently sold out of the navy, has left Portsmouth harbour for the shipbreaker's yard on the banks of the Thames.

THE tree at Yokohama under which Commodore Perry, United States' Navy, signed the original treaty with the Japanese, has been cut down, to make way for the residence of the British Consulate.

IT is rather ridiculous to read of H.M. ships "Buster" and "Monkey" doing solemn duty here and there. Could not the godfathers of H.M. ships find more dignified names than they do for some vessels of our fleet?

THE Royal Mail Company's steamship "Seine," just arrived, made the passage home with one wheel only, having broken the port paddle shaft 200 miles south of Bahia, and remained four days at Bahia securing wheel.

A TOULON letter in the "Messager du Midi" announces that fears are entertained of the loss of the French war corvette "The Rolland," 400 horse-power, eight guns, and 195 men. Having been caught by a squall while off the coast of Syria, she was driven ashore, and was considered in danger. The crew were saved, as were also the ship's stores.

THE Austrians have lately made experiments at Fiume with a new species of torpedo, the peculiarity of which is, that it can be set in motion under water, and directed against the object to be destroyed. Its use therefore, if successful, will by no means be confined to the defence of coasts and harbours, as it may be equally well employed in the open sea.

THE erection has been commenced of a landing stage and pier on the Thames bank in the Royal Arsenal marsh, for the purpose of discharging building materials for the construction of seven bomb-proof magazines, with a view of insuring an additional precaution against accidents in the preparation of live shells.

WE understand that the Government have either concluded, or are on the point of concluding, an arrangement with the Irish Lights Board to blast down Daunt's Rock, the dangerous obstruction at the mouth of Cork Harbour, on which the "Research" was injured, until there shall be at least thirty feet of water above it at low water.

IT is stated that The Colt Patent Firearms Company at Hartford, Connecticut, has made a contract with the Russian Government for the manufacture of 30,000 Berdan rifles within eighteen months. They have also made a contract with the Prussian Government for 100 Gatling revolving cannon, and some of these guns are also to be built for Russia.

MARINE disasters, by fire, wreck, collision, or other accident at sea, during 1867, happened to 536 American vessels, all of which have been totally lost, and, excluding their cargoes, were valued at 21,742,200 dollars. This is a large falling off from 1866, when 571 vessels, valued at 33,794,300 dollars were lost at sea.

THE "Elk," another composite-built, unarmoured gunboat of 463 tons, has just been launched from Portsmouth dockyard. The "Elk" will carry as her armament one 64-ton muzzle-loading rifle, and one 40-pounder breech-loading rifle. Her engines will possess a combined total nominal power of 120-horse, and will drive a pair of three-bladed twin screws.

THE Hamburg-American Company's screw steamship "Germania," Captain H. F. Schweusen, sailed from Southampton last Friday for New York, with English, French, and German mails. This is the first departure of this line under the new contract with Her Majesty's Government, and the steamers will continue to leave that port every alternate Friday until the end of February, after which they will sail every Friday.

THE "New York Tribune" has a despatch from Washington which states that, notwithstanding the abrupt termination of the Alabama claims correspondence between Lord Stanley and Secretary Seward, information has been received there that Mr. Thornton, the new British Minister, goes out empowered with full authority to reopen the question, and will present for the consideration of the United States a new plan of adjustment.

THE "Blanche," recently commissioned at Sheerness, was taken for a preliminary run on Thursday week, previous to the trial of her machinery on the measured mile. The vessel was timed on the mile for two runs, when an average speed of upwards of 13 knots was attained. The engines, built by Messrs. Miller and Ravenhill, worked exceedingly well, and it is believed the vessel will answer the utmost anticipations of her designer.

FROM Japan we learn that Osaca and Viogan, or the inland sea, were to be opened to foreign commerce on the 1st of January, 1868. The new port to be opened on the west coast of the empire is Neagata; but the harbour at that place being unsafe for foreign ships coming in, that of Ebisunito, on the island of Sado, thirty miles distant, is to be made the port of entry in its stead. This port and harbour are to be opened on the 1st of April.

WE are glad to be able to report that the Floating Obstruction Committee have at last carefully investigated the principle of Captain Harvey's Torpedo. We believe that they are so favourably impressed with its merits as to direct some trials to be made with it. We are glad to learn this, as well for the gallant Captain's sake, who has so untiringly devoted himself to its development, as for that of the country, which stands in a fair way of possessing the most perfect weapon of its kind extant.

THE actual waste of seamen in the financial year ending with March, 1867, was 4,077—viz., 1936 from casualties (death, invaliding, desertion, discharges with disgrace, by purchase, or on pension), and 2,141 by being paid off to the shore, or other causes. In the same year there were 1,899 entries from the training ships for boys into sea-going ships, and 95 men were otherwise entered in the navy, men of the "pure seamen" class. The actual number rated in the year as ordinary seamen, of the pure seamen class, was 2,399. The average number of boys in the training ships in the year was 2,811; in the last quarter of the year, 2,967. The actual number rated as ordinary seamen, pure seamen, was only 1,899 in the year 1864-65, and only 1,470 in the year 1865-66; and the waste of seamen was as many as 5,328 in the former of these two years, and 4,369 in the latter. In both respects, and also in the number of boys in the training ships, and the number transferred thence into seagoing ships, the latest year, 1866-67, shows much the best account.

Miscellanea.

THE imports of bullion for 1867 were £25,000,000, against £34,000,000 for 1866, while the exports were £14,000,000, against £22,000,000 for 1866.

THE railway from Nice to the Italian frontier, belonging to the Paris, Lyons, and Mediterranean Company, is now completed.

DURING the past week broccoli was despatched from West Cornwall to London and the chief provincial markets at the rate of seventy to ninety crates a day.

IT is understood to be the intention of Government to confer a title on Professor Wheatstone, in consideration of his great scientific attainments and of his valuable inventions.

THE lava is still flowing copiously from the crater of Mount Vesuvius. The stream of lava is from 7 to 8 metres high and from 50 to 60 broad. Shocks and explosions are frequent, and it is not likely that the eruption will soon cease.

THE police reports of New York city show that during the year ending November 1, 79,925,000 persons crossed over the ferries leading from that city to Brooklyn, Jersey city, and the other towns around New York bay. This vast number is double the population of the United States.

FOUR locomotives will be shortly at work in Abyssinia upon the railway formed in connection with the English expeditionary force now in that country. Two of these locomotives were obtained from the Kurrachee Harbour works, one from the Bombay, Baroda, and Central India Railway, and one from Messrs. Wells and Glover.

ON Monday, a boiler explosion occurred at Beckworth Colliery, near Newcastle. Though considerable damage was done to property, fortunately no lives were lost. The boiler that exploded was only erected a few weeks ago, and was employed in generating the steam required at the mouth of the pit. The men at work escaped by means of a shaft in another part of the workings.

AN extraordinary phenomenon is reported from Niagara Falls. A strong wind so pressed back the waters of Lake Erie that the waters of the falls fell twenty feet. The American fall could be passed on foot. A great many curious and unsuspected rocks and holes were revealed, and the pit below the falls presented a wonderful appearance. Such a decline of the waters has never been known before.

THE Society of Arts has issued invitations for a Conference on "Technical Education," to be held in its rooms on Thursday and Friday next week. A very full meeting is expected. Earl Russell, Earl Granville, representatives from various Chambers of Commerce, and other public bodies, and mayors of towns, the seats of leading industries, have already signified their acceptance of the Society's invitation.

THE Seine is entirely frozen over, a circumstance which has not occurred for twenty years. The accounts from the departments announce that the Loire is floating down a quantity of ice; the Saone is frozen over at Lyons between the Pont de Serin and the Pont Mouton; the Rhone is beginning to send down large blocks; the Sarthe and the Breante are frozen over in several places, as is the Indre at Nantes.

A CHRISTMAS treat was lately given to the aged poor of Bideford, Devonshire, by Mr. Pridham of that town. Twenty of those present were upwards of eighty years of age, and several of them were veterans who had fought at the Nile, Trafalgar, and Waterloo. One of them, John Barry, is ninety-three years of age; he fought in most of the Peninsular engagements, and was in Picton's brigade. His faculties are wonderfully vigorous.

THE number of passengers conveyed in Belgium during last September was 1,398,907, with 543,917 tons of heavy goods, 11,669 of parcels, and 85,152 packages of specie. The receipts were 3,622,013f., of which passengers produced 1,676,079f.; heavy goods, 1,458,547f.; parcels, 235,161f.; luggage, 92,981f.; bullion, 19,958f.; and horses, cattle, &c., the rest. The total sum shows an increase of 503,800f. over the same period in 1866.

A SMUGGLER'S cave has been discovered in Ireland. A pier has just been finished on the shore below Kilkeel, where a small river empties itself into the sea. The men employed in removing the shingle to enlarge the accommodation, came on an old cave roofed and full of tobacco. Some forty or fifty rolls were perfectly useless. It must have been upwards of twenty years buried, and is at the spot where the fishing boats are drawn up. Nobody seems to know anything respecting it.

DR. CHADWICK, who formerly resided and practised at Bolton, intends to offer £10,000 to be applied to the erection of working men's model cottages in that town, the rentals from which are to be devoted to the maintenance of an orphanage which he proposes to erect. In the first instance, the orphanage will be for the admission of girls, but it will ultimately be extended so as to receive boys; and to carry out this benevolent design a sum of about £17,000 will be required,

A CURIOUS phenomenon was noticed at Blackheath, on Saturday last. Rain had fallen for some hours; and a frost supervened, upon which every leaf was covered with a coating of ice, having an icicle depending from the tip. The whole icy coating was separated from the leaf without breaking, being a facsimile of the leaf in ice, with every vein and indentation clearly marked. These delicate casts appeared as if moulded in glass, and retained for a time all the form and character of the leaves from which they were severally taken.

THE plan of a railway connecting Dalmatia with the Brenner Pass has now been adopted, and arrangements have been made for completing the line by 1870. It is to pass from Fiume by St. Peter, Laibach, Villach, and Franzensfeste, where it will join the Brenner line. The construction of the railway would make Franzensfeste an important strategical point, and the Austrian Government has accordingly ordered the fortifications in the district surrounding it, especially those in the direction of the Pusterthal and of Brixen, to be considerably strengthened.

THE large slate quarries of Grands-Carreaux, France, have just been entirely buried by an earthslip, and three lives lost. The works on the previous evening were observed to be in a dangerous state, and all the labourers were withdrawn. Eighteen hours later the overseer, named Choinet, and two men were engaged in fixing barriers to pre-

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vent anyone from approaching the entry, when the earth sunk in beneath them for an extent of two acres, and to a depth of 200ft., and buried them in the ruins. Their bodies have not yet been recovered. The material loss is estimated at £8,000.

A NEW YORK paper publishes a special dispatch from Havana, to the effect that the Spanish Government has offered, through the American Minister at Madrid, to sell to the United States the islands of Cuba and Porto Rico. The price asked is 150 millions of dollars, in gold, payable in three equal instalments, the first payment to be made when the treaty is signed, the second, one year thereafter, and the last at the end of six years. The inhabitants of those islands are represented as being generally in favour of transferring their allegiance.

THE visitors to the South Kensington Museum during the week ending January 11, were:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., 5,749; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,237; total, 6,986. Average of corresponding week in former years, 9,832. Total from the opening of the museum, 7,143,810. Patent-office Museum, South Kensington.—Number of visitors for the week ending January 11, 2,341; total number since the opening, free daily (12th of May, 1858), 1,229,196.

MR. BIGELOW, late United States Minister to France, discovered in Paris, and took back with him to America, the original MS. of Benjamin Franklin's Autobiography, from which it appears that in the edition of 1817 large and many important portions of the original were omitted. Among other things not yet published, is a graphic account of Franklin's negotiations with Lord Grenville and Lord Mansfield concerning the taxation of English proprietors in Pennsylvania, on his first visit to England as agent of that colony. Mr. Bigelow is going to prepare an edition of the autobiography.

THE North-Eastern Railway has tired of the ten hours' system. It will be remembered that on the occasion of the strike last spring one of the points conceded to the engine-drivers and firemen was ten hours per day and two hours the quarter day overtime. This has been found not to work, and this month the old system of 12 hours per day and 2½ the quarter over has been re-established. The money paid to the men per day will be the same, but some of the men who struck, and were afterwards re-employed at reduced wages, will be a little better paid. It is said the return to the old system is by way of experiment for a month.

THE tone of the Belgian iron trade appears to have slightly improved of late. The Montigny sur Sambre Company, which had only one furnace lighted, has just brought a second into operation. The affair which is at present exciting the most interest on the Belgian markets is a contract for 25,000 tons of rails required for the Poti and Tiflis Railway (Russia). As the Russian Government is energetically promoting the development of new railways on its territories, while the Prussian and Austrian Governments are pursuing a similar policy, there can scarcely fail to be an increased demand for railway iron in Europe this year.

THE following is the list of subjects offered by the Belgian Academy of Sciences, Arts, and Literature for prizes of 1,000f. each in the section of the fine arts for the year 1868.—First: An historical account of medal engraving in Belgium from the sixteenth century to the year 1794, embracing all the country at present belonging to Belgium, and including the biography of the artists as well as a criticism on their works. Second: An inquiry respecting the period at which the architecture in the Low Countries was affected by Italian influence, with indications of the persons to which such influence is attributable, and citations of works in illustration of the same.

SOME statistics collected by the Mons Chamber of Commerce show that the coal production of Belgium amounted in 1866 to 12,774,000 tons, of which 9,851,000 tons were raised in the province of Hainaut, 359,000 tons in the province of Namur, and 2,564,000 tons in the province of Liege. The exports of coal from Belgium to France amounted, in 1866, to 3,880,848 tons, as compared with 3,453.589 tons in 1865. The exports to Holland declined to 137,700 tons in 1866, as compared with 195,700 tons in 1865. The internal consumption of coal in Belgium amounted in 1866 to 7,842,450 tons, as compared with 7,506,000 tons in 1865, showing an increase of 346,450 tons; the increase in 1865 over 1864 was 380,850 tons.

THE Chiltern hills were on Saturday visited by a severe storm. The trees and hedges were covered with ice to the thickness of half an inch in the more exposed places. The trees were frozen so stiffly, that, in spite of a strong wind, they stood perfectly motionless. The houses and buildings were coated with ice on their southern aspects, giving the appearance of a glass glaze; the glass in the windows was also thickly coated. The icicles on the gates produced an extraordinary effect, every bar being covered with ice, from which were suspended rows of icicles six inches long. These could be counted by hundreds—not hanging straight down, but all inclining at an angle of about 30 deg., with the most perfect regularity, to the north, or away from the wind.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—1558, 1574, 1584, 1686, 1592, 1615, 1629, 1637

BUILDINGS AND BUILDING MATERIALS—1548, 1569, 1598, 1613

CHEMISTRY AND PHOTOGRAPHY—1526, 1553, 1556, 1603, 1617

CULTIVATION OF THE SOIL, including agricultural implements and machines—1535, 1546, 1563, 1568, 1571, 1573, 1585, 1618

ELECTRICAL APPARATUS—1531, 1532, 1565, 1583, 1611

FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—1544, 1555, 1582, 1599, 1602, 1608, 1609, 1636

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1527, 1580

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1522, 1533, 1545, 1587, 1588, 1601, 1607, 1619, 1622, 1634

GENERAL MACHINERY—1523, 1524, 1525, 1534, 1540, 1551, 1561, 1600, 1604, 1633

LIGHTING, HEATING, AND VENTILATING—1572, 1595, 1597, 1610, 1616, 1628, 1638

METALS, including apparatus for their manufacture—1549, 1550, 1559, 1606, 1635

MISCELLANEOUS—1530, 1535, 1537, 1538, 1541, 1552, 1554, 1557, 1560, 1564, 1570, 1578, 1581, 1589, 1591, 1605, 1614, 1621, 1623, 1624, 1629, 1631, 1632

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1543, 1579

SHIPS AND BOATS, including their fittings—1567, 1620, 1627

STEAM ENGINES—1529, 1539, 1547, 1594, 1596

WARFARE—1521, 1590, 1612, 1625, 1626

1521 W. J. MURPHY. *Improvements in breech-loading firearms and cartridges.* Dated May 22, 1867.

In performing this invention the inventor proposes to attach to the breech end of the barrel of the gun or rifle a cartridge holder open at both ends. This cartridge holder is to swing on a pivot or spindle at any angle that may be required, so as to make it swing either above or below or through the side of that part of the breech made for its reception. On the cartridge holder, near where the spindle enters the swinging point or eye, will be cut two teeth, one tooth to keep the cartridge holder in its proper position when firing, the other to act as the half cock, as, until the cartridge holder passes the last tooth, it will be out of the centre, and the needle or striker, although on full cock, if it should go off accidentally, will only strike the side of the cartridge, and not the cap. On the spindle alluded to a spiral spring will press in so as to work into the teeth on the cartridge holder. When the spindle is drawn out, the teeth will be free, and if the cartridge holder be set in the side, it will swing out by its own weight ready for the introduction of a fresh cartridge, which will be introduced from the rear and push out the empty shell remaining in the holder after the explosion.—Patent abandoned.

1522 R. S. MOSS. *Improvements in wearing apparel.* Dated May 22, 1867.

Provisional protection has not been granted for this invention.

1523 W. BROOKES. *An improved lubricator.* (A communication.) Dated May 22, 1867.

This invention consists in the employment of a glass reservoir and glass tube furnished with two cocks, one to regulate the exact supply required, and the other to cut off the supply when needed.—Patent abandoned.

1524 A. M. CLARK. *An improved fabric for the manufacture of machine belting, and for other purposes.* (A communication.) Dated May 22, 1867.

This invention is not described apart from the drawings.—Patent completed.

1525 J. M. KAUFMANN. *An improved means or apparatus to be used for travelling through the atmosphere, and on land and water, part of which apparatus is equally applicable to other purposes.* Dated May 22, 1867.

This invention is too voluminous for insertion.—Patent abandoned.

1526 W. E. NEWTON. *Improvements in portable photographic apparatus.* (A communication.) Dated May 22, 1867.

This invention has for its object the construction of a convenient form of portable apparatus for taking views. The apparatus consists of a small circular box for containing fifty or more prepared glasses, and second of a camera resembling an opera glass. The two tubes of the opera glass are furnished with two lenses exactly similar in focus. One of these serves to project the image to be taken on to the ground focussing glass, which occupies the large part of the tube; the other to produce the image on the prepared glass plate, which occupies a small dark chamber formed in the opposite tube. The circular box in which are arranged the prepared glass plates is pushed over an opening in this chamber provided with appropriate grooves; the doors of the box and of the dark chamber are simultaneously opened, and a prepared glass plate falls from the box into the dark chamber. When the view has been taken, the apparatus is turned upside down, and the glass plate which has been exposed will fall back into its place in the box, which is then removed. The door of this latter closes, and a small movement to the right or left brings another prepared glass plate over the door and the opening in the camera.—Patent abandoned.

1527 A. MARTIN. *Improvements in preserving grain, and in the construction of the granaries to contain the same.* Dated May 22, 1867.

This invention has reference to the preservation of grain from the attack of insects, and consists, mainly, in so constructing the granary as to render it completely air-tight, some suitable gas or vapour being introduced which is destructive of insect life.—Patent completed.

1528 A. A. HELY. *Improvements in machinery for obtaining pressure.* Dated May 22, 1867.

This invention has for its object the combination of percussive force with hydraulic power for pressing and compressing purposes. The hydraulic parts of the machine consist of a head, support, cylinder, ram, and base, as usual, with one or more intermediate receptacles for holding the substance or material to be pressed or compressed sliding upon the supports between the pressing ram and the resisting head of the machine. According to one combination, the patentees employ a platten or false movable head placed under the resisting or main head of the machine, having one or more plungers or pistons working either through or outside the said main head, and having one or more weights, or one or more steam or other hammers, placed above the one or more plungers or pistons, so as to fall or strike upon or against it, and thereby cause the platten or false movable head to exert percussive force upon the substance or material contained in the one or more receptacles of the machine.—Patent completed.

1529 E. W. HUGHES. *Improvements in rotary engines and pumps.* Dated May 22, 1867.

Hitherto much difficulty has existed in the production of a complete rotary engine in which action and reaction are equal, and there is no loss while the piston is passing the valves; also in turbines from the rush of water only being made available; and in pumps and exhausters from the column of water not being kept always in motion, but constantly checked and started again. Now the object of this invention is to overcome these difficulties, and produce a complete rotary engine which maintains the action and reaction always the same, and all the pressure that is employed therefore effective, the pressure of the power always acting continuously according to the area of the piston and the pressure employed. The inventors accomplish this by means of an annular cylinder in which rotates a piston made tight, and carrying round with it on either side an induction and an eduction pipe; these pipes connect with the centre pipe, which also forms the axis and medium of motion. In this cylinder are placed two or more valves, as may be required, which are withdrawn as the piston passes.—Patent abandoned.

1530 F. H. JOHNSON. *Improvements in gas blow-pipes, and in blow-pipe torches or flames.* Dated May 23, 1867.

One part of this invention consists of an improved gas blow-pipe, whereby the gas jet or flame can be increased or diminished with the greatest nicety. Another part of the invention consists of an improved flame or torch holder to be used with the improved, or with any other blow-pipe, or the gas connecting tube pipe separately or combined therewith.—Patent completed.

1531 M., R., and M. THEILER, jun. *Improvements in telegraphic instruments and electric clocks.* Dated May 23, 1867.

This invention consists, first, in a mode of making electro-magnets and armatrices, the latter either of soft iron or of magnetized steel, by means of which a double motion can be given to a bar or needle, similar to that of an ordinary galvanometer or needle instrument, the needle dropping into its original position from either side as soon as the current ceases. The invention consists, second, in a peculiar kind of needle instrument, the whole contained in a circular, oval, or square box, which can be made so small and light as to be put in a pocket, and to be used if desirable in any position, and without any fastening to a base.—Patent abandoned.

1532 C. W. SIEMENS. *Improvements in the means and apparatus employed for conveying telegraphic dispatches, letters, and other light articles, through tubes.* (Partly a communication.) Dated May 23, 1867.

The present invention has for its object to obviate certain defects in the ordinary pneumatic apparatus by the establishment of a system of pneumatic tubes of comparatively small diameter, and, consequently, of an inexpensive nature, so arranged that, while the carriages or pistons travelling in the same are correspondingly of small dimensions, and, consequently, require no great power to propel them. The smallness of the capacity of these carriages is compensated for by the rapidity with which they may be dispatched in quick succession.—Patent completed.

1533 O. RODOLPHE. *A table with double face and surprise.* Dated May 23, 1867.

This invention is not described apart from the drawings.—Patent abandoned.

1534 A. M. CLARK. *Improvements in typographic printing machines.* (A communication.) Dated May 23, 1867.

This invention is not described apart from the drawings.—Patent completed.

1535 E. HOWELL and T. HARDY. *Improvements in turnip or root-cutting machines.* Dated May 23, 1867.

This invention consists in adding a small cylinder or barrel which is placed in juxtaposition to the main cylinder or barrel of the machine, and which small cylinder or barrel revolves in the recesses through which the uncut pieces of root have hitherto passed, thus effectually preventing the slabs of the roots from going through the machine without being cut into finger pieces.—Patent completed.

1536 S. and T. ATKINSON. *Improvements in machinery for folding paper.* Dated May 23, 1867.

This invention relates to machinery for folding the sheets of paper used in the manufacture of books, also for folding newspapers, circulars, letters, and other sheets of paper requiring to be folded uniformly, and the improvements consist of a rectangular or other suitable form of framework, the top part forming a hopper of suitable size, according to the size of the sheets of paper to be folded. A horizontal platform in two parts is provided in this hopper to support the papers, and a pair of india-rubber rollers, having slightly roughed surfaces, are placed side by side betwixt the two parts of the platform with their upper surfaces level or even with the upper surface of the platform, and their point of contact in the middle of the hopper, or at the place where the fold or crease in the paper is required to be made. The two parts of the platform are hinged to the hopper, and operated by a cam

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so as to alternately raise the paper clear of the rollers, and then lower it into contact with the rollers, which, having rotary motion, seize and draw the undermost sheet by its middle in betwixt them, folding or doubling it. As it emerges from these rollers it is conducted by tapes or other suitable guides to another platform, when it is pushed by a suitable instrument into contact with another pair of india-rubber rollers which draw it in betwixt them, as in the former case, folding or doubling it in another place, and as it emerges from them it is again conducted to another platform and pushed into contact with another pair of rollers between which it is drawn in like manner, as in the former cases, thus folding it a third time, and for any further number of folds required an additional platform and rollers may be employed.—Patent completed.

1537 C. E. BROOMAN. *Improvements in kilns or furnaces, particularly applicable for burning plaster of Paris.* (A communication.) Dated May 23, 1867.

The chief features of this invention are:—First, the distribution of the crude plaster or material in a state of powder upon two inclined surfaces heated by two fireplaces to commence the burning of the plaster. Second, the combination of the burning by the successive fall or descent of the plaster upon inclined surfaces, which are continued in a zig-zig manner to the bottom of the kiln, the said inclined surfaces being heated by a main fireplace at the bottom. Third, the escape of the steam or vapour from the plaster which is being burnt by tubes or passages in the side of the apparatus leading through the brickwork. Fourth, the continuous working of the kiln for burning crude plaster in powder. Fifth, the final fall of the burnt plaster into a receptacle formed underneath the apparatus.—Patent completed.

1538 T. G. GREEN. *Improvements in the manufacture of articles of earthenware.* Dated May 23, 1867.

The object of these improvements is to economize the production of articles made of earthenware by using an inferior or inexpensive body or material as the foundation or basis for a complete facing or covering of superior body or material, except where any portion of the body or basis may be desired to be exposed for ornamental effect, the same being most suitable for large pieces of ware requiring a considerable quantity of material for their construction.—Patent completed.

1539 A. V. NEWTON. *An improved feed-water arrangement for the tenders or water tanks of locomotive engines.* (A communication.) Dated May 23, 1867.

This invention consists of the employment of two branch pipes from the tender to the engine, by one of which steam can be blown in whilst water is being delivered by the other.—Patent abandoned.

1540 L. STUCKENSCHMIDT. *Improvements in the means of and apparatus for landing, trans-shipping, or discharging grain and other substances in or from ships, vessels, granaries, or warehouses, and for taking or drawing samples of grain from granaries.* Dated May 23, 1867.

According to this invention a travelling elevator is employed which is capable of being moved along the front of the wharf, granary, or warehouse, on rails provided for the purpose, so that the cargoes of barges or vessels that may be aground may be discharged and stored in the granary.—Patent completed.

1541 H. BLACKHAM. *Improvements in the manufaacture of spectacle frames.* Dated May 24, 1867.

This invention relates to D-eye or other side folding spectacle frame where a top eye is used in addition to the ordinary bottom eye, and consists in attaching the top eye to the bottom eye by means of a double joint, and in securing the springs to the top eye in any convenient manner, the object being to attach the spring to the top eye in a permanent manner, instead of pointing it to the bottom eye.—Patent abandoned.

1542 J. M. MUTERSE. *A process for extinguishing fires by means of cartridges composed of the most improper materials to combustion, diluted in water, for projecting on fire.* Dated May 24, 1867.

The principle of this invention is founded upon the extinguishing property of chloridric acid gas. The extinguishing cartridges are made with the residuum of salt pits or marshes.—Patent abandoned.

1543 C. MARTIN. *Improvements in railway buffers.* Dated May 24, 1867.

According to this invention the inventors arrange the buffers to act in pairs, one of the buffers being fixed to the buffer plank, and being formed with a recess into which the end of the spring buffer is received. The fixed buffer is bell-shaped, or the sides of the recess are so formed as to guide the end of the spring buffer into it, and towards the centre of such fixed buffer.—Patent abandoned.

1544 T. W. HELLIWELL. *Improvements in looms for weaving, and in apparatus connected therewith.* Dated May 24, 1867.

This invention cannot be described without reference to he drawings.—Patent completed.

1545 G. M. WELLS. *Improvements in apparatus to be employed in the manufacture of boots and shoes.* Dated May 24, 1867.

This invention relates to the sockets or holders and standards or supports employed for holding the lasts during the process of making and finishing boots and shoes, and has for its object affording facility for placing or adjusting the last in any convenient position required by the workman, and consists in mounting the standard which carries the last in a revolving socket, whereby the last is free to be rotated horizontally so as to bring any side in front of the workman.—Patent abandoned.

1546 L. SLATTER. *Improvements in cases for packing and transporting butter and other dairy produce.* Dated May 24, 1867.

For this purpose the inventor provides shallow cases on trays of wood or other material. The fronts of these cases are provided with rebates at each end taking into grooves in the sides of the case, from which they are easily lifted out at the time of tilling or emptying the cases.—Patent abandoned.

1547 A. M. CLARK. *Improvements in steam generators.* (A communication.) Dated May 24, 1867.

This invention consists in constructing the boiler entirely of tubes of such dimensions and calibre that the danger from explosion shall be determined at least fourfold when compared with the ordinary boilers now in use, and in arranging and combining the tubes in such a manner that the inventor can stop off or remove a defective ube with very little difficulty or delay, maintaining at the same time a perfect circulation of the water, and but slightly interfering with the efficiency of the boiler.—Patent completed.

1548 G. HOWARD. *Improvements in the construction of parquet flooring.* Dated May 24, 1867.

This invention consists in forming the foundation or backing the parquet or ornamental surface of the floor of any convenient or suitable number of layers of wood, arranged and combined as described.—Patent completed.

1549 C. SANDERSON. *Improvements in the manufacture or melting of cast steel.* Dated May 24, 1867.

The patentee claims the manufacture or melting of cast steel by first submitting the metal in crucibles to a preliminary heating, so as to bring it into a soft pasty state by the combustion of heated air and gases in a close space or chamber, and then completing the melting of the steel in a second furnace, in the manner described.—Patent completed.

1550 T. GREENWOOD. *Improvements in boring metals in the solid.* Dated May 24, 1867.

According to this invention the work to be drilled is mounted vertically above a tank containing lubricating material, and bored upwards from its lower end by fixed drills mounted in the tank.—Patent completed.

1551 G. T. BOUSFIELD. *Improvements in braiders or embroidering apparatus to be used with sewing machines.* (A communication.) Dated May 24, 1867.

This invention has for its object improvements in braiders or embroidering apparatus to be used with sewing machines when it is desired to employ the same for embroidering cloth or other fabrics or materials. For this purpose the apparatus is formed with a clamp by which it can be clamped to the presser bar, or other suitable part of a sewing machine. The clamp carries a plate or frame, to which is pivoted a vibrating arm, which hangs vertically, or nearly so, the pivot being placed intermediate of the length of the arm; in the lower end of the arm is an eye through which the embroidering thread or braid is led.—Patent abandoned.

1552 J. M. NAPIER. *Improvements in appliances for serving mustard.* Dated May 24, 1867.

This invention consists, essentially, in serving mustard by forcing it through an orifice, instead of with a spoon, as usual.—Patent completed.

1553 J. SIMPSON. *A new and improved arrangement of apparatus to be employed in producing photographic pictures.* Dated May 25, 1867.

This invention is designed for the purpose of facilitating the process of obtaining enlarged photographic pictures from small negatives, by the use, in connection with the ordinary camera of an elongated conical dark tube, which is connected with the camera so as to have the lens enclosed and embraced by the narrow end of the cone.—Patent abandoned.

1554 A. OLDROYD. *Improvements in the manufacture of tobacco and other pouches, part of such improvements being applicable to the frames of other bags or receptacles.* Dated May 25, 1867.

According to these improvements the patentee attaches or connects the india-rubber pouch to its frame by enclosing it in or covering it with the edges of the sheet rubber forming the pouch by means of india-rubber solution before it is cured or converted by chemical agency to render it permanently elastic. The second part of the improvements consist in forming india-rubber tobacco or other pouches (combined or made up with a hinged metal frame, as previously described, according to the first part of these improvements) with two separate pouches or receptacles, one of such pouches being attached to one part or half of the hinged metal frame, and the other to the other part or half of the metal frame employed for closing the opening to such pouches.—Patent completed.

1555 A. M. CLARK. *Improvements in the manufacture of what are termed watered fabrics, and in apparatus connected therewith.* (A communication.) Dated May 25, 1867.

This invention consists in producing a watered effect in fabrics by imparting a greater or less tension to certain threads, or groups of threads, during the weaving. The means employed for obtaining such result consist in imparting a variable tension to the warp threads divided into series on winders having different degrees of tension. Also in varying the beating at all points of the weft by means of a reed having teeth, which may be rendered rigid or deflected at will, such result being obtained, among other ways, by the aid of a roller provided with relief surfaces acting in each tooth of the reed, either direct, or by the aid of intermediate parts, all in the manner described, such effects varying according to the nature of the relief surface of the roller.—Patent completed.

1556 I. BAGGS and F. BRABY. *Improvements in the treatment and utilization of certain ferruginous and calcareous salts and solutions.* Dated May 25, 1867.

This invention relates to the treatment and application of the waste wash or liquor which results from the operation of cleansing iron by hydrochloric acid, for the purpose of depositing zinc and other metals thereon, ordinarily known as the "galvanizing" process. In order to neutralize the free acid which may remain in the wash or liquor, scrap iron may be digested therein, or the free acid may be neutralized by any convenient or suitable means. The wash or liquor should then be filtered or decanted, and upon the subsidence or separation of the impurities it should be boiled down to a moderate density for the convenience of carriage. The wash or liquor thus obtained and prepared contains a proportion of iron in the state of muriate or chloride, and may be employed for various manufacturing and useful purposes, and especially for the manufacture of muriate of ammonia from gas liqour, or other ammoniacal liquor or vapour, and which forms the subject of this invention, the muriate of iron, hitherto a comparatively waste and useless product, being thus employed and utilized instead of hydrochloric acid for the purpose of the formation and separation of muriate of ammonia from the gas liquor, or other ammoniacal liquor or vapour. The solution of muriate of iron is simply mixed with the gas or other ammoniacal liquor; the ammonia contained in the first-mentioned solution is converted into carbonate and sulphide of iron by means of chemical reactions, which are well understood. The iron salts, together with the tar contained in the gas or other ammoniacal liquor under treatment, should be allowed to subside, and be then separated by any of the well-known means. A solution of muriate of ammonia is thus obtained, which should be concentrated by means of heat, crystallized, roasted, and sublimed, as is well understood.—Patent completed.

1557 W. RYLAND. *An improvement or improvements in teapots, coffeepots, and other vessels.* Dated May 25, 1867.

The patentee claims forming under the sockets of the handles of the said vessels, or at the parts where the ends of the handles are connected to the vessels, air chambers projecting into the body of the vessel, and isolating the handles from the said sockets or hollow parts, substantially as described and illustrated, for the purpose of keeping the handles of the vessels cool during use.—Patent completed.

1558 W. DUTTON. *Improvements in constructing furnaces for heating salt pans, and for other purposes.* Dated May 25, 1867.

According to this invention, two sets of firebars are used in two fireboxes placed side by side, but with a flue space between them. At the back of the fireboxes are side openings into this flue space, which space is divided by a horizontal partition into two parts, communicating at the front. The products of combustion from both fireboxes pass in common into the flue space between the fireboxes, and then along the upper part thereof to the front; they then descend to the under side of the partition, and pass again to the back, and under the bottom of the pan. The pan also forms the top of the fireboxes and of the flue space between them.—Patent completed.

1559 W. P. STRUVE. *Improvements in furnaces for calcining copper ores, and other ores and metals.* Dated May 25, 1867.

This improved furnace consists of four containing walls enclosing a space, two horizontal partitions passing across this space form a chamber within it in which the ore or metal to be roasted is placed. There is a fireplace at one end of the furnace, and the heated products of combustion from the fire pass by passages from the fireplace into flues over and under the chamber. These flues are enclosed at the top and bottom respectively by other horizontal partitions, and the heated products having travelled to the further end descend into return flues at the bottom of the furnace chamber, and so pass into an underground passage leading to the chimney. The roasting chamber, thus, does not communicate with the flues; there may, however, be an opening from the one to the other provided with a valve or damper.—Patent completed.

1560 H. B. BARLOW. *Improvements in apparatus for coupling pipes.* (A communication.) Dated May 27, 1867.

This improved apparatus is applicable in coupling steam, gas, water, and other pipes, having a socket at one end into which the end of another pipe fits. This apparatus consists of four, or other convenient number, of segments, connected together by a hoop; one end of the segments is recessed to fit on the socket of the pipes to be coupled, and to the inside of each segment is screwed a thin steel blade, and these blades are surrounded by a ring or hoop of india-rubber or other packing. The apparatus having been placed on the socket of the pipe, the end of the pipe to be coupled is forced within the blades of steel, thereby expanding them and the packing ring inside the socket; the hoop is then knocked off the segments, and the segments with the blades of steel are drawn out of the socket, leaving the packing ring in its place. By this apparatus pipes can be coupled very expeditiously, and the packing ring is sure to be left in its proper place within the socket.—Patent completed.

1561 H. FROST, sen., and H. FROST, jun. *Improvements in apparatus for measuring fluids, which improvements are also applicable for obtaining motive power, and for pumping.* Dated May 27, 1867.

This invention cannot be described apart from the drawings.—Patent completed.

1562 W. P. METCHIN. *Improvements for taking copies of lithographs, zincographs, and other printed matters.* Dated May 27, 1867.

The inventor proposes to employ a powder composed of nutgalls, logwood, or any other woody substance containing tannin, with sulphate of iron and gum mixed in certain proportions. He then distributes this powder over the surface of the printed matter, which remains on the surface without mixing with the oily substance of the printing-ink. Having done this, a correct copy may be taken by applying a damp sheet of copying paper over the printed matter, and pressing it in the ordinary way in a copying press.—Patent abandoned.

1563 W. AFFLECK. *A new or improved tyre or guard for wheels of reaping, mowing, and other machines.* Dated May 27, 1867.

The patentee claims the construction and employment of a loose tyre or guard for fitting over the wheel or wheels of reaping, mowing, and other machines, substantially as described, and illustrated in the drawings.—Patent completed.

1564 R. R. KNOTT and J. JEYES. *An improvement in preparing wood and adapting it as a substitute for leather.* Dated May 27, 1867.

This invention consists in cutting wood into thin layers, so that it shall be yielding without breaking, and then placing one or more layers together, and securing them together by means of an elastic cement.—Patent abandoned.

1565 P. A. J. DUJARDIN. *Improvements in electric telegraphs.* Dated May 27, 1867.

This invention cannot be described apart from the drawings.—Patent completed.

1568 J. C. MEWBURN. *Improvements in harvesting machines.* (A communication.) Dated May 27, 1867.

This invention consists, first, in combining with a main frame balanced upon two supporting and driving wheels, and having a rigid tongue projecting from its forward end, and a driver's seat mounted upon the rear end, a supplementary frame hinged at its forward end to the main frame in advance of the main axle, and in line with the countershaft, and having the cutting apparatus hinged to the rear end of the supplementary frame in such manner as to have both a rising and falling and an axial movement independent of the main frame. Second, in combining with a supplementary frame, hinged as described, a finger beam pivoted at the heel of the shoe to the inner rear corner of the supplementary frame by a swivcling joint, and at the front of the shoe to a pivoted coupling arm passing over the supplementary frame, and secured to the outer side thereof, and a rocking lever pivoted to the supplementary frame and coupling arm to rock the finger beam axially. Third, in a lever which serves both to lock the finger beam, and to raise it horizontally, or parallel to the ground. Fourth, in combining with the

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hinged finger beam a rocking lever to rock the beam axially, and a lifting and locking lever which raises the beam horizontally. Fifth, in a novel mode of connecting the finger beam to the frame. Sixth, in a swiveling pitman box..—Patent abandoned.

1569 H. PETHER. *Producing by a new method ornamental bricks for building purposes.* Dated May 28, 1867.

This invention refers to a means of imparting to the faces of bricks a diaper or ornamental pattern, by the following means:—Upon a metallic table is affixed a vertical frame, the inner edges of which are prepared to receive and guide an ascending and descending horizontal frame, which, acting on wedges attached to the sides of a metallic box hinged and secured at the bottom, causes the same to collapse when this horizontal frame ascends, and resume their open or spread position on its descent. Into this box is placed in a firm state the clay intended to form the brick.—Patent completed.

1571 E. T. HUGHES. *A combined seeder, cultivator, and roller.* (A communication.) Dated May 28, 1867.

This invention cannot be described apart from the drawings.—Patent completed.

1572 G. H. J. SIMMONS. *A lamp for burning hydrocarbon oils (explosive or non-explosive, without danger), permitting the same to be replenished without extinguishing the flames of the burner or burners, also without danger, the receptacle containing the oil to be so closed as to prevent evaporation, or the escape of noxious vapours, the position of the receptacle containing the oil so arranged as to prevent any unnecessary shadow.* Dated May 28, 1867.

In performing this invention the inventor employs a receptacle having but one opening at its base for the entrance and exit of the oil; fastened over such opening is a dome of wire gauze; attached into the receptacle are two tubes of unequal length; attached to the shorter tube is a stop-cock to allow of the removal of the receptacle when containing oil without its spilling; the other end of the tubes are inserted into a small chamber; the ends of the tubes screwed into the receptacle containing the oil are level with each other, but the ends attached to the small chamber are not level, the effect of which is that the oil flows from the opening of the longer tube until it reaches the opening of the shorter tube, thereby preventing the admittance of the atmosphere.—Patent abandoned.

1573 F. J. VANDENVINNE. *An improved machine or plough for clearing or grubbing up uncultivated land.* Dated May 28, 1867.

This invention consists in an improved construction of machine for tilling or ploughing uncultivated land to a great depth, and also for the execution of all kinds of open earthwork, such as cuttings for railroads and canals. This is effected by forcing forward a framework carrying two vertical driven shafts in front of it; each shaft is armed with a series of picks stacked firmly on it, and so placed that the series on the two shafts intersect each other, and thus cut away the ground as the machine advances; if for tilling only, the earth is left as the picks leave it, but if a pass or cutting is to be made, the earth is excavated and thrown aside by elevators.—Patent completed.

1574 W. COULSON. *Improvements in the doors and door-frames of furnaces.* Dated May 28, 1867.

This invention consists in making the doors and door frames of furnaces hollow and water-tight, and causing water to circulate through the same. Firstly, in order to keep the doors cool, and prevent or diminish the action of the fire on the metal; and, secondly, to keep the engine and boiler-rooms cool in steamships, and to obtain from the waste heat thus absorbed a supply of heated water for feeding the boiler, or for other useful purposes.—Patent completed.

1578 H. and F. C. COCKRY. *Improvements in seal or dip pipes in combination with gas and other retorts.* Dated May 28, 1867.

The patentees claim, first, the constructing and arranging of the seal or dip pipes used in connection with gas and other retorts in such a manner as that they may be readily sealed before the opening of the retort, and unsealed after the retort is closed, for the purpose described. Second, the making of the seal or dip pipes used in connection with gas and other retorts telescopic, so as to be capable of being sealed or unsealed as required, by lowering or elevating them by a lever or otherwise, as described.—Patent completed.

1579 T. F. CASHIN. *A compound lever (or combination of levers) for working railway points and signals, and for all other purposes to which it may be applicable.* Dated May 28, 1867.

This invention consists in the combination of two levers whereby points or signals, or a set of points and signals of railways, can be actuated and locked in the position required, the points open or closed, and the signals up or down, by the direct action of the levers.—Patent abandoned.

1580 W. MITCHELL. *An improved food for sheep and other animals.* Dated May 28, 1867.

The patentee claims the use of the seed or pulse of the lupin, combined with linseed or other seed or grain or pulse, as food for sheep and other animals.—Patent completed.

1581 L. H. DETHIOU and F. BEAUBRY. *An improved tongless buckle with continuous pressure.* Dated May 28, 1867.

The object of the present invention is to do away with the tongue of the buckle, substituting in its place a spring pressing on an inclined plane; the spring is strengthened on one side by a frame bearing the plane, and is furnished with elbows or projections acting as stops for preventing the overstraining of the spring whilst inserting the belt or band between it and the inclined plane.—Patent completed.

1582 A. M. CLARK. *Improvements in machines for washing and bleaching cloths and all kinds of textile materials.* (A communication.) Dated May 28, 1867.

The patentee claims the improved washing, bleaching, and rinsing apparatus described and represented in the drawings, the chief features being the employment of one or more clasher plates, nets, rods, or other means of supporting the linen, which is alternately raised from and lowered in the of liquid, in the manner and for the purpose described.—Patent completed.

1583 D. TUNKS. *Improvements in galvanometers for receiving signals through submarine and other electric telegraph lines, and for testing them.* Dated May 29, 1867.

The object of the invention is to provide an instrument for use as a galvanometer that is of extreme delicacy, and not liable to be easily put out of order. An instrument which contains all the improvements that are comprised in this invention consists of an electro-dynamic coil in two halves, and having its axis horizontal. Each half is a complete coil, and the two halves are juxtaposed laterally so as to act as one coil upon a horizontal magnetic needle, which is mounted upon a vertical axis that passes freely through the division between the coils. The said vertical axis is mounted in jewel holes that are suitably placed on cocks which rise from the same foundation plate that carries the coil, the lower cock passing into the interior of the coil, and the upper cock projecting over the top of the coil. A horizontal graduated dial plate, and a pointer of aluminium, enable the motions of the needle from its normal position (parallel to the wire coils) to be noted, or its deflections to be observed. The electric current is conveyed to the coil by means of binding screws connected with its terminates, and placed upon the base plate or foundation plate of the instrument. A peculiarity of the invention consists in the use of a pendulum or hair spring in connection with the said vertical axis, and thereby accomplishing two desirable objects. First, the neutralization of the gravity of the vertical axis and its appendages; and, second, it affords the utmost facility to neutralize the directive influence of the earth's magnetism upon the magnetic needle, and thus enables it to move freely upon the slightest impulse.—Patent abandoned.

1584 R. POLLIT. *Improvements in steam boilers and the method of construction of the same.* Dated May 29, 1867.

This invention relates to a former patent granted to the present patentee, dated July 9th, 1860, and consists in the application or addition of "water tubes" to the back internal "elbow flue" of the boiler, for the purpose of obtaining a greater amount of heating surface. These tubes the patentee makes of any suitable section, as circular or oval, and fixes them in the said flue or flues in a vertical, diagonal, or suitable angular position, the ends of the tubes being open to the water space, and the body of the tubes being exposed to the products of combustion passing through the flue. The method of construction of the said "elbow" flue, as adapted to the application and attachment of the "water tubes," is also applicable to other forms of boiler than the one herein above referred to, and is as follows, namely, from about the centre of the plate which is to form one "ring" of the flue, a piece is cut out of a size and form suitable to the cross section of the water tube, and from each end of the plate a piece is out out of a form and size suitable to form a corresponding opening to the one in the centre of the plate. When the plate is bent into a ring or cylinder, and the edges or ends of the plate on each side of the opening are welded together, suitable rivet holes are formed around the openings for the attachment of the water tube in position, and a template is temporarily fixed by means of the rivet holes near the joint for the purpose of maintaining the form of the "ring," and the relative positions of the ends during the operation of the welding. This method of construction enables the patentee to obtain a sound weld, owing to the portion to be welded at each operation being comparatively short.—Patent completed.

1585 W. J. BURGESS. *Improvements in the construction of fingers for mowing machines.* Dated May 29, 1867.

This invention relates to the fingers of the cutting apparatus of mowing machines, and consists in forming the point of each finger of wrought metal, and the other parts of cast metal.—Patent completed.

1586 J. F. N. B. SIMONS. *Improvements in preventing the incrustation of steam boilers.* Dated May 29, 1867.

This invention consists in introducing into boilers several cakes of moulded charcoal, or what is called in France "charbon de Paris," on which incrustation is supposed to take place instead of on the plates.—Patent completed.

1587 C. MINASI. *Improvements in musical wind instruments, called trombomettes.* Dated May 29, 1867.

The inventor divides his invention into six parts; for perusal of which see his patent, which is not proceeded with.

1588 T. MITCHELL. *Certain improvements in the manufacture of felt carpeting.* Dated May 29, 1867.

This invention consists in so preparing the selvages or sides of the "lap" as it comes from the "batt frame" or the piece in its hardened state, and in so attaching them together by yarns or threads, or by gum or other adhesive matter, and submitting the whole fabric after being thus prepared to a subsequent process of "milling up;" that, when completed, the fabric shall present an appearance, and be almost as even and quite as durable as if felted in one width.—Patent completed.

1589 F. J. BREAN. *Improvements in producing letters in gold, silver, and other metals, on glass, and in implements employed for that purpose.* Dated May 29, 1867.

In performing this invention the patentee constructs type or stencil plates of thin metal or other suitable material, and of the form of the letters to be produced, which type, after the surface of the glass has been coated with gold, silver, or other thin metal leaf, are placed upon such coated surface in positions corresponding with those in which it is desired to produce the letters on the glass. The type being held securely in these positions by certain special means, the metal on the glass surrounding each letter is brushed off by means of a brush, thus leaving the metal beneath the type in the form of the required letters, which have perfectly sharp edges, and merely require to be trimmed off at the top and bottom after the type has been removed.—Patent completed.

1590 J. R. COOPER. *Improvements in cartridges for breech-loading firearms.* (Partly a communication.) Dated May 29, 1867.

The patentee claims fixing at the base of the said cartridges, and immediately behind a cap or disc containing the fulminate or detonating powder, a disc of india-rubber, or other elastic substance, through which elastic disc the needle of the gun passes to ignite the fulminate, and which elastic disc, on the explosion of the cartridge, is expanded laterally and made to close the chamber of the gun, and prevent the escape of gas at the breech, substantially as described.—Patent completed.

1591 J. M. FRENCH. *Improvements in instruments or apparatus for measuring spirits and other liquids.* Dated May 29, 1867.

The object of this invention is to permit of the rapid drawing off of measured quantities of liquid from a barrel or reservoir. The inventor describes his invention as being a measuring vessel placed between full and empty casks. Through the axis of this measuring vessel passes a stop-cock plug, which admits the liquid to the measuring vessel by one quarter turn, and lets it off by a further quarter turn.—Patent abandoned.

1592 R. NEWTON. *Improvements in the furnace apparatus of steam boilers.* Dated May 29, 1867.

This invention consists of an endless band of transverse fire bars caused to revolve slowly, carrying the fuel in with them. These bars are supported in the boiler flue by three ribs, one central and one at each side.—Patent abandoned

1594 T. E. PASSEE. *An improved mode of obtaining motive power, and the apparatus employed therein.* Dated May 29, 1867.

This invention consists in a method of procuring perfect vacua, or nearly perfect vacua, in cylinders of any given diameter, and of given volume or content, by pistons moving and fitting air-tight and freely within them, and in the application to an unlimited extent of the vacuum motive principle, either by one, less than one, or more atmospheres, or any other suitable pressure, to produce rectilinear action, which, adjusted with other auxiliary cylinders to alternate or reciprocate by spring, lever, beam, rotary axis, and other mechanical contrivances, and then started, results in continuous movement till stopped by failure of the vacua or other causes of derangement.—Patent completed.

1595 W. B. RITCHIE and J. G. WILLANS. *Improvements in drying peat and other materials.* Dated May 29, 1868.

The patentees claim drying peat, either alone or mixed with other materials, by means of vertical currents of air heated by waste products of blast or puddling furnaces in which peat is used; also, the formation of blocks of granulated iron ore and peat.—Patent completed.

1596 H. TURNER. *Improvements in marine and other steam engines on the high and low pressure compound principle.* Dated May 29, 1867.

This invention relates to an improved construction and arrangement of parts of engines on the high and low pressure compound principle, and has for its object the introduction of connecting links or rods to the shafts of high and low pressure marine and other engines working expansively, so as to obtain a short and direct passage across the high pressure to the low pressure cylinders, these cylinders being placed side by side. By the use of these links and rods, also, a well balanced engine is obtained, without the necessity of resorting to the use of heavy weights, as is now done, and the engine generally occupies less space than other engines on the same principle, while steam is also greatly economized.—Patent completed.

1597 E. JONES. *Improvements in the construction of safety lamps for miners.* Dated May 29, 1867.

This invention is not described apart from the drawings.—Patent completed.

1598 A. V. NEWTON. *An improved method of producing mosaic veneers.* (A communication.) Dated May 29, 1867.

This invention relates to the production of mosaic veneers or surfaces in an economical and expeditious manner, and consists, first, in forming prismatoidal rods of suitable form and colour for producing, when put together side by side, a surface with the required design by forcing through apertures of the form of the cross section of the intended rods a plastic material, which, after the rods have been formed, will become, or which may be rendered, of sufficient hardness to be used as a veneer. And, second, in uniting such strips so formed into blocks the cross section of which will be of the form of the surface to be veneered, or of a section thereof.—Patent completed.

1599 W. E. NEWTON. *An improved mode of producing printing blocks or surfaces for printing or staining various fabrics.* (A communication.) Dated May 29, 1867.

The patentee claims preparing electrotype printing blocks for printing fibrous and textile fabrics by means of a mould formed of different lengths of type (as represented in the drawings), so as to have a highly raised printing face composed of metal margins surrounding a felt or other equivalent soft or plastic substance to lift and carry the colour, substantially as described and illustrated in the drawings.—Patent completed.

1600 T. GREENWOOD. *Improvements in the construction of milling machines.* Dated May 29, 1867.

According to this invention the patentee forms in the bed of the machine, immediately below the spindle, vertical guides to receive a sliding block on which is mounted the slide for carrying the work, and by means of a vertical screw which enters a tapped hole in the bottom of the vertical sliding block he raises or depresses the block, as required, to any given distance within its range, without imparting any unsteadiness to the block.—Patent completed.

1601 H. OAKES. *Improvements in the manufacture of ear rings.* Dated May 29, 1867.

This invention consists in manufacturing earrings without the usual accompaniment of ring or hook, thus obviating any necessity for the ears to be pierced. This the inventor effects by connecting above the pendant a contrivance consisting of a pair of miniature jaws or clips, having a pincer or plier action.—Patent abandoned.

1602 H. BAIN. *Improvements in dyeing yarns, and in the machinery or apparatus employed therefor.* Dated May 30, 1867.

This invention consists, essentially, in a new or improved mode of dyeing yarns in banks, by giving them a slow motion in the direction of their loops or threads, while at the same time they are traversed in sets, also at a slow rate, horizontally immersed for a great portion of their length in the liquids or dyes employed in their treatment, placed within a suitable cistern for the purpose.—Patent abandoned.

1603 C. E. BROOMAN. *Improvements in photographic albums and other like articles.* (A communication.) Dated May 30, 1867.

This invention consists in the employment of movable name cards or slips, and in the formation of a sort of chamber or receptacle in the leaf or passe partout into which these name cards can be readily inserted.—Patent completed.

1604 J. FRANCOMBE. *A new or improved engine or machine for obtaining and applying motive power.* Dated May 30, 1867.

This invention essentially consists in the construction of engines or machines for obtaining and applying motive power wherein the piston is a fixture and the cylinder is movable. According to one arrangement the cylinder is suspended from a cross shaft resting on bearings in a frame, and free to oscillate thereon, the frame uniting the shaft to the cylinder acting as a pendulum.—Patent abandoned.

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1605 W. ORR. *Improvements in machinery or apparatus for separating liquids or moisture from substances, and also for rectifying and cooling animal charcoal and other substances, and for treating sugar.* Dated May 30, 1867.

The great length of this specification precludes our quoting it here at sufficient length for an intelligible abstract.—Patent abandoned.

1606 J. ASTBURY. *Improvements in casting Bessemer metal, steel, and other metals.* Dated May 30, 1867.

This invention is intended to avoid the chilling and honey-combing arising from and in the present mode of casting. For this purpose the patentee casts the metal to produce the ingot or other form into a mould which is heated in a furnace sufficiently to prevent the metal solidifying, and then he gradually cools the lower part of the mould whilst the heat is still maintained at the upper part of the mould, the cooling and setting of the metal taking place progressively from the bottom of the mould upwards, and then, as contraction takes place, fluid metal descending from the upper part of the mould prevents the formation of cavities in the casting.—Patent completed.

1607 W. WOOD. *Improvements in the manufacture of printed tapestry carpets.* Dated May 30, 1867.

The object of this invention is to make the carpet thicker, softer, more elastic and warm, and consists in making the dead warp wholly or partly of certain other materials in suitable forms and combinations. First, the patentee makes the dead warp of yarns composed wholly or partly of silk obtained from cuttings and rags of woven fabrics wholly or partly of silk, which he tears up, and either alone or combined with any other suitable fibres, forms by the usual or other convenient processes into yarns of suitable size and strength. Second, he forms the dead warp of yarns made wholly or partly of wool, hair, or such like animal fibres, either new or obtained from cuttings and rags of woollen, union, or linsey fabrics, and spun waste, and new or old carpeting; these, also, either alone or mixed with other fibres, he forms by the usual or other convenient processes into yarns of suitable size and strength.—Patent completed.

1608 W. E. NEWTON. *Improvements in the treatment of fabrics made wholly or partly of jute, flax, cotton, or vegetable fibres, so as to prepare them for dyeing or printing, and rendering them applicable for the manufacture of carpets or other printed goods.* (A communication.) Dated May 30, 1867.

This invention is carried out in the following manner:—The cloth after being woven from the raw jute, flax, or cotton in the ordinary manner, is immersed in a bath of water at, say, from 90deg. to 120deg. Fah., in which has been mixed a quantity of either wheat or corn bran, together with sub or bi-carbonate of soda. After remaining in this bath for a sufficient length of time to thoroughly dissolve the tannin in the jute or cotton, or the gluten or gum in the flax, the cloth must be removed and washed thoroughly in clean water. It is then to be immersed in a bath of cold water mixed with a solution of crystallized tin and muriatic acid, or strong muriate of tin with 20 per cent. of oil of vitriol or sulphuric acid, at a strength of from 1deg. to 2deg. Twaddel. When the cloth has been impregnated with this bath, it is to be again washed in clean water, and then submitted to a bath of a weak solution of chloride of lime, after which the cloth is to be washed clean and dried, and it will then be ready for printing or dyeing.—Patent completed.

1609 W. E. NEWTON. *Improvements in the manufacture of felted fabrics.* (A communication.) Dated May 30, 1867.

The patentee claims manufacturing felted fabrics with a velvet plush or napped surface in the manner set forth. He claims particularly producing the napped surface on felted fabrics by teazling the surface or fabric before the felting operation is completed, and then subsequently felting the fabric again in order to obtain the required texture, as set forth.—Patent completed.

1610 T. PETITJEAN. *A new means for procuring the more perfect combustion in the burning of fuel.* Dated May 30, 1867.

The patentee claims, first, the method of converting solid fuel into inflammable gases after having made use of it, that is, by the waste heat of the products of combustion only, when they carry out 60 per cent. of the heat developed in the burning of fuel. Second, the division of the total heat produced by fuel into heat of combination and heat of condensation, the latter forming the latent heat of the gases left after carbonic acid and water have been decomposed. Third, this division in heat of combination and heat of condensation giving a clear insight of the phenomena accompanying the conversion of carbonic acid and water into inflammable gases permits the laying down of rules to regulate the good working of the reproducer by fixing the temperature of its top and bottom, also the quantity of fuel it must contain, and, consequently, its exact dimensions. Fourth, the principle of a great fractional division for the use of the gas fuel which gives an easy control over the proper proportions of air and inflammable material, and secures their perfect mingling.—Patent completed.

1611 M. A. F. MENNONS. *Improvements in the construction of magneto-electric batteries.* (A communication.) Dated May 30, 1867.

This invention relates to improvements introduced into the construction of magneto-electro batteries with a view to obtaining by a slow motion of the armatures any required quantity or intensity of electric fluid. The improved battery may be constructed of different circles of bar magnets set partly around and partly above each other with corresponding intermediate armatures mounted on wooden or other suitable discs on a central shaft.—Patent completed.

1612 W. R. LAKE. *Improvements in breech-loading fire-arms.* (A communication.) Dated May 30, 1867.

This invention relates more especially to the conversion of muzzle-loading muskets and rifles into breech-loaders, which is effected in the following manner:—The rear upper part of the barrel is first cut away to form an opening or chamber for the breech-block. This block consists of a solid piece which fills up the said opening, as well as the bore of the barrel, and is hinged at its front end to a piece firmly attached to the barrel over the rear end of the same.—Patent abandoned.

1613 F. J. DEMANET. *An apparatus for the purpose of giving sufficient draught to any kind of chimney.* Dated May 31, 1867.

This apparatus consists of a square or other shaped chimney or body made of metal or other material, and surmounted by a cap formed of two vertical sides joined by an arched top, the cap being open at the ends. The said two sides are longer than the diameter of the chimney, and thus project beyond its exterior surface. One of the said vertical sides is curved concentric with the chimney, while the other vertical side is half straight and half curved eccentric to the chimney. The cap may have an opening in the top covered by an inclined plate to keep out the rain.—Patent abandoned.

1614 J. SCOTT. *Improvements in apparatus and in the means employed for subduing and extinguishing fires, partly applicable to other useful purposes.* Dated May 31, 1867.

This invention is not described apart from the drawings.—Patent completed.

1615 B. and W. SHAKESPEARE. *Improvements in reverberatory furnaces used for puddling, melting, and heating iron, and for other purposes.* Dated May 31, 1867.

The invention, with reference to a puddling furnace, is carried out as follows:—In a puddling furnace, as ordinarily constructed, the firegrate is placed at one end of the furnace, and the flame, after passing along the arch of the furnace, and over the iron contained on the bed of the furnace, passes to a flue at the end of the furnace opposite to that at which the fireplace is situated. In constructing a puddling furnace according to this inve tion the inventors build a firegrate at each end of the furnace, and they make a flue at about the middle of one side of the back of the furnace, by means of which flue the heated air and products of combustion are conducted to the stack or chimney, which may be placed near to the said flue. The flame from the fires on the said firegrates passes from either end of the arch and over the bed of the furnace, and meeting at the middle of the furnace passes by the flue described to the stack or chimney.—Patent abandoned.

1616 J. and J. HINKS. *Improvements in lamps for burning petroleum oil and other volatile liquid hydrocarbons.* Dated May 31, 1867.

This invention consists, first, in constructing and arranging the holders or galleries by which the shades of the said lamps are supported in the following manner:—The patentees take an ordinary flat wick burner, and place the shade holder or gallery at the bottom, or at the mouth of the said burner, instead of placing the said shade holder immediately below the cone or deflector of the burner. They make the said shade holder immediately below the cone or deflector of the burner, and of about 4in. in diameter, instead of 3in., as is usual, and they pierce in the said shade holder a series of small holes for supplying air to the flame, in place of cutting away about half or two-thirds of the metal of the holder, as is usual. In the shade holder they make a series of indentations or depressions in which they insert pieces of bone, wood, or other imperfect conductor of heat, the said non-conducting pieces projecting somewhat above the plane of the bottom of the shade holder. Upon the projections thus formed they place a disc of wire gauze or perforated metal, and thereby make a chamber through which the air has to pass before it reaches the flame. Upon this disc the shade rests, instead of upon the shade holder itself. By these means the currents of air produced by the punkahs or otherwise are prevented from acting upon the flame and causing the lamp to smoke, while the shade holder is isolated by the non-conducting pieces described from the shade, and thereby prevented from being heated by the said shade, and the punkah at the top of the said shade. The oil in the reservoir is thus kept cool. The invention consists, second, of a conical chimney, either circular or elliptical in cross section, to be used in place of the ordinary bulged shouldered chimney. The said chimney tapers from nearly the middle towards each end. By the use of a chimney of this kind, a free egress of the heated air combined with an equal expansion of every part of the chimney by heat are obtained, and hence the chimney is less liable to break than the ordinary bulged chimney. The invention consists, third, of the following improvements in punkah protectors for liquid hydrocarbon lamps. Punkah protectors are ordinarily made of wire gauze, or perforated metal, the said protectors having a conical figure, and being surmounted by a plain metal disc or a metal crinkle. In constructing the said protectors according to this invention the patentees make them of wire gauze or perforated metal, the tapering of the said protectors being greater than usual, that is, they make the base of the protector about 4in. in diameter, and the summit about 2in., instead of 3in. as usual. They surmount the protector by a cap or cover of a dome shape, the said cap being perforated at top and bottom, the perforations in the top being much larger than those in the bottom. Across the middle of the cap or cover they fix a disc or diaphragm of wire gauze or perforated metal.—Patent completed.

1617 F. W. DOLMAN. *Obtaining an essential oil applicable as a curative agent or medicine in the treatment of inflammatory joint diseases, rheumatism, sprains, bruises, and similar ailments.* (A communication.) Dated May 31, 1867.

This preparation is an oil obtained by distillation from a plant or grass called by the natives of India "Koos," also "Hurdwaree Koos," and is the sacred grass of the Hindoos. The botanical name of the said plant is Poa cynosuriolides.—Patent abandoned.

1618 J. LE BUTT. *Improvements in hay-making machines.* Dated May 31, 1867.

This invention relates especially to the construction of the frame of the machine, and to the means by which the inclination of the shafts to the frame may be adjusted, so as to vary the distance of the teeth from the ground. The sides and ends of the frame, in place of being in separate parts, as is usual, are formed of one bar of iron bent round; and to it, at the front, brackets are fixed to receive the shafts. The shafts are fixed upon a metal tube which enters between the brackets, and a bolt passing through it from end to end, and also through the brackets, secures the shafts, but they are free to turn upon the bolt.—Patent abandoned.

1619 T. PORTER. *Improvements in apparatus for supporting or holding music and other books, and for turning over the leaves of the same.* Dated May 31, 1867.

According to this invention the inventor supports the book, and holds it in its proper position, by the aid of a contrivance which is inserted into the middle of the desk at the lower part or supporting ledge thereof. This consists of two parallel pins connected together at one end by a cross piece, to which cross piece, and between the two parallel pins, he attaches (at right angles to the pins) an upright arm, which lies in the fold of the book when properly placed, and thus keeps the book in position on the desk laterally. To one or both of the two parallel pins there is secured a spring nick, and in the front of the desk two holes are made into which the pins are inserted, one or both of such holes being slightly oblong to admit the spring rack or racks as well as the pin.—Patent abandoned.

1620 JAMES EARL OF CAITHNESS. *Improvements in ships' compasses.* Dated May 31, 1867.

This invention relates to a mode of suspending ships' compasses with a view to prevent undue oscillation in heavy seas, and consists, essentially, in attaching to the compass box or case containing the card or needle a weighted rod or pendulum, which is allowed to swing freely by a ball and socket joint situate as close as possible to the compass. The socket for the ball is contained in the upper part of a "binnacle" or other convenient frame or support, which will allow of the free play or swing of the pendulum. The bob or weight of the pendulum is made adjustable along the rod by a set screw, or other convenient contrivance, so as to admit of alteration or adjustment. By this contrivance the compass is constantly maintained in a horizontal position, as whatever may be the motion of the ship, the pendulum will always remain perpendicular.—Patent completed.

1621 R. REECE. *An improved mode of, and apparatus for producing cold.* Dated May 31, 1867.

This invention consists, chiefly, in the peculiar construction and arrangement of apparatus for effecting the continuous distillation and rectification of dilute solution of ammonia upon what is known as the separative principle, and in the combination with the said apparatus of a condenser and refrigerator. The ammoniacal gas is reduced by its own pressure to a liquid condition in the said condenser, from which it passes into the refrigerator, and having a very low temperature, quickly abstracts the heat from any fluid passed through the latter.—Patent completed.

1622 J. LANCELOTT. *Improvements in the manufacture of ornamental chains and bands.* Dated May 31, 1867.

This invention is not described apart from the drawings.—Patent completed.

1623 P. LAWRENCE. *Improvements in apparatus for applying adhesive agents to pieces of paper and other light materials, and for lifting the same, especially applicable to machinery for the manufacture of envelopes.* Dated May 31, 1867.

This invention consists of an improved construction of apparatus in which a holder or vessel for containing an adhesive agent receives reciprocating up and down motion, and carries with it in its travel contrivances with which it is furnished, and which are so actuated as to effect and interrupt as required the emission of the adhesive agent which such vessel or holder contains, and which adhesive agent when emitted is, by the action or travel of such holder or vessel, brought into contact with the pieces of paper or other material to which it is to be applied, and is applied to the same thereby, causing the same to adhere to the vessel or holder, and to be raised by and with it in its upward travel. In one arrangement for the purpose the vessel or holder which has outlets at bottom is fitted with a piston or plunger, or a stem carrying a valve for opening and closing such outlets; such piston, plunger, or valve is raised by means of an adjustable abutment at the upward motion of the vessel, so as to open the outlets, and is depressed when released from the action of such abutment so as to expel the adhesive agent and close the outlets.—Patent completed.

1624 A. M. CLARK. *Improvements in apparatus for applying and regulating motive power.* (A communication.) Dated May 31, 1867.

This invention is not described apart from the drawings.—Patent completed.

1625 T. POULTNEY. *Improvements in the construction of revolving fire-arms.* Dated June 1, 1867.

This invention is not described apart from the drawings.—Patent completed.

1626 T. POULTNEY. *Improvements in breech-loading fire-arms.* Dated June 1, 1867.

This invention relates to that description of arm in which the movable block for closing the breech is hinged or attached either permanently or temporarily to the rear end of the barrel, in such a manner as to admit of it being turned back in order to open the breech for the reception of a cartridge. In this description of firearms the movable breech block when in place lies snugly in a recess formed either by cutting down the upper half of the rear end of the barrel, or by screwing on a piece of the required size and form. It has been found that with this description of arm, as ordinarily constructed, some little difficulty is experienced in inserting the cartridge in consequence of the projecting vertical sides of this recess. The present invention has for one of its objects to obviate this inconvenience, and this is effected by cross cutting down the sides of the recess, and turning the part down into a horizontal position on the wooden stock, thereby giving more easy access to the open breech, not only without weakening the arm, but actually strengthening this part of the arm. Either one or both may be turned down in this manner.—Patent completed.

1627 W. BRADFORD. *An improved combination of wood and textile substance for the construction of boats, baths, and other vessels to be folded up for carriage.* Dated June 1, 1867.

The inventor takes thin slips of wood and attaches them firmly to cloth or textile material, so that their edges are close where a curve is required, and are further apart where a sharper angle is to be formed. The slips are flat, and the whole can be rolled up or folded for carriage. Or when the edges are bent and confined by suitable bars, strings, or bolts, the whole may be made to form a boat or bath, or other vessel, according to the various forms of the slips, and the relative positions of their edges and ends.—Patent abandoned.

1628 A. G. SCHAEFFER. *Improvements in obtaining increased light in the combustion of illuminating matters.* Dated June 1, 1867.

This invention consists in effecting approximation of incandescent atoms, or clusters of atoms, by the approximation or coalescence of two or more flames containing these atoms, and in such manner as to obtain the most close possible approximation of the heated atoms in one flame to the heated atoms in another flame (but not so as to cause gases), to emit before ignition. Patent abandoned.

1629 F. B. HOUGHTON. *Improvements in steam boilers and in superheating pipes.* Dated June 1, 1867.

This improved boiler is fitted with a coil of pipes which is kept full of water, and the novelty consists in employing such pipes of a larger diameter than have heretofore been used, and in a different arrangement of them.—Patent completed.

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PROVISIONAL PROTECTIONS.

Dated September 3, 1867.

2492 A. E. Gelhaye, Windmill-road, Croydon, engineer. Improvements in machines for manufacturing chains, cords, ropes, and the manner of making such chains, cords, and ropes.

Dated November 23, 1867.

3318 P. Salmon, Great Smith-street, Westminster, engineer. Improvements in the manufacture of gas, and in the treatment and application of such and other gases for cooking, warming, lighting, generating of steam, and other purposes, combined with their use as a motive power, previous to being burned or consumed, and improvements in the apparatus for these purposes.

Dated December 2, 1867.

3421 W. Black and T. Hawthorn, Gateshead, Durham. Improvements in valves for steam engines.

Dated December 12, 1867.

3530 N. Paxman, jun., of Clifton Hampden, Oxfordshire, farmer. Improvements in steam cylinders and the peculiar arrangement of the mechanism connected therewith.

Dated December 13, 1867.

3542 E. B. Sintzenich, Duke-street, St. James's. Improvements in the treatment of gutta-percha, india-rubber, Honduras gum, and the other allied gums, for the production of a preparation or preparations applicable as a varnish, cement, paint, stain, water and air-proof material, solid or elastic material, and for other purposes. (A communication.)

3543 G. Whitehead, Newcastle-on-Tyne, chemist and druggist. Improvements in capsules or coverings for bottles and other like vessels.

3548 L. A. Damm, Seething-lane, City. Improved appliances and means for conveying salt water fish through fresh water and overland and on land. (A communication.)

Dated December 14, 1867.

3556 A. McMurdo, Rear-Admiral in the Royal Navy, Cargenholm, Dumfrieshire. Improvements in apparatus for saving life from drowning.

Dated December 18, 1867.

3597 T. Comfield, jun., Queen's-road, Buckhurst-hill, Chigwell. Improvements in breaks for railway and other carriages, and in signalling and other apparatus in connection therewith, which improvements are also partly applicable to other purposes.

3598 W. Preston and C. Walker, Dewsbury, York, overlookers. Improvements in machinery known as the condenser carder.

Dated December 19, 1867.

3605 E. T. Bellhouse, Manchester, engineer. Improvements in the construction of fireproof floors for buildings.

3607 W. A. Hubbard, Ramsgate. Improved proportional compasses and dividers.

3608 J. S. Gisborne, Liverpool, electrical engineer. Improvements in electric telegraphic apparatus, and in the symbols or characters connected with the transmission of messages by electric telegraphs.

3609 L. M. Becker, Guildhall Chambers, Basinghall-street, London, telegraphic engineer. Improvements in the arrangement of electric telegraph and other wires and the apparatus employed or connected therewith, and in laying and supporting wires for telegraphic or other purposes.

3611 J. Clay, Yardley, Worcestershire, saddler. Improvements in saddles.

3613 E. Breffit, Castleford, York. Improvements in glass bottle house pot carriages, and implements used in setting glass bottle house pots, which invention admits of improvements in the construction of furnaces for melting bottle or other glass in open pots.

3615 R. Chauncy, Clyde-street, Brompton. Improvements in the preparation of a substitute for emery paper.

3617 J. Simmons, Ravenscourt Park, Hammersmith. The purpose of producing an optical illusion of apparently beheading or otherwise dismembering a human being.

3619 C. Beck, Queen-street, Cheapside. Improvements in joining horn and whalebone.

Dated December 20, 1867.

3621 H. A. Bonneville, 38, Porchester-terrace, Bayswater. Improvements in machinery for carding and spinning wool and other fibrous materials. (A communication.)

3623 E. Field, Chandos Chambers, Adelphi, Westminster, consulting engineer, and F. P. Warren, Norwood, Surrey, Commander in the Royal Navy. An improved cowl for chimney tops.

Dated December 21, 1867.

3627 J. Kenyon, Blackburn, Lancaster, cotton manufacturer. Improvements in apparatus for boiling size.

3629 C. de Bergue, Strand, engineer, and W. Dredge, Buckingham-street, Strand, civil engineer. Improvements in the construction of and mode or modes of connecting and working railway carriages or trains.

3630 W. Walker, Rochdale, and E. Holt, Newton Heath, Lancashire. Improvements in direct-acting double-action steam pumps.

3633 J. Davidson, Woolwich. Improved machinery for manufacturing central-fire cartridges.

3637 J. Davison, Bishopswearmouth, Durham. Improvements applicable to the rigging, chains, windlasses, anchors, and other parts of ships or vessels, or to collieries, railways, rolling stock, or other purposes, to prevent sudden blows, jerks, or strains.

3639 J. G. Tongue, Southampton-buildings, Chancery-lane, engineer. Improvements in the manufacture of pomade for the human hair. (A communication.)

Dated December 23, 1867.

3641 W. Dixon, Maple-street, and W. Brown, Gray-street, Newcastle-on-Tyne, engineers. An elastic coupling for the prevention of sudden or undue strains upon ropes or chains, when used in towing, hauling, or lifting.

3643 W. W. Urquhart and J. Lindsay, Dundee, engineers. Improvements in machinery for softening jute, hemp, and similar fibrous materials.

3647 C. J. Adams, Stockton-on-Tees, architect. A self-acting fire alarm and extinguisher.

3649 J. Dawkins, Pembroke, tanner and currier. Improvements in tanning, and in the apparatus to be employed therein.

3651 M. J. Rice, Sherlock-street, Birmingham, engineer. Improvements in machinery for cutting and heading nails.

Dated December 24, 1867.

3652 F. A. Abel, Royal Arsenal, Woolwich. Improvements in the production of explosive compounds.

3653 S. Myers, St. George's-road, Kilburn. Improvements in apparatus for roasting coffee. (A communication.)

3654 W. Burley and W. H. Glasson, Landport. Improvements in the construction and arrangement of plummer blocks and bearings for propeller shafts, and other analogous purposes.

3655 P. F. Tranchat, Rue Gaillon, Paris, engineer. A universal machine for manufacturing circular cutters and milling tools of any form or outline, with either a rectangular or a helicoidal direction of cut.

3657 A. M. Clark, Chancery-lane. An improved colouring matter, chiefly applicable for dyeing and printing purposes. (A communication.)

3659 G. Layton, Liverpool. An improvement in the manufacture of soap.

3660 F. Render, Manchester, corn merchant. Improvements applicable to traps for pigeon and other shooting.

3661 T. Harbison, Manchester. Improvements in rails for railways.

3662 W. E. Newton, Chancery-lane, civil engineer. An improved alcoholmeter or instrument for ascertaining the alcoholic strength of liquids. (A communication.)

3663 J. Addie, Langloan Ironworks, Coatbridge, Lanarkshire, ironmaster, and F. Kohn, Westminster, civil engineer. Improvements relating to blast and cupola furnaces.

3664 G. E. Allshorn, M.D., M.R.C.S., Ludgate-hill, City. Improvements in the manufacture of artificial fuel.

3665 S. Lennard, Newark-street, and F. Lennard, Belgrave Gate, Leicestershire Improvements in the manufacture of warp fabrics.

3666 W. Hewitt, Birmingham, manufacturer. Improvements in holders for holding or gripping reins, whips, and other articles.

3667 G. J. Hinde, Wolverhampton, manager, and T. C. Hinde, Ynispenllwch, near Swansea, Glamorganshire, colliery proprietor. Improvements in the manufacture of iron and steel, and in furnaces and apparatus used in the said manufacture.

Dated December 26, 1867.

3670 B. and J. B. Bowen, Chipping Norton, Oxfordshire. Improvements in the manufacture of gloves.

Dated December 27, 1867.

3672 E. G. and E. E. Raffer, Rue d'Enghein, Paris. An improved braiding machine.

3674 E. J. Hughes, Manchester. Improvements in blankets used in machines for printing textile fabrics, and in the mode of joining together the ends of double-woven fabrics. (A communication.)

3676 J. Cockshoot, jun, coach builder, and H. Weatherill, Manchester, manager. Certain improvements in railway breaks.

3678 D. Steele, Farnworth, Lancashire, manufacturer. Improvements in apparatus for heating and agitating liquid or fluid substances.

3680 J. Clark, Redditch, Worcestershire, needle manufacturer. Improvements in wrappers or envelopes for needles.

3684 C. E. Brooman, Fleet-street, patent agent. Improvements in the application of electricity to clocks, watches, and other timekeepers, and in the apparatus employed therein. (A communication.)

Dated December 28, 1867.

3686 J. Capper, Birkenhead, accountant. Improvements in the construction of chimney tops or caps.

3688 A. V. Newton, Chancery-lane, mechanical draughtsman. Improvements in the mode of and machinery for making shot and shells for ordnance. (A communication.)

3690 W. E. Newton, Chancery-lane, civil engineer. Improvements in motors or apparatus for generating motive power, and in the method of applying the same to produce useful effect. (A communication.)

3692 R. Howarth, Southampton-buildings, Chancery-lane. Improvements in carriages, railway trucks, and other vehicles.

3694 E. Evans. Peacock-street, High-street, Newington Butts. Improvements in the construction of the sash frames and boxings of windows and shutters, and in the mode of hanging the sashes of windows.

3696 C. Churchill, Norwood, merchant. An improved gas burner. (A communication.)

Dated December 30, 1867.

3698 R. Fothergill, Abernant House, Aberdare, Glamorganshire. Improvements in the process of and apparatus for producing heat by the combustion of fuel for metallurgical and other operations where heat is required, and in the means for utilizing the waste heat from blast furnaces.

3700 W. Kendrick and J. Wooldridge, West Bromwich, Staffordshire, ironfounders. Improvements in the apparatus for consuming or preventing the formation of smoke in steam boiler and other furnaces.

3702 J. Davison, Bishopswearmouth, Durham. Improvements in furnaces for smelting glass, or the materials employed therein, and for consuming smoke.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated January 3, 1868.

3 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. Improvements in electric telegraph apparatus. (A communication.)

Dated January 3, 1868.

27 M. J. Frisbie, Fitzroy-square. Improvements in mechanism or apparatus for feeding fuel into furnaces, fire-boxes, and fire-grates.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," January 14, 1867.

2473 I. Dixon. Submerged propeller.
2474 M. Hammerstein. Smoking tubes. (A communication.)
2489 A. Field and W. B. Nation. Ornamenting candles.
2492 A. E. Gelhaye. Chains.
2495 L. N. Le Gras. Milk-cans.
2501 W. Weldon. Artificial oxides of manganese.
2503 F. B. Dœring. Working in rock.
2504 J. K. Smythies. Carrying passengers through the air.
2509 R. A. Jones and J. C. Hedges. Fire-escapes.
2510 A. C. Henderson. Applique embroidery. (A communication.)
2513 H. Carter and G. H. Edwards. Breech-loading firearms.
2514 G. Cope. Shaping cigar bunches.
2515 J. Ford. Securing wheels.
2521 H Gardiner. Miners' safety lamps.
2526 W. G. Creamer. Excluding dust from railway carriages.
2527 T. W. Helliwell. Looms.
2528 A. M. Clark. Ships.
2534 J. B. Rogers. Projectile anchor.
2539 B. F. Stevens. Illuminating roof.
2544 E. J. C. Welch. Artificial ice.
2547 W. R. Lake. Cartridge holder. (A communication.)
2548 C. E. Brooman. Hydrogen. (A communication.)
2554 J. Turnock. Cask stands.
2558 J. Dicken. Yielding fishplate.
2564 J. Rae. Filtering water.
2570 S. Brown. Ornamenting bottles.
2580 W. F. Cooke. Quarrying slate.
2584 J. Perrin. Fuel economizer.
2590 P. R. Couchoud. Chenille.
2593 W. F. Batho. Cooling liquids.
2595 J. M. Napier. Wine glasses.
2597 W. Whitehead. Printing fabrics.
2603 R. Canham. Sharpening knives.
2607 J. A. M'Kean. Cutting rocks. (A communication.)
2617 S. C. Amesbury. Communicating between railway trains.
2644 A. M. Clark. Colouring artificial flowers.
2662 B. and A. B. Blackburn. Lucifer matches.
2686 H. Forbes. Rotary pumps.
3075 R. B. Roden. Breech-loading firearms.
3106 A. V. Newton. Sewing machines. (A communication.)
3148 J. F. Brinjes. Cooling liquids.
3193 F. Ransome. Grindstones.
3292 J. Owens. Pile fabrics.
3311 A. Munro. Cutting rocks.
3341 E. Townshend. Tobacco pouches.
3471 S. Goldstein. Wearing apparel.
3483 R. B. Jones. Prevention of incrustation in steam boilers.
3496 W. H. Cooke. Door springs.
3523 G. A. Young. Curtain.
3572 J. E. A. Gwynne. Sinking tubes.
3688 A. V. Newton. Making shot. (A communication.)
3 W. R. Lake. Electric-telegraph apparatus. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed January 11, 1868.

2040 E. Hohenbruck	2108 T., J., and J. Palmer jun.
2045 F. Wilkins	2112 R. T. Bradbury and T. Bottomley
2047 W. B. Haigh	2186 E. Ravenscroft
2065 H. Fletcher	3066 J. T. Caird and S. Robertson
2067 E. T. Hughes	
2076 J. M. Hetherington and R. W. Pittield	
2180 P. A. Rohart	

Sealed January 14, 1868.

2078 A. B. Ibbotson	2117 G. T. Bousfield
2079 T. Redwood	2129 W. Potts
2082 F. B. Vallance	2158 C. H. Murray
2085 G. W. Hayes	2166 C. E. Brooman
2086 J. Mannock	2168 G. L. Barens and J. F. Ladougne
2087 W. M'Andrew	2234 J. Edwards
2088 T. Pirie	2282 E. T. Horsley
2094 G. Weedon	2294 H. A. Avery and G. Penabert
2096 A. de Smet	2408 A. M. Clark
2098 G. H. Daw	
2106 A. Morton.	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

50 T. Richardson and M. D. Rucker	101 F. Barnes
55 G. B. Galloway	119 G. Davies
60 J. J. Blackham	127 J. Young
77 H. Chamberlain	129 F. C. Fourgeau
82 J. F. Spencer	130 J. B. Farrar
89 J. Ramsbottom	164 R. Mallet
95 R. Chidley	166 W. C. Hicks
96 J. G. Jones	228 J. Hamilton
	725 H. Owen.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

62 S. Moulton	88 W. Bullough
89 G. Whight	194 T. Gibson and W. and H. Knighton
87 M. A. Muir and J. M'Ilwham	251 G. T. Bousfield

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending January 11, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1140	0 8	1516	1 0	1557	0 8	1585	0 6	1640	0 4	1673	0 4
1324	5 10	1517	1 4	1558	0 10	1589	0 6	1646	0 4	1674	0 4
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1513	0 10	1554	0 8	1582	1 6	1639	0 4	1672	0 4	2243	0 10
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THE

MECHANICS' MAGAZINE

LONDON: FRIDAY, JANUARY 24, 1868.

DR. LIVINGSTONE.

THE Livingstone search expedition has returned, and has brought with it news of an assuring, although not entirely satisfactory, character. We have always looked upon the hopeful side of this question, and have believed in the safety of our great African explorer—at least, as far as regards a violent death. This we have been enabled to do simply because the balance of evidence was in favour of such conclusions. Sir Roderick Murchison has ever been most sanguine, and he now has not the shadow of a doubt that the white man seen on the west side of Lake Tanganyika was Dr. Livingstone. We are heartily glad to hear it, and we believe that this will prove to be correct. Turning to the report of the members of the expedition, we find that Dr. Livingstone did not take the route expected from the Ruvuma River at about 11deg. S. along the north coast of Lake Nyassa in from 36deg. to 34deg. E., but from the Ruvuma went south round the south end of Lake Nyassa, going as far as 14·28deg. S. Thence he proceeded to the north-west, and was left pursuing that route either with the view of exploring the west coast of Lake Nyassa, and thus ascertaining how far it extends north, and then to proceed on to Lake Tanganyika, or he had gone direct for Tanganyika, and thence down the Nile home. Mataka, Makata, Marenga, and Maksura, mentioned by the Johanna men, were found on the southern route instead of the northern. The expedition followed Dr. Livingstone up to within a few miles of where it was reported he was murdered, and there found that the doctor and his "boys" were ferried over a marshy lake by Marenga, but the Johanna men under Moosa made a detour round the lake and returned next day to Marenga, saying they had deserted Livingstone and should return to the coast, because he was leading them to a country where they would be murdered by the Mavite. The expedition also had interviews with the native porters who had carried Livingstone's luggage five days' journey further to Pasombe. This is confirmative of Sir Roderick Murchison's oft-repeated conviction that the doctor had proceeded into the interior.

So far, we are well pleased with what the expedition under Mr. Young has done. But the question which occurs to us is, could they not have done a little more? The safety of the indefatigable traveller has only been proved negatively; could not the expedition have afforded some positive proof on this point, and thus have set at rest all doubts and uncertainties? We were ourselves somewhat surprised at the early return of the expedition, but attributed it to extraordinary success in their investigations. Some experienced African travellers, however, are inclined to think the return of the expedition somewhat hasty, and that it is possible, after all, that the natives were clever enough to say that which they thought would please rather than what they knew to be the fact. It appears that deception has certainly been practised on the expedition in one instance, and it was in this way:—The leaders of the expedition were specially instructed to recover, if possible, some papers known to have been left by Dr. Livingstone with a chief on the borders of Nyassa. When five days' journey from this chief's village, Mr. Young dispatched a few of the natives to the chief with presents, to obtain the papers desired. These natives returned eight days afterwards, however, with the story that the documents were lost or destroyed. With this answer, Mr. Young was so far content that he did not think it necessary to take steps to corroborate the information. This is to be regretted, as we find that on the return journey it was elicited that the messengers had halted when they had gone one day's journey, had bartered the cloth and beads sent to the chief as presents for personal refreshment, and afterwards returned to the Europeans with a lying story as to the missing papers. Moreover, the absence of the messengers was suspiciously less by two days than it had been calculated it would be. This circumstance should have been sufficient to have induced an investigation into the matter, and the dispatch of other messengers under trustworthy supervision. Indeed, it appears to us that this should have been done in the first instance. Surely, one of the European members of the expedition, if not the leader himself, should have accompanied the native messengers. And why not, when their trick was discovered, have retraced their steps, and have proceeded to the village where the papers were supposed to be? Surely, there is some want of heart in the matter. It is true, we have reason to hope, that these documents are now on their way to England; but how much more satisfactory and assuring to have had them here now? We repeat that the members of the expedition have done well in proving the safety of Dr. Livingstone by a negative process, but they would have done far better had they endeavoured to prove it positively. We might even go farther and suggest that, having so easily satisfied themselves of the fact that Livingstone had not been murdered, the expedition might have pushed on in his wake, and have ascertained a little more of his actual existence and whereabouts. We write, of course, under the disadvantage of non-acquaintance with the local conditions and other circumstances attending the expedition, but we write with a feeling of disappointment which must be shared in by every friend of the great explorer. We shall, no doubt, hear the details of the expedition next Monday evening at the Geographical Society's meeting, when a little more light may be thrown upon the matter. Besides, we are looking for Mr. Young's narrative, which is to be published. This, we believe, will be followed by a pamhplet from the pen of Captain Faulkner, who accompanied the expedition; and as the narratives are expected to be somewhat dissimilar, if not contradictory, we shall have the opportunity afforded of judging of the conduct of the expedition. Meantime, we continue hopeful as to the safety of our great traveller, and believe that we shall see him amongst us yet again.

THE AMERICAN RAILWAY CONSTRUCTOR.

THE Union Pacific Railroad presents an example of rapid construction unparalleled in the history of American railway formation, much less of our own. Granted that the lines in the States are for the most part less substantially made than ours are, still we could not construct them even in a similar manner in the same time. Much of the material is so well to hand, and there is such ample room for whole troops of workmen to move in, that with discipline and order the progress made in this class of work is really astonishing. On the 9th of May, 1866, forty miles of the Union Pacific Railroad were completed, but in 182 working days from that date 245 miles more were laid and put in prime condition, every rail, sleeper and spike being brought up from the rear. Seven saw-mills furnish the sleepers—or, as the Americans call them, "ties"—and lumber, and all the bridges are framed, the pieces being numbered and fitted where wanted without delay. In this way was constructed a bridge at Loup Fork, 1,500 feet long, on the Howe principle, and which is as fine a truss as any put up in the States. On the 1st of January, 1867, 305 miles of this railroad were completed, and by June last 500 miles were in working order. There yet remains much work to be done, and during the past winter some heavy rock-cutting has been accomplished. The work at the California end of the route is being energetically pushed forward towards the east, and it is expected that the whole grand line to the Pacific will be open in 1870.

The way in which this important work is being so rapidly carried out deserves a brief allusion here, as well on its own account as that it will contrast with what we shall presently have to say. Two engineer officers lead the way, laying out the work, fixing the gradients, laying down the track, and putting up the telegraph. With these officers are first 2,000 navvies, or "graders," as the Americans term them. Next there are 1,500 timber getters and tie makers, then follows a small army of tie layers carefully performing their share of the great work. Twenty miles behind these workers are the construction trains loaded with materials. Beyond these again some miles is another grand reserve of trains of a similar character. Near the working party, and following it hour by hour, as the line advances, are the boarding cars and a construction train. The boarding cars are 80 feet long, and include dining rooms, sleeping berths, kitchens, store rooms, and offices. The boarding cars go in advance, followed by a construction train, which unloads, and then goes back for fresh supplies. The boarding train is then run back beyond the unloaded materials, and trucks are placed on the line which supply them to the tracklayers. The arrangements throughout are the very embodiment of system, and this is the key to the rapidity with which the work advances.

One would have supposed that this rate of progress would have contented any nation. We should have been—nay, we are—satisfied with very much less. Fancy a line of railway from London to the Land's End constructed in less than two-thirds of a working year. But this rate is not sufficient for our transatlantic friends. A people who peel their apples, shell their peas, and stone their plums by machinery, must of necessity construct their railways by the same means. So we find them bringing out a railway constructor, which is certainly one of the most remarkable machines we have ever heard of. Its birthplace is San Francisco, where it has been tested in the presence of all the local authorities, and pronounced to be a perfect success. Its invention is due to Mr. D. W. Robertson, of Star City, Humboldt, Nevada, who pithily describes it as an apparatus which, by a combination of movements, will level the loose surface of the soil, place the ties at uniform distances, follow any curve, and accommodate itself to ordinary gradients, deposit the rails with the chairs attached, and nail them securely in their places. It is estimated that, with a complement of twenty men, it will do as much work as two hundred men can without its aid. We gather from the San Francisco "Bulletin" that the machine is comprised within a frame 60ft. long, 8ft. high, and 12ft. wide, and with its trusses, struts, and tie-rods, has the appearance of the skeleton of a wooden bridge placed on a low railway truck. The frame, however, is only supported over the truck wheels one-third of its length; the forward part of the frame, which is two-thirds of the whole, overhangs the ground on which the track is to be laid. To preserve the balance of the apparatus, the heavy stringers, which give strength to the machine, taper gradually to the front, so that without the engine and boiler, or any load of ties, rails, or other ballast, there is no possibility of its tipping forward.

When completed for actual service, it will

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be fitted with a ten-horse power engine, which will be placed between the two supporting trucks, and with twenty or thirty rails laid lengthways, and a ton or two of ties stored transversely at the extreme rear, the suspended portion, when the concern is in motion, will be as firm and solid as if supported on wheels the entire distance. As the machine travels forward, it will move on rails of its own laying. In front of the machine is a plough which levels the ground for the permanent way. The ties are brought from the back over the machine and above the heads of the workmen by two endless chains, and are laid on the ground in front exactly in the position required. On each side of the motive power, on the rear of the platform, are the stacks of rails, which are picked up singly by clamps connected with a hoisting apparatus raised to a sufficient height, and while in suspension are run forward by means of overhead cars and tracks till they hang over the spot they are destined to occupy. The chairs are slipped over the rail ends as they travel, and at a signal by the foreman the rails are lowered by machinery to their places. The chairs have then only to be nailed firmly to the woodwork, the spikes driven home, and the work is complete, and the machine moves on over the road it has just constructed. Fresh ties can be constantly supplied by the track behind without stopping the work. When the gradient rises or falls, the front of the machine is elevated or depressed to a fractional part of an inch by a system of rods and set screws, which perfectly adjust the machine to its work. The constructor will, if necessary, turn itself on a radius of 200ft. The position of the managing engineer is on a platform built above the heavy framing of the machine, where, housed as comfortably as the pilot of a river steamer, he can overlook all the machinery in the work, direct, and control, and survey the ground ahead, and view the finished line behind. Such is the new constructor which is to revolutionize the system of railroad construction by laying a track at the rate of from six to twelve miles per day. Should the Union Pacific Company take to this machine, they will finish their work in far less time than they will under the present system of manual labour. Repeating our parallel, with the aid of the constructor working at the slower of the two rates named, we can say,—Fancy a line of railway from London to Land's End constructed in forty-one days!

NEW SYSTEM OF GASLIGHTING IN PARIS.

OF all the practical applications of science to the welfare and comfort of civilized nations, that of gas is unquestionably the most valuable and most conducive to public convenience. In spite of many attempts to manufacture gas from other sources than coal, it has nevertheless remained as the material "par excellence" from which to obtain that illuminating luxury. So far back as the year 1838, London possessed upwards of twenty gas works, representing a capital of three millions invested in apparatus, mains, and pipes. The great difficulty to overcome in manufacturing gas from coal was the purification, which at the present day cannot be said to be altogether vanquished. In many towns the reverse is the case, and the gas is far from possessing that brilliancy and illuminating power which should be the result of it attaining the orthodox standard of the light of so many wax candles. Some years ago, gas evincing superior powers of illumination to that manufactured from coal was produced from oil, by bringing that substance into contact with coke in a retort heated to redness. A company was started in London to carry out the project. The oil in this situation becomes decomposed and converted into a volatile gas, which being altogether destitute of sulphur and those ammoniacal ingredients which adulterate coal gas, requires no purification. Notwithstanding this great advantage, owing to the comparatively high price of the material, and other circumstances—possibly the strenuous opposition of the existing companies—the scheme proved abortive, and the undertaking was abandoned. The fact, however, that gas produced from coal is not the best description of artificial light that can be procured has long been the opinion of chemists and scientific men. To bring the matter to a crisis, a company has been quite recently established in Paris to light that city with an illuminating medium of a new description. The proposed method of illumination may be termed new when applied upon a scale so vast as that under consideration, but viewed simply as a means of producing a brilliant light, it is familiar to every chemist or even student of the laboratory. Most of our readers are possibly acquainted with the vivid light obtained by what is termed the oxy-hydrogen process, and can recall to their minds the dazzling effect produced by throwing an incandescent jet of this compound gas upon a piece of chalk.

The Parisian Gas Company propose to illuminate Paris by means of igniting the gas formed by the union of oxygen and hydrogen. One of these elements, namely, oxygen, is not "per se" an inflammable gas, but rather the agent or a source of combustion for other substances. This is apparent from the simple and elementary experiment of burning bits of phosphorus, or a bit of red hot wire in a receiver of oxygen. The gas does not take fire and suddenly blaze up, but performs the part of a feeder, as it were, to the combustion already set up in the substance placed within its influence, which it at once intensifies and maintains until it is itself exhausted. Very opposite features characterize the other component, hydrogen. It is inflammable, but when burning emits only a feeble light, although its flame possesses a very high temperature. When mixed with a certain proportion of air it is rendered explosive. Apropos to our subject, it may be remarked that its diffusive power is so great, that it becomes no easy matter to secure it in a receptacle which shall totally prevent its escape. The immediate application of a light to certain proportions of these two gases, as is well known, determines their combination, producing water, but by adopting precautions the compound jet may be burned in a manner similar to that of the ordinary coal gas. A peculiarity of the flame of the oxy-hydrogen light is that it is solid, and not hollow, as is the case with other illuminating agents. In fact, independently of what the actual flame may be composed of, it is oxygen which really supports all combustion, and it therefore appears at first sight the proper medium to utilize, if possible, and cause it to be a principal instead of playing a merely subordinate part. Assuming, therefore, that it is proposed to employ pure oxygen in place of that existing in the air, it is evident that the first step is to obtain means of procuring that gas in a state of purity, at a cost which will prove remunerative. Granting that this indispensable step is achieved, the utility may be questioned of establishing expensive reservoirs, and laying down a costly system of mains and branch pipes to supply that which can be obtained from the air gratuitously. It must, however, be kept in view that it is one thing to supply a flame with oxygen diluted, or rather adulterated, with four parts of nitrogen, and another to feed it with that gas in a state of purity, and supplied, moreover, in the exact proportion required, so that from the mixture is obtained the maximum illuminating and warming effect that the constituent elements are capable of developing. At the same time, a light too vivid is insupportable—the electric light, for instance—and the ordinary gas flame has frequently to be toned down and softened by globes of muffled glass. From a peculiar class of schist, from many resinous substances, and other sources, all possessing a large proportion of carburetted hydrogen, an excellent gas can be procured, endowed with a high power of illumination. The practical impediment to its employment is that during its passage through long pipes it loses, by condensation and other causes, those very elements which render it valuable.

Although we have stated that the object of the new Parisian Company is to use a gas produced by the union of hydrogen and oxygen, yet it must not be supposed that the process is identical with the well-known oxy-hydrogen light. The project to be carried out does not consist in adopting any other method of illumination than that arising from the use of the ordinary gas, nor does it include any new method of manufacture of that substance. In a few words, it is simply a new plan for burning or consuming the gas already supplied to the city. We now return to the question of the feasibility of producing upon a large scale the quantity of pure oxygen required for the execution of the intended scheme. Evidently the source from which this gas is to be derived must not only contain it in great abundance, but must also be capable of yielding it up with what might be called "very little persuasion." It must not in any sense come under the category of what are known to chemists as refractory bodies, or those which refuse, except under very strong pressure, to part with the particular constituents demanded of them. Manganate of soda is the substance at present considered to possess these qualities, and it is therefore proposed to give it a trial. The element manganese, especially in the binoxide, $Mn\,O_2$, is a fruitful source of oxygen, and is often used for the production of that gas. By submitting the manganate of soda to the action of heat, it first yields up its oxygen, then draws a fresh supply from the air, which it again parts with, and this process of loss and recovery continues for an indefinite period. There is another and a grave difficulty to be surmounted in furnishing the actual quantity necessary, without reference to the mere price. In a period of twenty-four hours each retort could supply only 9 cubic yards of oxygen, which is a very small quantity compared with the 220 cubic yards of coal gas furnished by each existing retort in the same interval of time. The result of a calculation demonstrates that nearly 12,000 retorts for the production of oxygen would be needed, while the total of those used for the manufacture of coal gas is but 2,000. Conceding that both in quantity and quality the oxygen can be produced and stored in suitable reservoirs, the next step is to convey it to its destination, and this involves a task of no ordinary magnitude. Owing to the tremendous explosive powers of the two gases when mixed, and ignited without due precaution, the oxygen and the coal gas could not be conveyed in the same pipes. The former must, therefore, have a special service of its own, and also one in every respect superior to that given to its neighbour. Coal gas is so readily manufactured, that, comparatively, its value is not very high, and companies are quite satisfied to regard with indifference the enormous loss that occurs through leakage and bad manipulation of the pipes. It has been alleged that so much as 50 per cent. of all the gas made in London is lost in one way or another. When, however, it becomes a question of transporting a substance which under the same volume possesses a much higher value than coal gas, the service pipes must be laid in a better manner, and the whole system attended to with a commensurate degree of vigilance and precaution. In addition to entailing a new set of pipes, all the present burners would be useless under the proposed system, and it would be necessary to replace them with others adapted for the employment of a solid instead of a hollow flame. Reviewing all the points to which we have drawn attention, the truth of the

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economy of the project, as announced, is not altogether apparent. The projectors of the scheme intend employing the oxygen in the proportion of about a fourth of the coal gas, so as to increase the intensity of the illuminating power nearly eight times. Firstly, can this result be accomplished? secondly, if it can, will it be more economical than the present system? Taking the relative values of coal gas and pure oxygen as 1 to 7, it is evident that in order that the price should remain the same, the quantity of gas consumed by the proposed plan should only be one-seventh of that burned at present. But the quantity of light developed by a burner, is proportional to the area of the flame for a given intensity. If oxygen be the illuminating agent, the intensity will be greater than that of the same quantity of coal gas consumed in a given time; but since the combustion of the former will be more energetic, the area of the flame will undergo a corresponding diminution, which may be estimated at one-fourth. As the quantity of gas is reduced to a seventh, the actual flame is, therefore, represented by a twenty-eighth, and, consequently, instead of an illuminating power of seven times the intensity of coal gas, one of twenty-eight times is required to maintain an identity in the cost. Unless the manufacture of pure oxygen can be reduced to a price less than 1s. per cube yard, which is certainly assuming a condition of affairs for which there is no warrant, it is scarcely possible that the new project will be found to succeed. With respect to a city similar to Paris, there are many additional disadvantages which a company of this description has to contend against which are unknown to ourselves. Our streets are common property, and anyone who owns a few yards of piping may prove his title to "a right of way" by ripping up the road, obstructing the traffic, and causing a local nuisance for almost any length of time. There is not a single main thoroughfare in London that is not disembowelled at least once every three months. Matters are otherwise managed on the other side of the Channel, and in connection with our subject it may be remarked that the ground is already occupied by an existing company whose interests would be carefully protected. There is another feature presenting itself worthy of consideration. The City of Paris levies a duty upon every cube yard of gas consumed. If, therefore, the employment of pure oxygen will reduce the annual consumption of that article to one-seventh of the original quantity, there is no question but that in order to preserve the total amount of the rate unaltered, seven times the duty will be levied off the oxygen which has caused the decrease.

MOLECULAR VIBRATIONS CAUSED BY THE ELECTRIC CURRENT.

IT has long been known that a thin wire which has conducted a current of electricity for some time becomes somewhat shorter and, as it were, crinkled, or it may be slightly spiral, also that it becomes harder by use; but a more decided proof of these molecular vibrations in a metallic conductor of electricity, as we think, has come under our notice than anything we have seen noticed by any experimenter. Some time ago we were engaged in some experiments for the deposition of iron from various solutions, such as sulphate of iron, chloride of iron, ferrate of potash, and ferrocyanide of potassium. For the deposition of iron from the first three solutions, an intensity of one cell only being necessary, the molecular vibrations are but slight, but for the deposition of iron from ferrocyanide of potassium, under the most favourable circumstances, not less than three cells are effective, and, even with these or higher intensities, the phenomenon we are about to name does not always take place.

The conditions under which the experiment was made are these. In an outer cell, containing common salt and water, was placed a porous cell, within which was a saturated solution of ferrocyanide of potassium in the cold, to which was added one-third its weight of pure potassa; this potassa was to take up any carbonic acid gas that might be disengaged from the ferrocyanide solution. The whole was then placed in a chafing dish containing water which was kept at 150deg. Fahrenheit. A positive electrode of gas carbon was placed in the outer cell in the salt and water. Within the porous cell the steel blade of a knife was placed as a negative electrode. Three cells of Daniel's battery were then attached with a regulator, and the current was adjusted till there was just a slight evolution of hydrogen at the negative pole. The apparatus was kept in action for four hours. The steel blade before being placed in the solution was thoroughly cleaned and examined, and was perfectly sound. At the end of four hours it was taken out to ascertain the amount of iron deposited, and it was found that there were two cracks in the steel from the edge towards the back; the longest being about a quarter of an inch. This being so unexpected, the blade was again placed in the solution for four hours more under the same conditions, and again on examination it was found that there was another crack; but this time from the back towards the edge, and the other cracks were extended somewhat. A third time it was subjected to the same treatment, and another crack was found much longer than the others in another part of the blade, from the edge towards the back as the first ones.

If this last crack had been directly opposite to the one produced in the second experiment, the blade would have parted, because the two cracks together were longer than the width of the blade. Similar results have been produced in later experiments, though not to the same extent. No doubt these results are produced by the molecular vibrations of the metal while the current is passing, but it is only in exceptional cases that they occur, and they are doubtless owing, when they do occur, to some inequalities in the steel, either in density, composition, or temper; for in most steel blades no such thing happens, nor in blades of brass or copper, nor in a very hard and brittle alloy of copper and tin. Apparently, if the metal be perfectly homogeneous no such thing happens. The cracks are altogether similar to those produced in steel, when it is hardened by being plunged into cold water, and these, it is well known, are the results of unequal contractions, whether from injudicious manipulation or from inequalities in the structure of the metal. And this latter cause is probably the reason of the electric cracks. However, these experiments prove this fact in a new form, that any metallic electric conductor conducts with its whole substance. This is a fact well known to electricians, and though sometimes it has been disputed, yet it has been abundantly proved to be the fact, but we think never in so striking a manner.

There is another matter that we think it also bears upon, which has been much in dispute. That is, whether electricity is a fluid or simply a peculiar form of vibrations of material molecules. Certainly of late this latter notion has much gained ground, to the exclusion of the irrational theory of an imponderable fluid. Light now is considered to be motion, heat also is considered to be motion, and without doubt electricity is motion, and moreover these motions are convertible.

At the present time, Professor Tyndal, in his lectures on heat and cold, is teaching this doctrine of molecular vibrations to his juvenile audience in a very simple but very effective manner, by means of a row of solitaire balls. The first being struck, motion is communicated to the last, not by the transmission of anything, but by each communicating its vibration to its neighbour; and we think such an illustration of electric conductivity is also applicable, and not only so, but it is most appropriate. Many who hold electricity to be a force and not matter, have considered that the most apt illustration of an electric current was that of water flowing through a pipe, quantity being represented by the bore of the pipe, and intensity by head of water. But why not take the musical vibrations of a string, or the air of a musical pipe, or the vibrations of the reed of a harmonium, for here we have something like the compass necessary to represent electric intensity, the vibrations ranging from about two thousand in the second to many hundreds of thousands. However, we will leave this for the consideration of electricians, but think that our experiment at least proves this, that an electric current is manifested by the molecular vibrations of the conductor.

RAILWAY ACCIDENTS.

THERE should not be, of course, any preventable accidents, but accidents will happen, it is to be feared, while the world endures, or, at least, until the millennium arrives. Some classes of casualties receive quite as much attention from the press and the public, and some others, again, much less than their numbers and character respectively entitle them to. Railway accidents are almost invariably thoroughly ventilated, and full publicity is given to the details, both before and after the scrutiny of the Government inspector, sent by the railway department of the Board of Trade, who reports upon the casualties which the companies are bound, under penalties, to report to the Board. There is much less alarm excited by, and much less known concerning, the far more numerous fatal accidents that occur in connection with horses and vehicles in the streets of London. Often there are as many such fatal accidents in a week as there are upon all the railways in the United Kingdom in a year. There is, of course, when a person is killed, a coroner's inquest, a verdict in accordance with the evidence, a two line record in the Registrar's fortnightly return, and there an end. It is a startling fact that to those who tread the streets of London the chance is ten times greater of their being killed in the streets than of their being killed by railway travelling. A curious calculation has been made, in vindication of the rail, with all its imperfections, as by far the safest mode of travelling now practised, or ever known; that a man runs a greater chance of being struck dead by lightning, or actually of being hanged, than of his being killed by railway travelling. The chances of the last-named mode of departure from this life are of course based upon figures, and apart from any moral considerations.

From the Board of Trade railway returns just published it appears that in 1866 there were fourteen passengers killed on railways by causes beyond their own control in England, and one in Scotland; in Ireland not a single passenger was killed or hurt. Of the six accidents in which lives were lost, two, involving nine deaths, are of an exceptional nature, and can scarcely be regarded as attributable to railway travelling, in the ordinary sense. In one of these cases, where six persons were killed, the accident occurred on the Carnarvonshire Railway, upon which the contractor ran an excursion train before the line was inspected. In another instance, upon the Metropolitan, an iron girder fell upon a passing train and killed three persons. The passengers who lost their lives were one in above 20,000,000, and the passengers injured one in about 600,000. There was no fatal accident to passengers upon the systems of any of the great companies, excepting the Brighton and the North-Eastern. The London and North-Western, the Great Western, the Great Northern, the Great Eastern, the Midland, the South-Eastern, the Lancashire and York-

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shire, and the Manchester, Sheffield and Lincoln, all conducted their enormous traffics without the loss of a passenger's life. On the South-Western there was not even an injury of any kind sustained by a passenger. In Scotland, the Caledonian, the Great North of Scotland, the Highland, and the North-Eastern, conveyed the whole of their passengers without an injury being sustained, as was happily also the case with all the Irish railways. We therefore arrive at the inevitable conclusion that, notwithstanding the terror inspired by a railway accident, the rail is really by far the safest mode of locomotion with which the travelling public have ever been made acquainted.

ELECTRICITY AND TELEGRAPHY.

IT has been reported during the last few days that the honour of baronetcy is about to be conferred upon Professor Wheatstone for his numerous inventions and their great practical value. The invention of the stereoscope, and, in a very great measure, the present position of telegraphy, are due to him. It will be recollected that he was associated with Mr. W. F. Cooke in introducing the needle telegraph, and telegraphy generally into this country. Since that time, he appears to have given his time and attention more to the study of electricity and telegraphy than to other matters, the result being the enormous practical advantage to the profession and to the public by the invention and adoption of many valuable instruments, and amongst them we may mention his balance, or, as it is generally known, "Wheatstone's Bridge," by the use of which testing resistances of various kinds have been so much simplified and made so accurate; his magneto-electric alphabetical telegraph, rendering signalling so easy that the veriest tyro can exchange communications with one equally unacquainted with telegraphing, an instrument that is so pretty and complete in its appearance that it usually forms an ornamental object in a merchant's office. Very lately he has introduced an automatic instrument for sending messages at a high rate of speed; his other inventions and practical applications of electricity are really too numerous to mention. We feel sure that any recognition of his valuable services will be looked upon by all as a suitable recompense for time spent in bestowing practical advantages upon the country, and that an honour conferred upon one so high in the electric world will be deemed an honour to the profession generally, of which he is, and we trust may long continue to be, so bright an ornament.

Mr. Latimer Clark is bringing generally into use a unit of inductive capacity which will be found of great practical advantage. Its value has, we believe, been determined by Mr. Fleeming Jenkin. It is contained in a small box, and consists of a number of sheets of tinfoil fastened on to thin sheets of talc, by means of a hot iron and Thomson's wax, in series like an ordinary condenser, sufficient being used to make up the required unit.

The Spanish Government have invited tenders for the construction and submergence of a submarine line from Spain to the Antilles—to Porto Rico, and to Cuba—with a further extension to Panama and Nicaragua, the tenders to be sent in by the first of February. One special clause is worthy of remark: the contracting parties are to deposit the sum of £20,000 as guarantee for the fulfilment of the contract, which must be completed within three years. We have seen the rise of several schemes for crossing the Atlantic, but few with so little to recommend them as the present one, and we do not think it will be taken much notice of by our submarine telegraph manufacturers. Is it not strange that this should take place almost simultaneously with overtures made by the Spanish Government to the United States for the sale of the islands of Porto Rico and Cuba?

We noticed in our summary the appointment of instructors for the Indian Telegraph Service; two such appointments have been made. Mr. Louis Schwendler, from the firm of Messrs. Siemens, and Mr. Lambert, who has been for many years an assistant to Mr. Latimer Clark. Mr. Schwendler has already left, Mr. Lambert follows in a day or two.

Colonel Robinson. R.E., the Director-General of Telegraphs in India, has just returned to India to superintend in person the many improvements he has been organizing since his stay in England. Amongst these improvements may be mentioned the appointment of gentlemen to fill the positions of superintendents, who by passing through a course of studies in physics, electricity, and practical telegraphy, prepare themselves for a final examination preparatory to being sent out. By this week's steamer six of these gentlemen leave for India who have been undergoing for some time this course of study, and have satisfactorily passed their examination, a result we cannot but feel due to their studying so much under a practical telegraph engineer. We feel quite sure that the plan of placing them under a well-known electrician and practical telegraph engineer is a step in the right direction, and we understand that the progress made by them under the care of Mr. Preece, to whom we allude, has been so satisfactory that it has met the approbation of the Director-General. Mr. Preece still has a number of pupils under him studying electricity at Southampton, in addition to which they are undergoing further instruction in chemistry and mathematics at the Hartley Institution, preparatory to their examination for the various appointments in the Indian service.

A suit promising to be of great interest has been commenced in New York; a bill in equity has been filed on the part of Horace B. Tibbits against Cyrus W. Field and others representing the New York, Newfoundland and London Telegraph Company. The original concessions for Newfoundland appeared to have been obtained for the plaintiff by Mr. Frederick N. Gisborne, and after constructing some works, until stopped by financial embarassment, agreements were made with the defendants, and the works finally carried out for certain considerations to Mr. Tibbits, which not being, as he states, fulfilled, he has brought this suit. The total amount of his claims may be stated to be, with interest added, equal nearly to one-half of the whole capital stock of the existing company.

We have an account from America of a late telegraphic feat there—speaking from Houston (Texas) *via* New Orleans, Washington, New York, Chicago, Salt Lake City, and Helena (Montana), a total distance of nearly five thousand miles. It is considered as a very remarkable performance, and the account states that the wires were in fine condition and the weather favourable!

PHOTOGRAPHY.

MR. WARREN DE LA RUE'S PHOTOGRAPHS OF THE LUNAR MOUNTAINS.—CLOUDS IN LANDSCAPE PHOTOGRAPHS. — THE LONDON PHOTOGRAPHIC SOCIETIES.—PRINTING ON COLLODION.—IMPROVEMENTS IN THE COMMON CAMERA.

THE experience gained by Mr. Warren De La Rue, F.R.S., during a course of many years, as to the best methods of photographing the moon and other astronomical bodies, has led him to the adoption of collodion salted with iodide of cadmium only, coupled with pyrogallic and acetic acid development. Mr. Hardwich, the standard authority on photographic chemistry, also came to the conclusion, in opposition to the opinion of many practical photographers, that when collodion free from organic reactions and very pure chemicals are employed, the greatest rapidity is obtainable with iodides, without any admixture of a bromide. Mr. De La Rue's pictures are taken by means of the mirror of his reflecting telescope at Cranford Observatory, the image of the moon being thrown direct upon the photographic plate by the mirror, without the intervention of any second reflector, as in the Newtonian telescope, to cause loss of light. But owing to the unequal refraction, and ever-varying currents in the atmosphere, the image of the moon will not keep still upon the collodion plate, but is always quivering more or less: hence the necessity of a very rapid process to take the picture.

As already stated, Mr. Warren De La Rue works upon sound principles, but for theoretical reasons we think he may not yet have attained the greatest possible rapidity in his manipulations. It is a principle in photography that solarization, or over-action of light upon the plate, may be counterbalanced by the employment of a stronger retarding acid in the developer, but the stronger the retarding acid, the longer must be the exposure. Thus, if solarized pictures are obtained with acetic acid in the developer, the substitution of citric acid is the remedy, but the exposure must be longer. This argument cuts both ways, because if a weaker retarding agent than acetic acid be employed, greater rapidity is the result, and a shorter exposure of the plate is necessary. Formic acid is a very weak retarding agent, giving excessive solarization when the plate has long been exposed to a bright light, so there is reason to suppose that formic acid instead of acetic acid in the developer will slightly shorten the time of exposure. Very little difference in time will be noticeable, but in instantaneous photography, as it is called, every fraction of a second saved in exposure is of value.

Mr. De La Rue's exposures may possibly also be further shortened by another method. In instantaneous photography, the colour and composition of the glass forming the lenses affect the results, for all glasses are opaque more or less, to a portion of the visible rays of the spectrum. The same difficulty besets photographic work with a reflecting mirror, for the experiments of Professor W. Allen Miller, F.R.S., show that polished metals do not all reflect the extra-violet rays so perfectly as they reflect the visible rays. For instance, he found that speculum metal and polished steel reflect exactly the same rays of the spectrum, and give spectra on a photographic plate of exactly the same length each. But he also found that speculum metal gave an intense image for one-half only of the length of its spectrum, whilst steel gave a more intense image than any other metal throughout the whole length of the spectrum of the light reflected from its surface. These results point to the conclusion that a steel parabolic mirror will enable a photograph to be taken more rapidly than can be done by speculum metal or silvered glass reflectors.

Nothing but experiment can decide the two points here raised, and the first is very easily tried. The common formic acid of commerce is very impure; it frequently strikes a purple colour when added to pyrogallic acid, and some samples of it have a tendency to cause fog. Hence the pure monohydrated acid, as imported from abroad, should be chosen; and as it acts injuriously upon the skin, it may be at once diluted with nine times its bulk of water. Ten minims of this dilute solution will act as a sufficient restrainer over three grains of pyrogallic acid in winter and two in hot weather. In instantaneous photography, the quantity of restraining acid added to the developer should always be as small as possible. Professor Miller's results could be very easily tested by polishing two small circular pieces of steel and speculum metal, each exactly the same size, and allowing them to reflect two beams of lunar light upon separate parts of a photographic plate for a few seconds. On applying a developer it would at once

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be seen which plate reflected most chemical rays.

The lunar photographs are copied in an enlarging camera. Mr. De La Rue finds that the enlarged positives are never so good as the original negatives, some of the smaller details being always lost in the process. Mr. Dallmeyer is now specially making an enlarging lens, which he thinks will give a perfect copy. The best slabs of optical glass are not commonly used in photographic lenses, as perfection is less necessary for such purposes than for the object-glasses of telescopes. Mr. Dallmeyer has the reputation of being a good optician, and it will be interesting to see how perfectly he can make a lens, to enlarge to a given size, without any loss of detail, now that he has put himself to solve the problem.

At the last meeting of the South London Photographic Society, Mr. J. R. Johnson called attention to the necessity of photographing the clouds and natural atmosphere of a landscape at the same time that the view is itself taken. In the days of old, photographers rarely produced natural clouds in their pictures, because the sky requires far less exposure than is necessary to obtain all the details of the landscape below, and except with very quick processes, the operators were usually under the necessity of spoiling either the sky or the landscape, by wrong exposure, and the former alternative was always chosen. At last, photographs of great beauty, with natural clouds in the sky, appeared in the market, and had a great sale, since which time, natural clouds have become common in photographs, being usually produced by double printing, the landscape being printed first, and the sky afterwards, from a cloud negative. Mr. Johnson pointed out that the clouds and landscapes of such pictures are not always illuminated in the same direction, and are otherwise untrue to nature. He exhibited some beautiful natural clouds, taken by means of the V-shaped moving diaphragm in the pantoscopic camera, and announced his intention, at a future meeting, of showing how to alter the common camera, so that the natural atmosphere can always be taken at the same time as the landscape or building below.

At the last meeting of the Photographic Society of London, Mr. Spiller, F.C.S., of the Royal Arsenal, at Woolwich, read a paper suggesting the use of hyposulphite of ammonia in the place of hyposulphite of soda to fix photographic prints, stating that it is slightly more efficacious, and that such pictures are likely to be more permanent. Mr. James Glaisher, F.R.S., presided, and stated that he had been absent from many of the past meetings in consequence of illness. He also spoke of the death of M. Claudet, F.R.S., and announced that the council recommended that the vacancy thereby made in its ranks should be filled up by the son of the deceased gentleman.

There are three photographic societies in London, and it has often been suggested that it is a pity they do not unite into one, thereby acquiring more power and more spare funds to devote to the advancement of the science. These divisions are much to be regretted.

Mr. Sutton, editor of the Jersey "Photographic Notes," is now yachting off the coast of Brittany. He suggests an improvement upon the method of printing photographs on wet collodion, recently published in these columns, and recommends that after the positive is taken out of the bichloride of mercury bath, it should be immersed for a long time in weak ammonia before fixing with hyposulphite of soda. This, he says, gives a richer black colour to the picture. One of the advantages of taking pictures for this process of enlarging is that the original negative may be very small, so that when taking views out of doors the operator need be burdened with a camera no larger than an opera-glass. With short focus, small lenses, such as would be used in a camera like this, negatives may be taken rapidly enough to secure tolerably good natural clouds, but, except in sea views, the best effects will only be obtained when some radical alteration is made in the ordinary photographic camera, so that the sky shall always be exposed for a much shorter time than the foreground. Some such plan will probably be broached by Mr. Johnson at the next meeting of the Photographic Society of London, where he will read a paper upon "A New System of Landscape Work." At the next meeting of the South London Photographic Society, Mr. John Traill Taylor will read a paper "On a Lime Light Burner of the First Order, by means of which an Explosion is rendered Impossible, either by Accident, Carelessness, or Design." This title is somewhat long-winded, but it betokens an interesting paper.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

THE USE OF A MIXTURE OF GAS AND AIR FOR ILLUMINATING PURPOSES — ANOTHER ICE-MAKING MACHINE—AN INDELIBLE MARKING INK.

WE have before referred to the proposed use of the Drummond light for the illumination of public places in Paris, and to the process by which oxygen is procured for the purpose. The manufacture of the oxygen is indeed the chief difficulty in the way of the application, and the municipal authorities of Paris hesitate to regard the method of M. Tessié du Motay, which we have described, as perfectly satisfactory. In this state of affairs another inventor comes forward with a scheme for burning a mixture of coal gas and atmospheric air so as to produce an intense light. Every one knows that the ordinary flame of a Bunsen's burner is but faintly luminous. The particles of carbon are so rapidly consumed that their momentary incandescence which, according to the generally received opinion, gives luminosity to the flame, is not permitted. It is necessary, therefore, to introduce some other substance which shall be maintained at a white heat, and so furnish the light. M. Bourbouze employs for the purpose a roll of very fine platinum wire gauze, upon which he directs a large number of very small jets of the mixed gases. The combustion of these gives a vivid incandescence to the platinum, and furnishes light at a considerably reduced cost. The air, however, has to be supplied by a sort of blow-pipe apparatus, which complicates the matter; but, notwithstanding this, the inventor assures us that a great saving is made by the use of his invention.

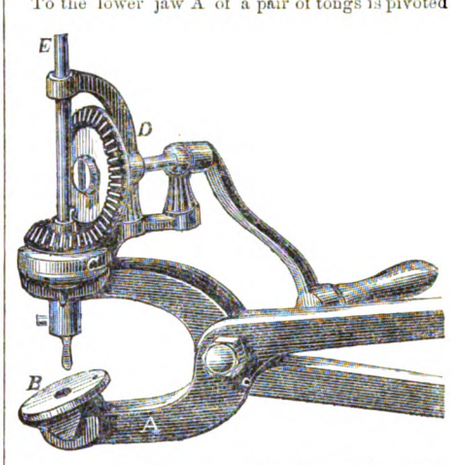
Another ice-making machine is described by M. Tellier, but it can hardly come into general use, although no doubt very efficient, since it involves the use of condensed methylic ether. This body at the ordinary temperature and pressure of the air is a sweet smelling gas; but, by great cold and by moderate pressure, it can be condensed into a colourless liquid. It is easily supposed that by the rapid evaporation of this liquid, when the pressure is removed great cold will be produced, and by proper arrangements, easily devised, large blocks of ice may be procured. The principal difficulty and cost will be the first production of a sufficient quantity of the condensed gas.

Dr. Jacobsen suggests the use of Lightfoot's aniline black for marking ink, which, on the score of indelibility, must possess some advantages over the ordinary nitrate or tartrate of silver ink. We give the author's receipts for two preparations. He first prepares a solution, No. 1, by dissolving 8·52 parts of crystallized chloride of copper, 10·65 parts chlorate of soda, and 5·35 parts of chloride of ammonium in 60 parts of distilled water. Another solution, No. 2, is made by dissolving 20 parts of hydrochlorate of aniline in 30 parts of water, and adding 20 parts of mucilage (one of gum to two of water), and 10 parts of glycerine. To make the ink, which must be prepared as wanted, one part of No. 1 solution is mixed with four parts of No. 2. The mixture will be of a dull greenish colour, and is ready for use at once. It can be applied either with a quill pen or with brush and stencil plate. The colour of the writing will at first be only pale green, but it will darken gradually on exposure to the air, or the black may be produced at once by employing heat. The best way of using heat is to hold the article marked over a vessel of boiling water, but the heat from a lamp or fire will of course effect the purpose. When the articles are washed with hot soap and water, the colour of the writing will be a dark bluish black. It will not be affected by dilute acids nor by alkalies. A strongish acid will turn it green, but an alkali will directly restore the black. A very strong solution of chloride of lime will first turn the colour red and finally discharge it, but only for a time. It will return again in a few days with increased intensity. The colour, in fact, can only be removed by destroying the fabric, which is more than can be said for the silver inks.

IMPROVED HAND DRILL.

THERE are frequent occasions in a machine shop where light drilling is required on work it is inconvenient to bring to the lathe. For this the Scotch or ratchet drill, if the job is heavy, is employed, and if light the breast drill. The placing and working of the former consumes considerable time, and the labour of drilling with the breast drill is excessive and exhausting. It is difficult also to hold the instrument so steady as not to cramp and break the drill. The combination of the drill with tongs and a pivoted bed piece, as seen in the engraving, which we take from the "Scientific American," obviates these objections.

To the lower jaw A of a pair of tongs is pivoted



a platten or bed B, having a hole through its centre, which is continued through the jaw for the passage of the drillings. The upper jaw is formed with a circular flange on which is mounted the circular or disc-like base C of the drill frame D. This, with the frame, is secured on the jaw of the tongs by means of two screw bolts—one seen in the engraving—passing through the jaw and screwing into the base of the drill. These bolts pass through semi-circular or segmental slots, by which the drill frame can be swung around at different angles to the tongs, to adapt itself to the convenience of the workman and the requirements of the work. If desired, the crank by which the drill is driven may be used on the upright spindle E. It will be seen that the pivoted base or bed B will allow the work to adapt itself always to the line of the drill.

In operation, the work being placed between the drill and platten, the left hand presses the handles of the tongs together, while the right turns the crank; the feed is thus graduated wholly by the pressure of the hand. This tool is the invention of Messrs. Nevergold and Stackhouse, of Pittsburgh, America.

AT the first ordinary meeting of the Society of Engineers for this session, held on Monday, the 20th inst., Mr. W. H. Le Feuvre in the chair, the following candidates were balloted for and duly elected as members:—Messrs. R. F. Fairlie, J. T. Chappell, Henry Gore, Lieutenant-Colonel Henry Wray, R.E., and Mr. George Spencer. As associates, Messrs. James Knox, Edward Harlock, and C. W. Salmon.

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SOCIETY OF ENGINEERS.

THE first ordinary meeting for this session was held on Monday last, Mr. W. H. Le Feuvre, the president for the past year, in the chair. Premiums for papers read during the year were presented to Mr. S. W. Worssam, jun., for his paper on mechanical saws; Mr. A. Rigg, jun., for his paper on heavy guns; Mr. J. Gresham, for his paper on the injector; and Mr. E. Matheson, for his paper on the quality of iron. Mr. Baldwin Latham, president for 1868, then took the chair and delivered the following

INAUGURAL ADDRESS.

It is with mingled feelings of pleasure and anxiety that I enter upon the duties and responsibilities of the important office of President of this Society. It gives pleasure by reason of the honour conferred upon me, which I assure you I feel deeply; but I also feel some anxiety as to the results of my term of office. We have just terminated the most successful year in the annals of the Society, and I succeed, in the duties of the office of President, a gentleman who has devoted a larger amount of time to the affairs of this Society than usually can fall to the lot of a professional man to give. It is my intention, so far as lies in my power, diligently to discharge the duties imposed upon me; and I earnestly solicit your hearty co-operation and support. On an occasion like the present, I know it is expected that the President of this Society should give an address upon some subject associated with the objects of the Society. Year by year the task becomes more difficult, but on this occasion it is my intention, after having drawn your attention to some matters of passing importance to our profession, to speak to you of the results that have been attained from the prosecution of the sanitary works that have been carried out in the towns of this country. At the present time we cannot be unmindful of the position in which our profession is placed, the period being marked by the almost total suspension of public works. The present condition of things may not be without its lesson, and the time may not be unprofitably employed in taking our bearings and ascertaining our position, in order that in future we may steer clear of the rocks and quicksands of speculation. Engineers are, in a measure, responsible for the present position of affairs; and every engineer should know that the success of great public works is due, not only to the care and skill which have been displayed in the design or execution of the works, but also to the financial results of the enterprise; for unless public works, of whatsoever character or description, are made to pay, the employment of the private capital employed in their construction will be diverted into other channels.

In the railway system of this country we have an immense capital employed, but, unfortunately, at the present moment this description of property is at a discount, and there is a want of confidence in the public mind in all public works, arising, in a great measure, from the financial disclosures of the condition of some of the railway companies of this country; for when we know that upwards of 600 millions of money have been authorized by Parliament to be raised for the railway companies of the United Kingdom, and that probably upwards of 500 millions of the money have been actually raised in the shape of ordinary capital, preferential capital, debenture stocks, and debenture loans, we cannot but see that any commercial panic or failure of the system, tending to deteriorate the value of the property, must be attended with an immense amount of inconvenience and loss to the country. In a great measure the present financial position of some of the railway companies of the United Kingdom is due to the influence of Parliament in encouraging a rivalry that has led to the construction of many unprofitable works and to the deterioration of others. The conduct of Parliament with regard to the legislation on railways appears to have been most incongruous; at one period the committees report against the possibility of maintaining competitive schemes; on another occasion powers are given to increase the capital of existing companies, and, after all, schemes are sanctioned that tend to divide the traffic and divert the legitimate profits of the original undertaking. All the great works in this country that have been established with the sanction of Parliament should have their interests protected; at the same time, judicious regulations as to the limitation of profit and as to the general management of the concern should be imposed, which would give the public those advantages which are supposed only to accrue in the face of competition—competition often ruinous, and which is ultimately terminated by failure or combination. It cannot but be seen that the opening of upwards of thirteen thousand miles of railway in the United Kingdom, apart from the capital employed in their construction, has given an immense impetus to the trade and commerce of our country; moreover, the works of this character have not been without their influence in increasing the value of property throughout the kingdom. The knowledge of these simple facts will, at no very distant date, lead, it is to be hoped, to the resumption of operations whereby the benefits of our great railway system may be further extended; and, when this day does come, we shall be the wiser and more able to meet its requirements; in the mean time we must direct our attention to other works, and so provide employment for the industrial classes of this country.

With our railway system has sprung up that system of electric telegraphy which has been so generally adopted and usefully employed throughout this country. This branch of engineering has received very great attention, and has reached a high degree of excellence. The completion of the Atlantic cable, the successful measures taken in grappling for the original and broken cable in deep water, are now facts of history; but we well know that the news of the success attending the various operations of laying the cable sent a thrill of joy through the veins of every true citizen. We rejoiced with those who had successfully linked the New and Old Worlds; we felt thankful that their skill, industry, perseverance, and enterprise had been rewarded with a success that marks the event as an era in history. The present period is a critical one for those who have devoted their attention to the telegraph system of this country; for it is not impossible that Parliament, in the ensuing session, may be asked to adjudicate upon a measure by which the telegraph system of the country may be handed over to the Post Office authorities. It is thought by some persons that, by combining the offices of the telegraph and the postal arrangements of the country, a great reduction of expenditure will accrue, and that, therefore, the cost of forwarding telegrams will be reduced. We cannot but see that the proposed measure is one of those steps tending to centralize power in the hands of Government, and it may have the effect of stopping the efforts of private enterprise; therefore, a measure of this kind, although it may be attended with some advantages, yet, as it may tend to cramp the spirit of enterprise of the country, it should be carefully watched by those interested in the development of all public works.

The past year has been signalized by one of those international exhibitions of the industry and commerce of the nations of the earth. The late Exhibition of Paris differs somewhat from the former Exhibitions, inasmuch as an attempt was made to render the visitor conversant, not only with the products and state of the manufactures of different countries, but likewise with the habits and customs of their inhabitants. Exhibitions of an international character were inaugurated by our own countrymen with a view to stimulate the trade of the country, by inducing a spirit of rivalry and competition, which would lead the manufacturers to vie with each other in advancing and perfecting our arts and manufactures. The International Exhibition of Paris of the past year cannot be studied without giving a lesson to the manufacturers of our country; for we saw in it how closely we are being copied and followed in those manufactures that mark the modern progress of science, and that we have a task to undertake if we hope to maintain our supremacy and sway the commerce of the civilized world. There are those at the present day in this country who believe that, unless immediate steps are taken to avert the calamity, our manufactures are fated for destruction, and our commerce doomed to perdition; and who look to the little progress made by our country, between the Exhibition of 1862 and that of last year, in support of their views. It does appear that the short time that has elapsed between these Exhibitions is not sufficient to throw out in strong contrast with other nations the improvements and advances that we, as a nation, have made; but, if we take a longer period, dating from the Exhibition of 1851, of which the late and lamented Prince Consort spoke prior to its formation, "as a new starting-point from which all nations will be able to direct their future exertions," we shall be enabled to see that we have been moving forward in the march of human progress.

In chemistry important discoveries have been made; amongst others, those beautiful colours known as the aniline series have been produced. Hydrocarbon oil distilled from coal is manufactured on a large scale. The art of photography has been extended until it is become of infinite service to every branch of art and manufacture. The fine arts of painting and sculpture have not been surpassed. Electric telegraph communication has become oceanic. Magneto-electricity has been adapted and used for illumination of lighthouses, The manufacture of iron has been improved, and steel is now made by one process. The art of ship-building has made great strides. The appliances and munitions of war have been perfected. Economic appliances in connection with steam power have rapidly advanced. Greater attention has been paid to the value of human life, and the conditions best calculated to preserve its integrity. Steam power has been successfully applied to the cultivation of the soil. Numerous inventions have been patented tending to abridge and facilitate labour. The old established manufactures of the country have been improved, and new industries have arisen, which have a vitality that promises long endurance. The wealth and commerce of the nation have increased.

Although it must be clearly seen, when viewed through the long vista of time, that we have progressed and are still progressing in our arts and manufactures, we cannot lose sight of the fact that foreign nations have advanced fasetr than we have. They started in the race with a place far below us, and are now treading closely on our heels, and even now compete with us in our own markets for works requiring engineering skill and knowledge, as can be seen from the returns of the exports and imports of our country, which show that the value of the exports of raw and unmanufactured iron has year by year steadily increased, while our exports of machinery have decreased, and the imports of manufactured iron and steel into the country have increased. We find that Austria, Belgium, France, Prussia, and Switzerland are the nations that have made the greatest progress; and these are the nations, by a singular coincidence, which have paid the greatest attention to the education of their populations. The art of learning has been fostered by them, and has grown up and developed itself simultaneously with the development of the manufactures of those empires. The foreign workman is taught the principles that govern his every-day operations; and, by the aid of his theoretical knowledge, the successful copying of English designs, and the use of English tools, he has been able to develope and advance his particular manufacture in his own country; and so an impulse has been given to foreign industries, that we, in this country, only realize by the startling results. It cannot be gainsaid that the English nation have displayed in a greater degree than any other nation talent for inventions and all the energy and enterprise necessary for success; and therefore, if we develope and cultivate the intelligence of our citizens to the same extent as in foreign countries, we shall never be beaten in the great race of human progress. We, as a nation, must remove every obstacle to the progress of our people; we must teach our workmen applied science, which will give them confidence in the development of improvements; above all, we must teach them to emulate those truly great men who have risen by their own exertions from lowly positions to be the brightest ornaments of our profession, and whose memories still endure in all that perpetuates the memory of men on earth—in the offsprings of their genius and in the respect and homage of mankind. We cannot be unmindful of the fact that, in order to secure the result we hope to bring about by the means of technical education, we must place labour and capital in closer relationship, and must adopt measures that will put an end to strikes and lock-outs. The combinations of capital against labour, and labour against capital, must come to an end. The restrictions of trade societies compelling men to work with an average ability must be removed. Labour, like trade, should be free, and having all the blessings of liberty it will expand and progress.

We will now consider briefly the results of the sanitary works that have been carried out in this country. History teaches us that in remote periods works of drainage and water supply were considered necessary, whenever men congregated together in large masses; hence we find that the oldest cities of the world were sewered and well supplied with water. But then came a period in history, when the benefit of sewers and abundant supplies of pure water appear to have been forgotten, or at least ignored; when sanitary science, like many other branches of science, descended to the very lowest ebb, only to be revived in its

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true spirit within the memory of living man. In our own country, the evils arising from retaining decaying animal and vegetable substances in the vicinity of our dwellings, and in some cases in our habitations, was patent to the early sanitary reformers. Year after year the fearful scourge of epidemic and endemic diseases, and the clear and unmistakable warnings of the cause, compelled Parliament to pass that measure known as the Public Health Act, 1848, the aim and object of which was to maintain and improve the state of the public health of the country. No sooner was the measure passed, than a large number of towns took advantage of it; and there are now about 650 towns and districts in this country that are governed in their various sanitary operations by that Act and its subsequent amendments. The sanitary laws of the country are intended to promote the adoption of such measures as are calculated to secure the health of its citizens. Pure air and water must be considered absolute necessaries, if life and health are to be maintained. The crowding together of masses in the cities, towns, and villages of our country naturally leads to the production of much offensive matter, which, if retained in the midst of our populations, will vitiate the atmosphere and poison the water supply; and the human body, robbed of its life-giving elements, is poisoned by the emanations of its own creation, and soon becomes the victim of disease and death. The modern works of sewerage and water supply have been experiments made for the purpose of improving the state of the public health, and that they have accomplished the end for which they were inaugurated will be seen by the following table, containing the results in twelve towns:—

Name of Place.	Population in 1861.	Average mortality per 1,000 before construction of works.	Average mortality per 1,000 since completion of works.	Saving of life per cent.	Reduction of typhoid fever rate per cent.	Reduction in rate of phthisis per cent.
Banbury	10,238	23·4	20·5	12½	48	41
Cardiff	32,954	33·2	22·6	32	40	17
Croydon	30,229	23·7	18·6	22	63	17
Dover	23,108	22·6	20·9	7	36	20
Ely	7,847	23·9	20·5	14	56	47
Leicester	68,056	26·4	25·2	4½	48	32
Macclesfield	27,475	29·8	23·7	20	48	31
Merthyr	52,778	33·2	26·2	18	60	11
Newport	24,756	31·8	21·6	32	36	32
Rugby	7,818	19·1	18·6	2½	10	43
Salisbury	9,030	27·5	21·9	20	75	49
Warwick	10,570	22·7	21·0	7½	52	19

It will be seen at a glance that the sanitary works which have been carried out in these towns have had a marked effect in staying the ravages of disease and death, and of prolonging the average duration of life, in those towns that have adopted proper measures. By reference to the last column we see that a great reduction has been made in the number of deaths from that painful and lingering disease that is so fatal in our country; which is an unlooked-for success, and is probably due to the drying of the soil by works of sewerage. How much society loses annually by preventable diseases it is impossible to fully estimate, as health is so intimately connected with all the branches of every-day life. We know full well that the power of physical ability forms the basis of all descriptions of labour, and that the full value of work cannot be got from a sickly, and therefore feeble population; therefore those communities that are in bad sanitary condition are considerable losers. The national prosperity of the country is impeded by the undue amount of sickness we have to support, and the losses of human life we have to sustain. If, upon no other than economic grounds, it is true economy to spend some little of our earnings in the prosecution of sanitary works. An estimate of the probable result of the value of sanitary works can be propounded in this way:—1st. The saving in the cost of funerals, inclusive of mourning and fees, which may safely be set down at £5 each. 2nd. The saving, by reason of the escape from sickness, with its cost, and the value of lost labour; and it may safely be taken that, for every life saved by sanitary works, twenty-five persons escape sickness, and that £1 per case would represent a moderate value of the result. 3rd. The value of the labour saved to the country by prevention of premature death. For every adult female 5s. per week, and for every adult male 10s. per week, or a mean of 7s. 6d. per week, may be taken as the value of the labour over and above the cost of maintenance. Taking a town in this way, and comparing the result with the expenditure that has been incurred in providing the means by which these results have been obtained, we shall see at a glance the result of sanitary operations. We will take, for the sake of example, the town of Croydon, in connection with which many of you are aware I have laboured for some years:—

EXPENDITURE IN CROYDON.

Purchase of freehold lands	£50,000
Construction of waterworks	70,000
Construction of sewers, sewage irrigation works, public baths, abattoirs, and general improvements...	75,000
	£195,000

The average mortality of the town of Croydon for seven years previous to the construction of sanitary works was 23·66 per thousand; and for thirteen years since they have been in operation it has been 18·64 per thousand, showing a saving of 5·02 per thousand per annum. The mortality in the year 1848 was 28·16 per thousand, and in the year 1867, 16·6 per thousand; in 1848, the population was 19,380; in 1867, it was 50,750, showing that the population increased 160 per cent., and the death rate reduced 40 per cent. between the extreme periods. The mean population for thirteen years since the works have been completed and in successful operation, commencing with the year 1855, has been 37,375. By taking the mean saving of life of 5·02 per thousand, and multiplying it by the mean population in thousands, and again by the number of years, we get 37·375 by 5·02 by 13 equal 2,439 lives saved. Of this number, six-tenths, or 1,463, would be adults, or persons above the age of twenty years, and probably one-tenth would be infirm from age; by making this deduction, we have still 1,317 lives, in the full vigour of life, saved. By using the figures before quoted in connection with the lives saved, we shall get the money value of the benefits conferred by the works:—

2,439 funerals, &c., saved, at £5 each...	£12,195 0
2,439 by 25 equal 60,795 cases of sickness prevented, at £1	60,975 0
1,317 value of labour, at £19 10s. for 6½ years	166,828 5
	£239,998 5

These figures show that in Croydon, in the short space of thirteen years, a sum exceeding by 25 per cent. the total expenditure for all purposes has resulted from the prosecution of the sanitary works. Although it has been here attempted to put a money value on life, we feel individually that life is priceless, and that we may look to the 2,439 persons saved from the jaws of death in this town alone as the living testimonies of the great value of sanitary works.

It cannot but be seen that the case has been understated. The averages do not give the full saving, when the population increases rapidly, and the scale of mortality as rapidly declines; and, moreover, it should be considered what would have been the probable increase in the death rate if the original state of affairs had been allowed to continue to the present period; for an examination of the mortality tables, prior to the existence of sanitary works and the efforts of sanitary labour, shows a gradual increase. With all the benefits that have been conferred by the prosecution of sanitary works, it cannot be overlooked that the first efforts of our sanitary reformers have been marred by reason of the state of pollution of the watercourses and rivers of the country. The growing evil of the system has found a remedy in the application or the liquid sewage to land; and, by a natural process, those foul streams that taint our rivers and water supplies may be turned from a course of destruction into a channel that will add to the material wealth of the nation. The results of sewage irrigation, as it is termed, are marvellous. Large and luxuriant crops are produced, while the foul streams are converted into comparatively pure water. The following analyses will show the result: they are by Doctor Oddling, a result of samples taken every quarter of an hour for twenty-four hours on the 23rd and 24th of November last. The sewage at the time was flowing over thirty acres of land, on which it had been continuously flowing for about two days; the volume of sewage passed on to the area in the twenty-four hours was 3,274,300 gallons, and the effluent water, flowing off after purification, was 2,245,200; so that 31½ per cent. of the whole volume was lost by evaporation and absorption. As the land was completely saturated prior to the experiments, it may fairly be taken that 15·75 per cent., or one-half the entire loss, is due to evaporation through the plant and from the water surface. This would tend to condense any impurities that remain in the effluent water in the proportion of the reduction of volume. In the analyses given, the result that would be obtained by condensing the water supply is shown in the third column:—

	Water Supply of Croydon. Average of the wells, Nov. 1867. Analysis by Dr. Oddling.	Sewage of Croydon after purification by irrigation, Nov. 1867. Analysis by Dr. Oddling.	Water Supply of Croydon condensed to some extent as sewage.
	Grains per gallon.	Grains per gallon.	Grains per gallon.
	21·777	26·180	25·233
Total solid residue	21·409	25·025	24·807
Mineral matter	·368	1·155	·426
Volatile matter	1·454	3·400	1·684
Chloride of sodium.....	·032	·042	·037
Ammonia	·026	·032	·030
Nitrogen as ammonia	·243	·419	·281
Nitrogen as oxides.....	·002	·144	·0023
Nitrogen as organic matter.			

A comparison between the second and third columns will show how nearly the sewage has returned to the state of the pure water as supplied to the town. It may be observed, that the total amount of organic and volatile matter contained in the effluent water after passing over the land is less than the average amount contained in the water supplied by any one of the existing London water companies; and, therefore, it may safely be laid down that sewage after such purification is fit to be turned into any fresh watercourse. It may be remarked, that the analysis of the sewage was made at a period of the year very unfavourable to the system. We must all have seen that as the process of applying sewage to land has become successful in effecting the purification, doubts have arisen as to the probable effect of spreading large volumes of it over areas in the immediate vicinity of populous places. The result of the application of sewage to land, in a sanitary point of view, is equally assuring, for we find, upon examination, that Norwood, which has its irrigation area close to an inhabited district, during the three years the sewage has been applied to the land, has had a mortality of 18·17 per 1,000 in 1865, 15·13 in 1866, and 14·21 in 1867; while the same area, but inclusive of more distant localities, has had during the same period, the respective mortalities of 21·26, 20·04, and 16·60, so it appears that, in the rapid growth of the plant, the assimilation of nitrogenous and carbonaceous matter, and the elimination of large volumes of oxygen by the plant, we have the antidote for what otherwise might prove baneful in its effects.

(To be continued.)

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NEW METHOD OF CONSTRUCTING AND PACKING SLIDE VALVES.

BY MR. N. W. WHEELER.

FIG. 1.

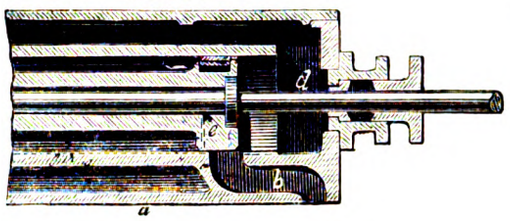


FIG. 2.

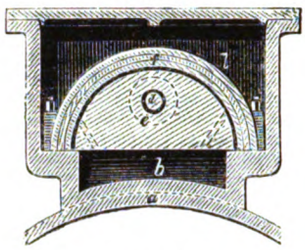


FIG. 6.

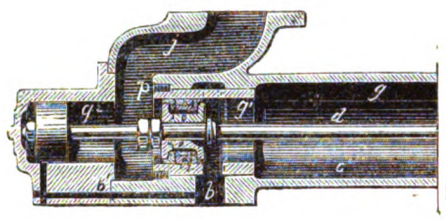


FIG. 4.

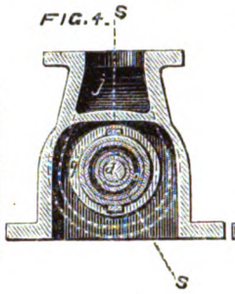


FIG. 5.

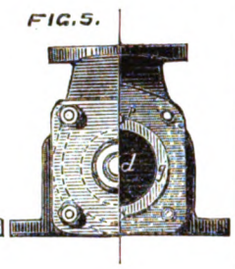
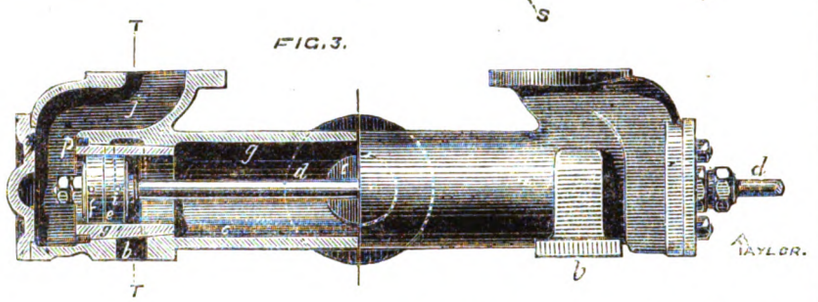


FIG. 3.



CONSTRUCTING AND PACKING SLIDE VALVES.

THE accompanying engraving illustrates a system of constructing and packing slide valves which has been patented here by Mr. N. W. Wheeler, of Brooklyn, U.S. Fig. 1 is a longitudinal section of a part of a steam chest fitted with a half piston or valve; fig. 2 is a cross section of the same; fig. 3 represents a steam chest fitted with a piston valve, the left half being a longitudinal section, the right half a side elevation; fig. 4 is a cross section of the same on line T T in fig. 3; fig. 5 is an end elevation of the steam chest, the left half having the cover on, the right half the cover off; fig. 6 is a longitudinal section on line S S representing an additional detail.

Piston slide valves have been considered by theorists the best valves known for steam engines; they probably would be so were it not for the difficulty of mechanically adjusting the packing rings to meet the peculiar requirements of their functions. In all examples that have come to the knowledge of Mr. Wheeler, the packing rings have been set or compressed against the sides of the valve cylinder by springs or other means by a constant energy. Now when the valve covers only a part of a port which is taking steam, so much of the surface of the piston as is not covered by the surface of the valve cylinder is pressed inwards by the action of the steam, and if the springs be not so strong as to cause a great amount of friction, the ring must yield to such pressure and allow steam to pass the valve into the exhaust chamber. This difficulty has instigated the trial, in many partially successful instances, of methods of setting the rings by rigid mechanical arrangements, whereby the valves while in use were in effect solid and unyielding pistons or discs, and only adjustable while less hot than when in use, and not capable of accommodating themselves gradually to the gradual wear of the parts.

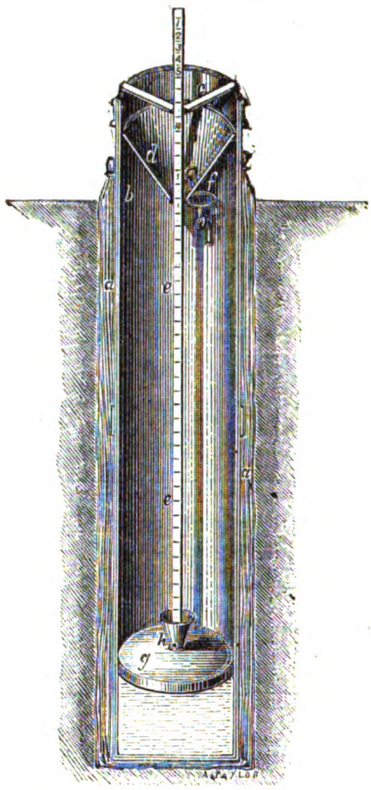
In the examples before us *a* is the steam cylinder; *b b* the steam ports; *c c* the exhaust way; *d d* the valve rod; *e e* the piston valves; *f f* the packing rings; *i i i* small ports leading from the exposed valve faces into the space within the rings *j j*, the live steam passages *g*, the valve cylinder which is seen in figs. 1 and 2 as a semi-cylinder *l l*. When the engine is in motion the valves *e e* have a reciprocating motion longitudinally with their axes over and across the ports *b b*, and when either valve is delivering steam to the engine steam passes into the corresponding port and presses the rings inward; or in the example figs. 1 and 2 presses the valve up against the semi-cylinder *l l*, but at the same time steam passes into the spaces *o o* inside the rings and neutralizes this pressure. When the exhaust takes place the valve is in such position (see the left in fig. 3), that the steam flows out of the ports *i i* and relieves the internal pressure at the same time that the external pressure is relieved. Thus if the valve pistons be fitted with ring springs, or the rings fit the valve cylinder by their own elasticity, in the same manner as is usual for working pistons, the rings will have for all the time not requisite for the lap of the ports *i i* the effective pressure only of the springs against the sides of the valve cylinder, and will accommodate themselves to the varying expansions and wear of the valve cylinders in a more perfect manner than analogous devices have hitherto been made to do.

In figs. 1 and 2 the valves having a solid face and being backed with packing rings, the rings are made in halves or such parts of a circle that their ends may fit fair upon the valve face, the semi-rings being riveted together near the ends, and the cuts distributed properly around the semi-circle. In the construction and use of piston valves, especially in the case of these, which are provided with periodical steam packing behind or inside the rings, experience has shown that the bridges across the port for the cuts of the rings to traverse are necessary, and that it is difficult to bore the valve barrels truly cylindrical if the ports are made in the barrel before it is bored; and, further, that the aberrations occur chiefly upon the surfaces of the bridges. Of course, if the barrels are not true the valve rings will not fit tightly in all positions, and there will occur a loss by leakage, and the friction will be increased. For the sake of truthful work, Mr. Wheeler bores out the chamber to fit a tapered bush g^1, which is in turn fitted by turning and grinding to the chamber, and secured tightly by the half-and-half threaded set bolts *p p*. The bush is then easily bored true, and the ports cut afterwards, leaving the bridges true with the other parts of the barrel. The work is greatly facilitated, for the reason that the bush may be treated separately and no hand holes or caps to allow access at the proper points to cut the ports are necessary, as would be the case if the barrels were in one piece with the chamber.

Fig. 6 shows an attachment which is useful in some cases; for instance, when it is not desirable to construct the engine with a crank attachment. g^2 represents a small cylinder in one with the cap of the valve chamber, into which is fitted a corresponding piston attached to the end of the valve rod, and so proportioned that the steam port for the small cylinder will be covered by the piston as it approaches the end of its throw, so as to imprison the steam beyond it and form a steam cushion to arrest the movement at the proper point. At the opposite end of the valve chamber is fixed a corresponding piston and cylinder. The steam passages b^1 lead from the steam passages *b* between the valve and the working cylinder. Now, when the valve is thrown by means of a tappet, so far that steam will enter the working cylinder through one of the passages the release will have taken place through the other, and the steam pressure upon the respective small pistons will be equal to that in the respective ends of the working cylinder by reason of the communications through the small passages b^1, and the overbalancing pressure upon one of the small pistons will complete the throw beyond that made by the tappet, which must compress or cause the partial expulsion of the steam in one of the cylinders opposing its action until the release takes place.

RAIN GAUGES.

IN his excellent little work on rainfall, noticed by us last week, Mr. Symons describes a form of rain gauge, which we have reproduced, together with the inventor's description and remarks. It is one of a class known as float gauges, and its principles are readily seen from the engraving. The rain falling in the cylinder



b is obviously equal to that falling on any equal area of the surrounding ground, and as the cylinder is uniform throughout, the float *g* will raise the divided rod *e*, inch for inch as the rain falls. Evaporation is prevented by the float *g* nearly covering the water, and also by the funnel *d*. The measuring rod is sometimes attached to the float, and sometimes dropped in only when it is desired to know the contents. The former arrangement is objectionable, because directly the amount of rain in the gauge equals the semi-diameter of the funnel, the measuring rod stops some rain which should pass over the gauge, and conducts it into the gauge, thus unfairly increasing the amount collected. The rod *e* is detached, and only dropped into the cup *h* when an observation has to be made, the exact quantity being shown by the loose cross piece *c*, which cuts the rod at the true reading, viz., as shown, at 8½ inches. The rod, cross piece, and funnel being lifted out, the whole inner case, with the accumulated rain, is removed by the handles *f*, emptied, replaced, and the funnel being returned to its ledge, the gauge is ready for another month. It is 4ft. long and 8in. in diameter; the cylinder *b* is double, the inside one lifting out when it is requisite to empty the water, and the outer one being wrapped in straw *a*, covered with canvas saturated with gas tar—the object of these strong precautionary measures being to prevent the water from freezing and bursting the inside cylinder; a handful of salt is also thrown in after each time of emptying. By the joint action of all these frost-resisting schemes, they have

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defied Jack Frost amid the Cumberland mountains, even in the severe winter of 1865-6. We are not aware of any gauge better adapted for rough usage in mountain districts than this. Its price, made by Casella, is very moderate, and it can hardly be read incorrectly by the most stupid, or ingeniously perverse, inhabitant of these islands. We think, however, that the gauge is somewhat too small; a larger one would prove much better in practice.

In the form of gauge just described, we have explained that inasmuch as the cylinder is of uniform diameter throughout, the float rises inch for inch as the rain falls. But showers often yield very small quantities of rain, such as one or two hundredths of an inch. This would be almost invisible on the scale just described, and therefore a modification has been introduced, in which the collecting area is twice, thrice, or more than that of the cylinder. In this case it is obvious that the float will rise two inches for one inch of rain, three inches for one inch, or more, as the case may be. These are generally perched on a pedestal, but Mr. Symonds says they cannot be recommended for several reasons. 1. They are too much above the ground. 2. They are too much exposed to sunshine. 3. The rods are always attached to the float. 4. The rods are very frequently broken. 5. Owing to the exposure of the cylinders, the water often freezes and bursts them. Mr. Symons found one, which by causes 4 and 5, had in its old age recorded 25 per cent. too little!

ENGLISH AND FRENCH NAVIES.

THE following letters, illustrative of the manner in which naval matters are managed in England and France, are from the "American Army and Navy Journal." They are particularly interesting to Americans at the present time, from the additional light which they throw on the subject of boards of survey, which it is now sought to establish in the States. This step does not appear to the taste of Mr. Isherwood, who has at present the sole direction of these matters. But that it is necessary we may infer from the following passage in the above journal. Says the editor:—"A board of survey would not be expected to build ships or engines, but to hold a rigid scrutiny over those who have charge of the several departments. The experience of the past would tell them that no more Monitors should be built that would not float, like the twenty-eight that were designed by Mr. Isherwood, and superintended by his chosen subordinates. They would negative such private contracts as have taken millions out of the public treasury, and, having found out the inefficiency of our present chief of the Bureau of Steam Engineering, they would call to their aid the best ability among the civil engineers of the country."

The writer of the first letter says:—At one period in our history, when the United States were comparatively remote and unknown in the great family of nations, our policy was shaped with a modesty becoming our circumstances; but now, by the westward course of empire brought into a more central, and by our late struggle a more commanding and influential position, our policy must necessarily change with our condition. One result of this must be the building up of a modern navy; and as we will always rely mainly on the militia or volunteer elements for its expansion, that navy, forming a nucleus merely of the force that would be actually employed in a naval war, should be as perfect in its conception and detail as the genius of the country can make it. Probably a more propitious time for a recast of characters and a change of scenes than the present never occurred. But who is to line out the plot or perfect the detail? Both in England and in France the navy is under the direct control of naval officers, or, in other words, its destiny is shaped by those who know it best, and who are most deeply concerned in its welfare, whose honour in time of war depends upon its efficiency, and who, consequently, are the most likely of all others to devote to its interests their time, talents, and strength. Uninfluenced by party feeling, alone undisturbed amid the ceaseless mutations of office, unshaken by political convulsions, they are the conservators of their own history, and calmly pursue even amid civil discord, one high and undeviating line of policy. The exact sciences afford no plainer axiom than that to such hands should be confided the administration of naval affairs.

In France, the Board of Admiralty consists of a president and seven members. The first office is filled by the Minister of Marine, who may be either an admiral or a civilian; the others by six vice or rear-admirals, one of them having the title of inspector-general, and one inspector-in-chief, a civil office for which we have no equivalent. In addition to the Board of Admiralty is a Board of Works (*Conseil des Travaux*) to which have to be submitted all plans, propositions, &c., relating to works, plans of ships, engines, guns, &c., for the navy, and pronounced by the Board before being presented to the Board of Admiralty for their final decision. After the Board of Works comes the various bureaus for the transaction of the business of the several departments, as navigation, light-houses, &c., somewhat like ours. The French system is almost perfect of its kind, and is conducted with great precision, nor am I aware that the machinery of their naval administration is so cumbersome, or so complicated, as to impede work. One thing is quite certain, that waste and peculation are rare, and if we are to judge from results, the French method has in its composition a large element of success.

The much-abused English Board of Admiralty presents a curious contrast to that of their neighbours and rivals, and, so far as I can learn, has no very clearly defined duties, and yet does everything. The two Boards are eminently characteristic of the two countries; one has produced a navy by force of science and skill, the other by dogged perseverence, and both are remarkably fine in their way. I was told by English officers that they could get nothing better to take its place were their Board abolished, and by all persons on both sides of the channel, the opinion was expressed that naval officers of experience must necessarily govern their navies if they were to exist at all. Judging from the records of history, it would seem to be one of the most natural and self-evident deductions of experience, that a commercial marine will always require in proportion to its extent a military marine for its protection, for, however pacific the character and policy of a people may be, they must perforce provide against the warlike and aggressive propensities of their neighbours, and the responsibility of such protection cannot be avoided, for according to the ethics of nationalities, a country is as deeply committed to the security of its commerce as to any other of its obligations. Who that compares our commercial statistics of 1857 with those of 1867 will not say we have paid the full penalty attached to a violation of this well-established law.

On comparing the powerful squadrons of England and of France, and their great naval depots with our own, it is impossible to close one's eyes to the fact that our naval establishment is not what it should be. Who can contemplate the partial ruin of our once transcendant commerce—a ruin wrought by one pitiful corsair—without lamenting that violation of sound principles, that pursuit of false economy, which kept our navy far within the limits of efficiency, for want of a proper board of survey? Still smarting from the scourge that enforced the lesson, it would seem that the present is the auspicious time for a wise and far-sighted policy to apply the dearly-bought knowledge in laying the foundation for a navy, which shall be commensurate with the great country whose flag it has the honour to bear. An attempt has been made to pourtray the characteristics of the two Boards of Admiralty—each a type of its respective country. Our national character partakes of both. We have the indomitable energy of the one, the science and organizing powers of the other. With the histories of their navies before, with their failures to warn, their grand success to instruct, we only need with our superabundant wealth of material, the master spirit to call into existence a navy which shall be superior to either.

Another officer, writing from England, says:—We are a long way behind England in our material resources, so far as our facilities for building steam engines are concerned. England possesses fine Government workshops for building steam engines, but in time of war she would rely mainly on the private establishments, which are on a large scale, and turn out the finest engineers in the world. Indeed, several of these establishments are actively engaged at this time in constructing engines for some of the heaviest class of iron vessels which have lately been ordered; also, at private establishments, and built on plans designed by the Board of Admiralty. One cannot but feel disgusted when going over these huge, clumsy-looking, iron-plated vessels of the English, to see their light and beautiful engines that propel them thirteen and fourteen knots an hour, and then to see how little speed can be got out of this beautifully-modelled ship, the ——, which has an engine with twice the necessary weight of iron, and boilers that take up nearly all the ship. It is a reflection upon our engineering skill that we should be so far behind the English in our public vessels, while we are so far ahead of them in our magnificent river steamers. All this is owing to the difference in the two systems. We have given up everything to a chief engineer without any practical knowledge, whose theories are laughed at by all the great engineers in this country.

They are entirely at variance with English practice, and do not satisfy the English mind, no matter how many books may emanate from the Steam Bureau to cheat the world. The British Government employs none but the best private workshops to build its engines, and the Board of Admiralty exercise the most rigid scrutiny over them while they are building. The Board of Admiralty call to their aid the best naval and civil ability to be found in the country. Every marine engine is set up on shore before it goes on board ship, and every part is made to work harmoniously before it is accepted. Such is the result of having naval officers at the head of naval affairs; the men who have to sail and fight these ships exercise a positive and intelligent control, in a matter where our line officers have nothing to say. They build engines for one third of what it costs in the United States, not because the prices are higher, but because we seem to have no fixed plans, but go on altering from day to day, frittering away millions on doubtful experiments.

THE LEEDS ASSOCIATION OF FOREMEN ENGINEERS.

WE have much pleasure in noticing the progress of the Leeds Association of Foremen Engineers—a society which is doing an important work, not only in promoting a better feeling between capital and labour, but also in advancing that technical education about which so much has been said of late. At the annual dinner of the institution (dinners are the things to consolidate those societies), the half-yearly report was read, and from it we glean the following particulars:—The report congratulated the members upon the position the association had attained during the comparatively short period of its existence. The want of such an association had been long felt, and on March 4, 1865, the society was formed by the enrolment of seventeen members, a number which had steadily increased, there being at present thirty-eight ordinary and seven honorary members. The members were required to be managers, foremen, or principal draughtsmen connected with the different branches of the engineering trade, the object being to afford facilities for promoting acquaintance and information amongst its members, the formation of a library of standard works on mechanical and scientific subjects, and for philanthropic purposes. The first two objects had been satisfactorily accomplished, and no less than ten papers on very important subjects—such as the clip pulley as applied to mines, the injector as an elevator, safety valves, the manufacture of iron, coal, the application of steam power on common roads, &c.—been read, all of which had evinced considerable skill and laborious research, and most of them had been illustrated by carefully executed drawings and diagrams. The discussions elicited by the reading of the papers were of the greatest importance, the members reading up on the subject, and criticizing freely and reasoning acutely. The committee urged upon the members the fact that it was only by close and careful study, especially in professional subjects, that they could hope to retain a right to the title of foremen in their various departments; and they expressed the hope that when any member was in doubt or difficulty on any mechanical or scientific subject, he would bring it forward at a general meeting, so that he might have the benefit of the experience of other members, if such information could be given without infringing upon any trade secret. The report concluded by alluding to the notion entertained by some persons that that was a trade society, and in proof that this was a misconception of the objects they had in view, the committee referred to the preface to the rules, where it was stated that the association did not, on any occasion, discuss the politics of the trade, that it had no secrets, but rather courted publicity; that its objects were purely and solely philanthropic and instructive, and that it essayed to assist its members in creditably filling the important posts confided to them.

HEAT WITHOUT COAL.

RECENT scientific discoveries should do much to lessen the alarm of those who fear the exhaustion of our coal fields. Mr. H. W. Pond, of Newark, U.S., remarks, in the "Mining Journal," that economists have speculated on the possible discovery of some method of producing heat independent of coal, and the decomposition of water has been regarded as a probable expedient. With our present knowledge and appliances it appears not to be difficult to realize this proposition, even in competition with coal—at least in a small way. The agents are obvious—wind-power, a magneto-electric machine, oxygen and hydrogen gasholders, and the electrolysis of water. The result would be that oxygen and hydrogen would be available for the production of the heat which would be required. For use in the arts the oxy-hydrogen furnace would, of course, offer advantages far above any other known, and results could be reached impossible with the lower temperature of the coal fire, while the flame would be free from deleterious substances common to coal. Owing to its gaseous form, and the intensity of its heat, this fuel would be manageable in many ways impracticable with coal. For instance, seams could be hard-soldered with great rapidity with the jet of the compound blow-pipe, and it is probable that the joints of steam-boilers could be heated for welding in a suitable oxy-hydrogen jet.

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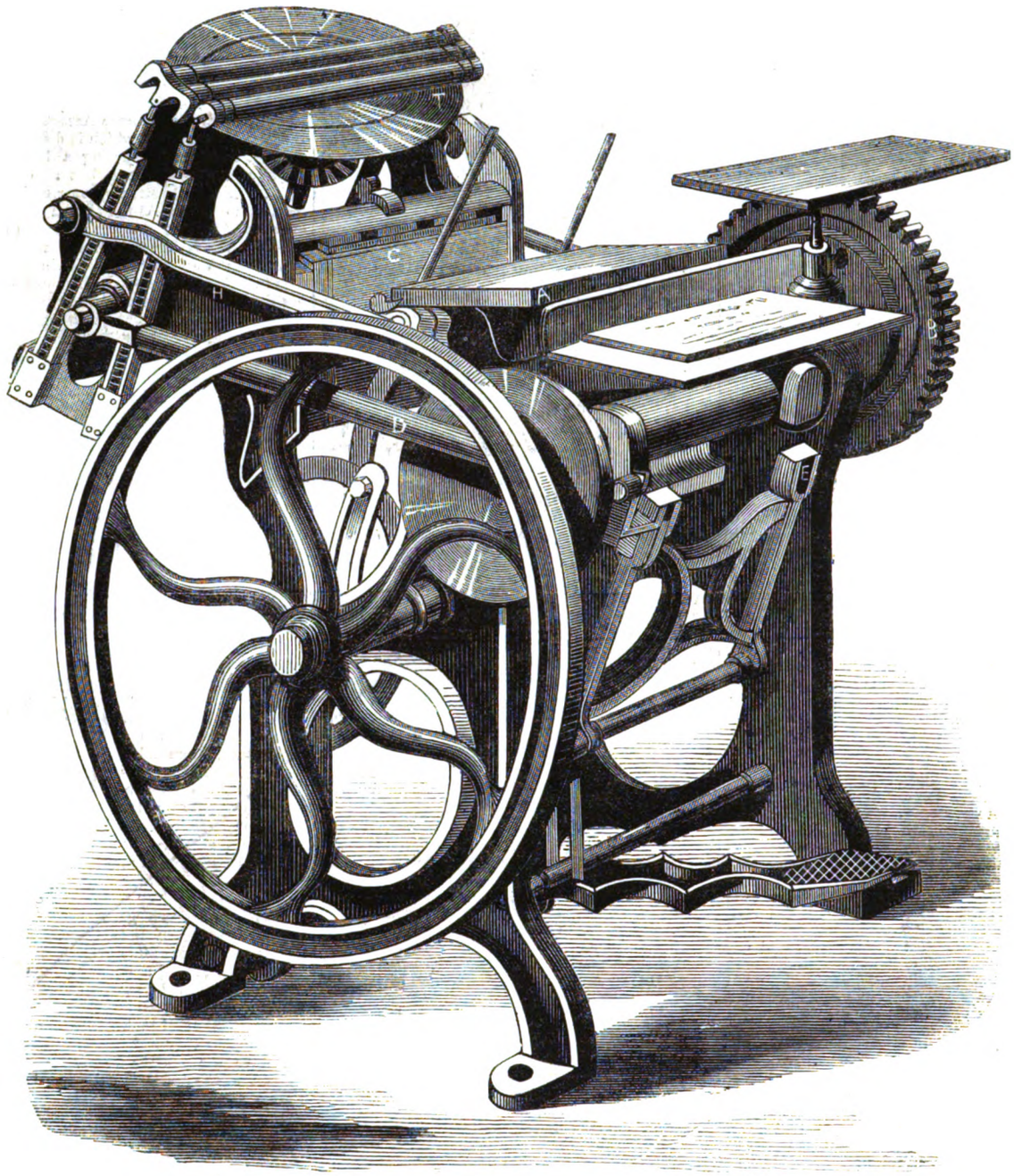
THE MINERVA PRINTING PRESS.

BY MR. CROPPER.



THE MINERVA PRINTING PRESS.

THE press illustrated above is specially designed for the execution of all that class of work ordinarily performed by hand in the platten press. It may be well to explain to such of our readers as are not acquainted with the process of printing, that two forms of presses acting on distinct principles are in use. In the simplest of these the type, locked up in an iron rectangular frame or chase, is fixed on a metal table, which can be traversed in V grooves like a plane table by a rack and pinion worked by the operator. The table being drawn to the front of the machine is inked by running a roller over it. The sheet to be printed is then placed on the "forme" of type, and pushed back beneath the platten, an iron horizontal plate worked up and down between guides through a small distance. The printer then takes the impression by pulling a horizontal lever, which operates very powerfully on the platten through a series of knuckle joints. This answers well where the number of impressions required per hour is limited; in other cases cylinder machines are employed. The type is locked up and placed on a sliding bed as before, but the pressure is applied by passing the forme under a large roller or cylinder, on which the paper is held by tapes for the time. As the paper is generally printed on both sides, two cylinders and formes are employed, the paper being passed over and under the cylinders from one to the other by an ingenious system of tapes. The whole is worked by power. The forme is inked by being drawn under a number of small inking rollers made of treacle and glue. In this way a very large number of impressions may be thrown off in a limited time, and the proper amount of pressure can be brought to bear on a large sheet which could not possibly be worked by manual power.

The Minerva press very ingeniously combines many characteristics of the two. It can be worked by either hand or power according to the size of the sheet. Its construction may be thus explained:—The platten, A, is operated upon by an internal cam on the spur wheel, B, and is brought into a horizontal position, as shown in the engravfng, to receive the sheet. It is then rocked upon its axis by means of this cam until it stands in a vertical position opposite the forme, C, when the forme is brought towards it to give the impression by means of the arms, D, on each side of the machine. While receiving the impression, the platten, or its counterbalance, is securely locked by the gate, E, so as to prevent the possibility of any movement of the platten by vibration or otherwise. This gate is operated upon by a surface cam inside the crank disc, F. The disc carries the axle of the crank arm, D, which rocks the back frame to and fro; the back frame carries the type bed and inking apparatus. The inking apparatus consists of two discs, which revolve in opposite directions, to ensure a more perfect distribution. The inking rollers receive their supply from the disc, to which a self-feeder may be applied if necessary, and are thence carried down over the type. These rollers are operated upon by the arm, G, which has a peculiar and novel motion not easily rendered intelligible. The rollers are held down to their position by means of elastic springs, and are thereby suitable for any size of type. The chase for the type is held by a screw and clip; it is perfectly secure and instantaneously removable. The sheet is withdrawn from the type by the "frisket" arms, which are operated upon by the cam and lever, H. For card printing there are two guides attached to the surface of the platten, one of which is operated upon by the cam, B, which allows the card to fall into a suitable receptacle after receiving the impression, so that the machine merely wants feeding, an operation which any lad of ordinary energy may perform at the rate of 2,500 to 3,000 copies per hour, working the machine with his foot. The engraving shows the manner of working. The press is open to receive the sheet; the operator puts on with the right hand and takes off with the left. He has perfect command over the machine

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TYPE PRINTING TELEGRAPH.

By M. DUJARDIN.

FIG. 1.

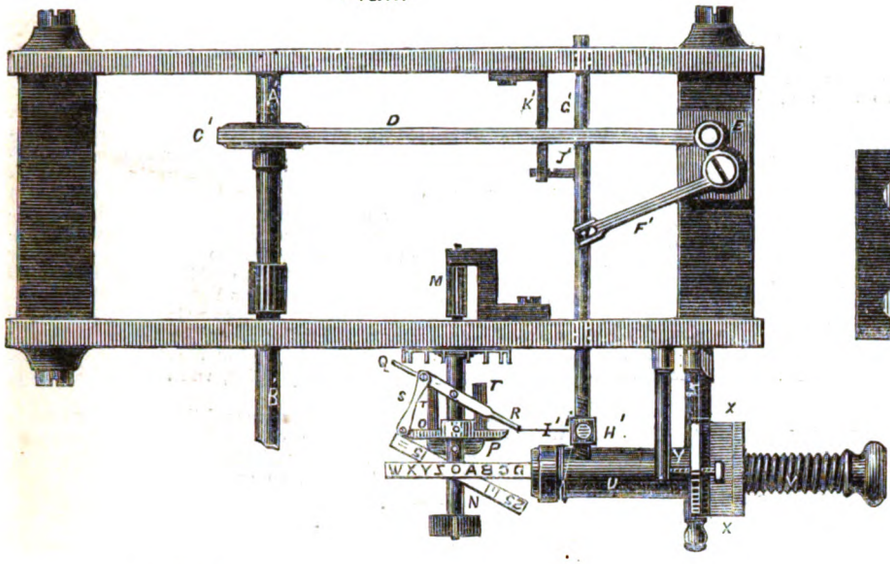


FIG. 7.

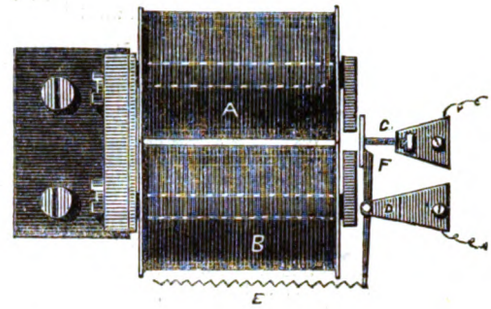


FIG. 5.

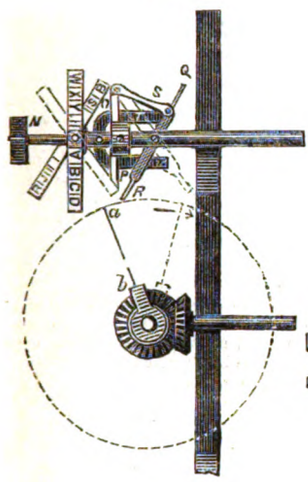


FIG. 8.

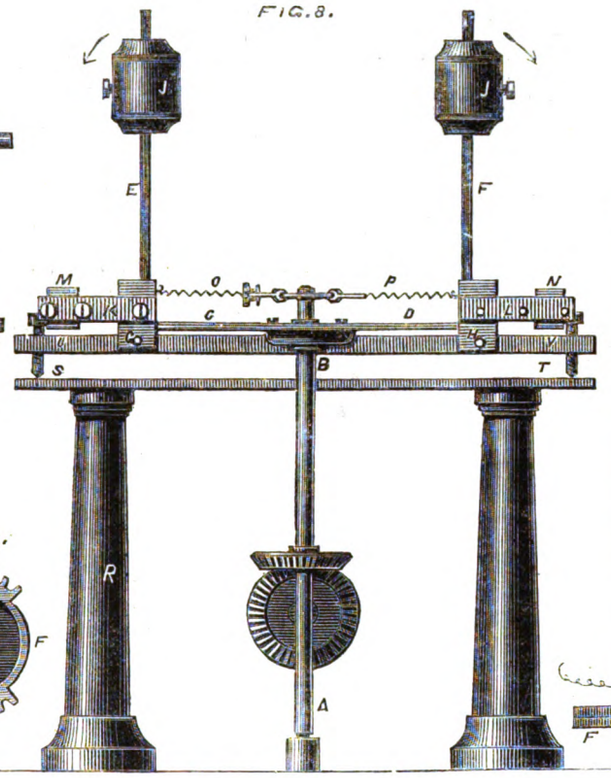


FIG. 6.

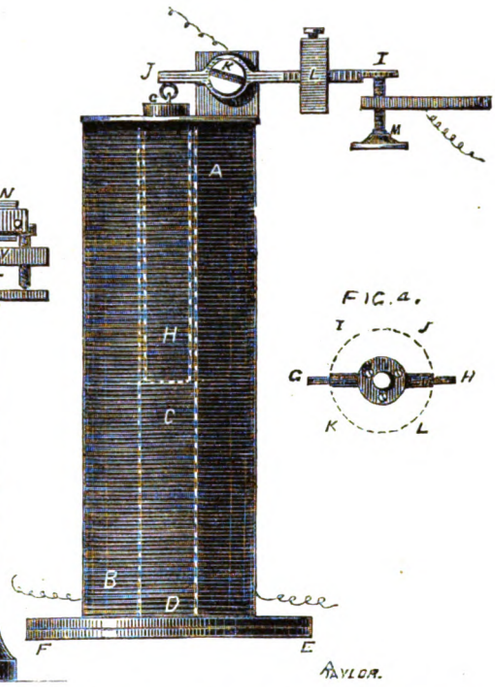


FIG. 4.

FIG. 2.

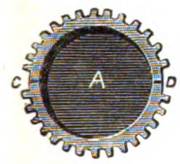
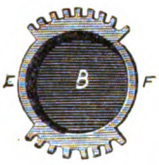


FIG. 3.



—sees the face of the type, the ink disc, the rollers, and all the working parts of the machine—without changing his position, and the printed sheet is presented to him face upwards, so that any imperfection may be instantly detected. The impression is adjustable by means of four screws and check nuts under the platten. As the platten is brought into a horizontal position to receive the sheet there is no danger of the operator being trapped, as in some other platten machines.

THE DUJARDIN TYPE PRINTING TELEGRAPH.

IT is now just three years since we placed before our readers particulars of the Dujardin type printing telegraph, and pointed out its advantages for overland lines.* We now illustrate some improvements in this apparatus, recently patented in England by M. Dujardin, whose address is 29, Boulevart St. Martin, Paris. These improvements consist, firstly, in a special arrangement of cross type wheels which being made to oscillate on one common axis will allow of printing at will either letters or figures; secondly, in an inking piston pad especially applicable to this system of cross wheels; thirdly, in a sort of electro-magnet as distributor of the printing currents; fourthly, in a system of governor for regulating the gear by which the transmittor is driven. These various improvements are represented in the accompanying engraving, in which fig. 1 is a plan view of part of the receiving apparatus provided with M. Dujardin's system of type cross wheels; these being fixed crosswise one on the other rock on their common axis, and are placed now the one now the other opposite to the paper strip, which always keeps the same direction.

A and B are two type wheels cut out in a ring shape; A is the letter wheel, and B the figure or other complemental mark wheel; A has at C D two apertures formed through both ends of one of its diameters; B has likewise at E F two similar apertures through the two ends of one of its diameters. The wheel B is made to enter the wheel A so that the apertures C E and D F may coincide. A and B are made to cross over one another, and are secured to each other by rivets. I J K L represent a metallic disc fitting exactly within the wheel B; this disc being placed within the wheel B two screw cut holes are pierced in its periphery through the apertures E F into which apertures are engaged headless screws G H where the cross wheels are pivoted. The disc is then so cut out as to only preserve a centre and two spokes, both centre and spokes constituting the rocking axis of the cross wheels. The cross wheels thus prepared are secured on the last mover axis of the clockwork, whereby the type wheels are rotated; a piece of steel O P serving as a stop to the cross wheels is screwed upon M N, and a double lever Q R is securely fitted in a slide formed in M and N. A connecting rod S is jointed to the double lever and the figure wheel; a horseshoe-like spring T is pressing on the two ends of the double lever so as to give the cross wheels proper steadiness.

With regard to the mechanism whereby the cross wheels are made to oscillate, A^1 B_1 represent the last axis in the clockwork which serves for printing; it makes a complete revolution at every time a type is printed; it carries an eccentric C^1 which through the connecting rod D^1 and the bell lever E^1 F^1 causes a to-and-fro motion being made by the rod G^1 H^1, which is elbowed at H_1, and terminated by a spring I^1. A pin J_1 fixed into G_1 H_1, and sliding in a groove formed in the knee K_1, serves to maintain G^1 H^1 in an invariable direction. When by means of the transmittor of the apparatus one of the double lever ends Q R is set in contact with the spring I_1, the printing action will cause the

* See MECHANICS' MAGAZINE for February 10, 1865.

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cross wheels to oscillate in one direction until they are stopped by the piece O P, and vice versa.

In fig. 5 we have represented another device which M. Dujardin uses for procuring the oscillation of the cross wheels. *a b* is a flexible finger or pin effecting through the action of the printing gear a complete revolution at each time a letter or a figure is printed. Whenever through the transmitter one end of the lever Q R is set in contact with *a b*, the cross wheels will rock in one direction, and when the other end or side is set in contact with *a b*, the cross wheels will rock in the opposite direction. This system of cross wheels requires an inking pad which may work softly or by slight touch.

This inking piston pad is shown at fig. 2. It consists in a brass tube U, fig. 1, to the top side of which is applied a piece of velvet fixed thereto by means of an edge ring, and inside which enters a piston-like acting screw V. A thick leather washer X fixed by rivets to the mouth of the tube U serves as a female screw to admit the screw V. The pad is set on an axis on which it is free to rock; an adjusting screw Y and its abutment allow of the pad being brought more or less close to the type wheels, so that the nap only, and not the very fabric, can touch the wheels; a spring Z throws the pad on the type wheels. In tube U is put some cotton impregnated with an oleic ink, and by means of the piston V the ink is made to pass through the velvet gradually, and as wanted.

M. Dujardin's improvements also consist in a special electro-magnet distributor of the printing currents. We should here observe that the type wheels of his receiving apparatus are turned through the action of alternate positive and negative successive currents without any apparent intermission, and that the printing is produced by the breaking off of the line current corresponding to the letter or type to be printed. This special electro-magnet receives the line currents in the like manner as the electro-magnet or magnets of the type wheels. The rod of its pallet communicating with a local battery and abutting against two regulating screws, the one against which it is abutting during the attraction presents no peculiarity, but the other against which it abuts when the attraction subsides is isolated and communicating with the printing electro-magnet. The special electro-magnet is so disposed that its pallet during the whole time it is run through by the line currents may be attracted in a continuous or equivalent way, which prevents the local current from being conveyed to the printing electro-magnet. But when an interruption of the line current is taking place, the pallet rod attracted by a reacting spring, or by a counterweight, abuts against the adjusting isolated screw above mentioned, which allows of the local current being conveyed to the printing electro-magnet, so as to actuate the printing mechanism.

Two arrangements of this electro-magnet are shown in the annexed engraving, one being represented at fig. 6. A B is a vertical thin wire coil run through by the line currents. Inside the same is fixed a soft iron cylinder C D, terminated at its lower part by a soft iron washer E F. Another cylinder G H of similar metal, hollow and thinner than C D, is suspended above C D from the end of the lever I J oscillating round the point K; this lever is provided with a movable counterweight L, for which may be substituted a reacting spring; the end I of the lever is abutting against the adjusting screw M. The local current or printing current enters the lever I J at K, and is conveyed through the regulating screw to the printing electro-magnet. Now, when it is desired to set the type wheels in motion, the iron cylinder G H is drawn continuously by the cylinder C D, and the local or printing current is cut off at I M. When the line current is cut off, G H being no longer attracted by C D, the lever I J falls back on M; on the local current passing into the electro printer, printing is produced. As soon as the current is returned to the line, the local current is broken, and so on.

Fig. 7 represents the other arrangement of M. Dujardin's electro-magnet. A B is a thin wire electro-magnet run through by the line currents. The pallet C is very light, and so is its rod; it oscillates round the point D; E is its reacting spring; F is both an abutment screw, and an adjusting or regulating screw. The local current passes into the system through the support of screw F, and goes out therefrom through the support of the pallet C. When the type wheels are set in motion the pallet C is attracted continuously by the electro-magnet A B, and the local current is broken at F. When the line current is cut off, the pallet being no longer attracted, rushes on the screw F, and affords passage to the local current, whereby printing is to be effected. When the current has returned to the line the pallet C cuts off the local current, and so forth. The electro-magnet and its pallet may vary in their shapes and sizes indefinitely, which is unimportant, the main point being that the wire of the distributing electro-magnet, and that of the electro-magnet, by which are rotated the type wheels, can receive the line current in bifurcated ways.

The gear regulator or governor by which the transmittor is operated is represented at fig. 8. A B is the vertical axis gearing with the last mover axis of the clockwork; C D cross bar secured to the top of A B; E F vertical rods jointed to the ends of C D; G H are the axes of the jointings; I J metal balls fixed on E F; K L screw pincers secured on E F, above the jointings or articulations G H; M N pieces of leather held by the pincers K L; O P springs which may be given more or less tension by means of an adjusting screw; they serve to bring the rod E F close to one another. In the resting condition of the governor the leathers M N do not touch the circle which they are intended to rub upon; Q R pillars supporting a circle, S T serving as a support to circle U V arranged quite horizontally by means of three wedging screws. When the axis A B is allowed to rotate, its rotary speed increases, or is accelerated so far as the centrifugal force of the ball I J has become superior to that of the springs O P, when the balls I J recede from each other, and compel the leathers M N to rub on the circle U V, which prevents the rotary speed from accelerating any longer. The more the springs O P are bent, the more can be accelerated the rotary speed before the leather pieces M N can rub on the circle or hoop U V, and vice versa. By varying the weight of the balls I J, the march of the governor may also be regulated at various speeds. The circle U V needs no lubrication.

ROYAL GEOGRAPHICAL SOCIETY.

THE fourth meeting of the present session of this Society was held at Burlington House on Monday evening last, Sir R. I. Murchison, Bart., President, in the chair. The following new fellows were elected:—A. L. Elder; Dr. J. A. B. Horton; R. Jardine, B.A.; Eugene Morris; M. C. Morrison; A. H. Mounsey; G. Macnair; J. F. Pownall; J. Pender; J. B. Redman, C.E.; H. P. Stephenson; Dr. T. Staley, Bishop of Honolulu; T. O. Stock, M.P.; H. A. Tilley; Major G. H. Waller; R. Watson; and E. B. Webb, C.E.

Before the commencement of the ordinary business, the President read a letter respecting Dr. Livingstone, which he had received the same day from Dr. Kirk, of Zanzibar, dated 29th October; it ran as follows:—"I write now only to assure you that nothing further has reached us regarding the traveller in the Lake Regions, who must, without doubt, be Livingstone, since we have news of him from Quilon as having been seen west of Nyassa, where gold is found. Bunduki, the native to whom the letters were given, has not yet reached the coast, being delayed, as we hear, by carrying ivory in double journeys from village to village; and he is still too far off to make it of any use sending men to receive the letters which he has in his possession. It will be some time before we can write to Johanna, but I hope that Moosa and his companions may be well watched, and, when the time comes, severely punished for the misery they have caused. They, however, press their claims for salary, and have even sent men here, in the hope of getting their wages paid."

A paper was read on Explorations in the Isthmus of Darien, by M. Lucien de Puydt. The author, in this memoir, gave the scientific results obtained during two expeditions he had made, in 1861 and 1865, into the interior of the isthmus, having for object the discovery of a practicable line for a ship-canal from ocean to ocean. He first directed his attention to the routes followed by Captain Prevost, Mr. Gisborne, and others; ascending the river Savannah, and crossing to the confluence of the Rio de la Paz and the Chucunaque, acquiring the conviction of the impossibility of constructing a canal in this direction towards Caledonia Bay. The statements made by Dr. Cullen on this subject he ascertained to be completely erroneous. He found, moreover, that the altitude of 152 metres—on which was built a host of projects for a canal—was founded on an erroneous reading of the tables of Colonel Codazzi, the New Granadian surveyor; this altitude being given as that of a village on the road and not as that of the greatest height of a pass in the mountains. M. de Puydt afterwards turned south, and ascended the Tuyra River as far as Paya. The broken nature of the Andean chain there gave him hopes of finding a low pass; and he returned to Europe, organised a new expedition, and penetrated the isthmus again in 1865, from the side of the Atlantic. With three companions and a party of eleven labourers he entered the river Tanela, north of the delta of the Atrato, and sending away his vessel to cut off the retreat of his men, he opened a path through the forest, and on the 25th of August discovered a break in the mountain chain, having an altitude of only 120ft. above the level of the sea. His observations for heights were taken by measuring the velocity of current of a river which flows from the pass to the sea. The memoir included interesting details on the orography, ethnology, &c., of the isthmus.

The President observed that the paper gave a well-written and attractive description of a country very little known to geographers, and that the author's enterprise was carried out with a gallantry deserving of all commendation. In so far as related to the course of the Tanela River, and the depression in the chain, the geographical facts communicated were new.

In the discussion which followed, Mr. G. W. Hemans, C.E., disputed the accuracy of the means employed by M. de Puydt for the determination of the altitude of the pass. Captain Bedford Pim stated that should the line examined offer facilities for a ship-canal, the construction of one could not be carried out in the face of a treaty concluded on the 26th of August last, between the Government of New Granada and the Panama Railway Company, by which the former bound itself not to concede to any one the right to construct a railway or ship-canal west of a line which would include the Pacific terminus of M. de Puydt's project.

A second paper was read "On the Physical Geography of the Belize River," by Mr. S. Cockburn: an account of the extent of the Belize River-basin, the rainfall, evaporation, and so forth, over the area.

The President announced that an exploration of the Belize region, of some interest to geographers, had been made by Lieutenant Cooper Abbs, of the "Doris" frigate, an account of which had been that day communicated to the Society.

PEAT FUEL.

THE great difficulty encountered hitherto in the utilizing of peat for purposes of fuel in Ireland has arisen from the existence of the large quantity of water which the bog-land contains. By a system just invented by Mr. Hodgson, a member of the Irish Institute of Engineers, this obstacle to success appears to have been removed. Mr. Hodgson uses a tube of iron 5ft. long and 4in. in internal diameter, at one end of which a hydraulic ram works. The tube is filled with the peat to be operated upon, and at each stroke of the ram a cake one inch thick is produced, the peat in the tube being at the same time pushed forward an inch. As each cake requires about a minute to traverse the length of the tube, there are 60 cakes produced at the time. Numerous experiments have proved that a tube of this description, worked by a ram, will produce 100 tons of compressed peat weekly. In order to make the peat serviceable for fuel, it is necessary that the tube be supplied with dry turf. This is obtained by using the upper surface of the bogs, which, having been exposed for a few hours to the atmosphere on a fine day is rolled slowly over iron plates, heated only by the waste steam of the compressing machine. By this treatment the turf is rendered sufficiently dry to face the tubes, and it has been ascertained that by the combustion of 25 tons of compressed fuel, power and heat enough can be obtained to dry and compress 75 tons of excellent peat. It has been further computed with a tolerable degree of certainty that eight acres of bog-land are sufficient to yield during fine weather some 5,000 tons of compressed fuel. The cost of production, as far as it has hitherto been ascertained by experiment is, for 400 tons per week, 3s. 11½d. per ton, exclusive of the expense of management. The total cost of production cannot be more than 5s. 10d. or 6s. per ton, and as the peat has been sold for 9s. a ton at the works, and for 11s. 6d. in Dublin, a considerable margin is left for profit.

THE POISON OF THE COBRA.

OUR readers will recollect that some interesting experiments have lately been made in India relative to the action of the poison of the cobra by Dr. Shortt. This gentleman, having regard to the numerous lives that were lost annually in India from the bite of this snake, was mainly anxious to discover some antidote for its poison, and set about testing its various remedies in repute for that object. After much expense, and no little risk to himself, he has found that all are valueless. Still thinking that some effective agent might be known to the natives, he offered a reward of 500 rupees for its production, stipulating that he (Dr. Shortt) should find the cobras and conduct the experiments, which were to be three in number. The prize still remains unawarded. Recently Dr. Shortt has received a communication from Sir T. Madava Row, the Dewan of Travancore, intimating that his Serene Highness the Maharajah has taken much interest in the question, and begs to offer a reward of 1,000 rupees, under such conditions as Dr. Shortt may think desirable, to the person who can produce a remedy, and satisfy him that it is effectual against snake bite. The prize, therefore

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now amounts to £150. The discoverer, whoever he may be, will serve the cause of humanity greatly; and this announcement, we hope, will awaken an interest in the question that may lead to some satisfactory result. Dr. Shortt has been good enough to say that he will be glad to facilitate the conduction of experiments (or to receive any suggestions thereon), and that he will consign to the "Lancet," for the use of any gentleman disposed to investigate the question, heads of cobras, uninjured, preserved in spirits or simply dried, or in any other way that may be desirable; and, should it be advised—the idea is exceedingly unpleasant, but if science demand we must obey—he will send one or more cobras themselves for experiment, on being fully satisfied that every precaution will be taken to prevent the likelihood of any accident occurring. Certainly never were conditions more favourable for experiment, ugly though it may be. We therefore hope the result will be the discovery of an antidote to a poison which kills so many human beings every year.

The "Madras Times" observes that Dr. Shortt's challenge will doubtless call forth Indian specifics from all parts of the country. We would recommend to him a trial, if possible, of those remedies which the South American Indians practise in their gloomy and snake haunted forests. For every vegetable poison and for every snake poison—and they are many—which exist in the forests of Brazil, it is asserted there is a vegetable antidote growing close at hand, and it is to be regretted that when Mr. Clements Markham introduced his chinchona trees into India he did not endeavour to procure a few of these boasted South American plants which are said to cure the most venomous bites. The experiment would have been worth a trial, and may yet be tested.

SCIENTIFIC EDUCATION.

IN order to assist the artizan classes who may show an aptitude for scientific instruction, the Committee of Privy Council on Education have resolved to aid local efforts in founding scholarships and exhibitions. The scholarship is intended to maintain the student while remaining at the elementary school, and the exhibition to support him while pursuing his studies at some central institution where the instruction is of a high grade. The local scholarships are of two kinds, the elementary school scholarship and the science and art scholarship. With regard to the first, the Science and Art Department will make a grant of £5 towards the maintenance of a deserving student to the managers of any elementary school who undertake to support him for one year and subscribe also at least £5 for that purpose. The grants will be made from year to year on the condition that the student each year pass in a new subject or in a higher grade of the same subject in which he first passed. It will be for the locality to determine for how many years the student may hold the scholarship, but in no case can he be allowed to hold it for more than three years. With respect to the science and art scholarship, the Science and Art Department will make a grant of £10 towards the maintenance of a student at an elementary school, who has taken a first grade in freehand or model drawing and elementary geometry, and passed in one of the subjects of science. The Department will also make a grant of £25 per annum to the managers of any school or educational institution, or any local committee formed for the purpose, who will raise the like sum by voluntary contribution for the maintenance of a student at some college or school where scientific instruction of an advanced character may be obtained. The exhibition may last for one, two, or three years. The conditions under which these grants will be made may be obtained from the Science and Art Department, South Kensington.

ALLEYNE'S PUDDLING FURNACE.

PUDDLING furnaces offer a wide field for improvements to the practical man. Of this stamp is Mr. J. G. N. Alleyne, of the Butterley Iron Works, Derby, whose invention has reference more particularly to puddling furnaces having rotating beds, and consists in an improved arrangement for keeping these beds cool. For this purpose the bed is made of wrought iron, and is supported centrally either directly by the vertical shaft from which it receives rotary motion, or it is carried by means of a wrought or cast-iron cylinder fixed on a turntable upon the vertical shaft, the inner part of which cylinder has a communication by means of pipes or air tubes with the outer part, to allow of the circulation of the air and water jets.

Our engraving shows at fig. 1 a sectional elevation of a puddling furnace with a rotating bed, and at fig. 2 a sectional plan on the line X X of fig. 1. A is the bed, constructed of wrought iron, and provided with a lining of fire-clay, slag, or other material. This bed is supported upon a wrought-iron cylinder B fixed on the turntable C, carried by the shaft D, and by rollers E at its circumference. A slow rotary motion is imparted to the shaft D, and through this to the turntable C and furnace bed A, by a worm F and worm wheel G. Between the bottom of the bed A and the turntable C, and surrounding the cylinder B, is an annular water trough H, carried by the girders I, in which a continuous circulation of cold water is maintained by means of the inlet pipe J, and the overflow pipe K. To the outer circumference of the bed A is fixed a cylindrical flange L, passing down as shown, and having fixed to it a second flange or rim M projecting over the outer edge of the trough H, and dipping into the water. A second cylindrical flange or rim N is fixed centrally to the under surface of the bed A, which flange also dips into the water in the trough H.

By this arrangement, while the flanges L and N are free to revolve with the bed A, they form, by means of the hydraulic joints, an enclosed air-tight space surrounding the entire outer surface of the bed

FIG. 1.

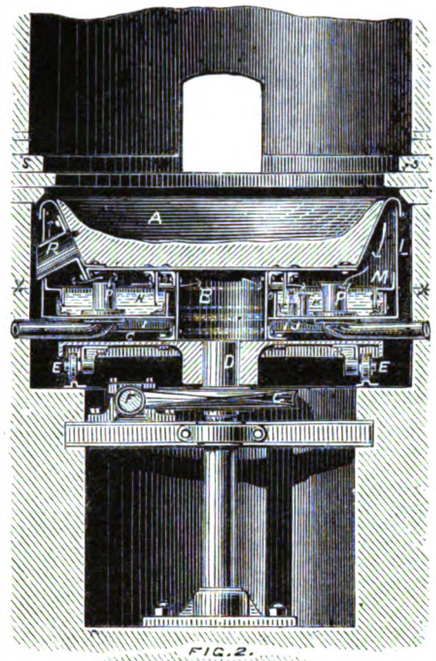
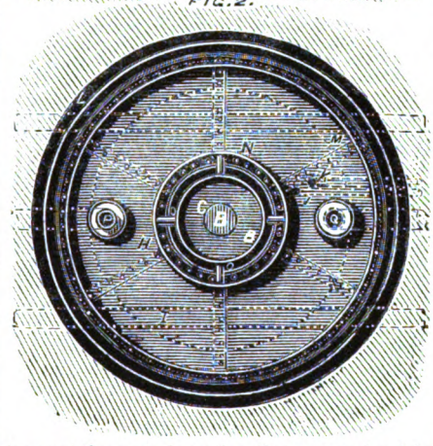


FIG. 2.



A except the central portion, that part enclosed by the cylinder B being, however, put in communication with the air-tight space by means of pipes O O. A pipe P passing through the trough H projects into the enclosed space below the bed A, through which pipe air is forced by means of a fan into the space, a jet of water entering such pipe being at the same time made to mix with such air in the form of spray. This mixture of air and water spray, in circulating in the space, passes in contact with the under surface of the bed A and very effectually absorbs the heat therefrom, and then passes away through a second pipe Q as indicated by the arrows, the escape of the air being, if necessary, accelerated by the application of an exhaust fan to the pipe Q. R is a spout to the bed A passing through the enclosed space for running off fluid slag or metal when required. The brickwork S of the furnace is made to project over the edge of the rotating bed, in order to protect it as much as possible from injury.

Mr. Alleyne's apparatus has been in use at the Butterley Iron Works for some time, and has made over 250 tons of iron. Mr. Alleyne first commenced working in June, 1866, with the machine applied to an old puddling furnace without a revolving bottom, the machine being arranged to turn on its centre and by a self-acting motion to move across the whole bottom of the furnace. It was arranged to turn from the bridge to the flue and work all the iron on the bottom in two minutes. By this arrangement it was found that the quantity of coal ordinarily used for 4 cwt. of metal melted and worked 10 cwt. It would have worked more, but the capacity of the furnace was limited, and it boiled over. Although only on an experimental scale, 10 cwt. heats were actually worked. Mr. Alleyne next put up a furnace worked by the same machinery with a rotating bottom, kept cool by the spray jets. This rotating bottom was made to work in an ordinary furnace. This self-acting, vibrating, or rather oscillating motion was disconnected, and the machine worked beautifully. The bottom was necessarily limited in size, but 5cwt. heats were worked, the apparatus for cooling the bottom and all the driving gear acting most satisfactorily. The waste on the average of the last month's work with this apparatus was 1cwt. 2qr. 16lb. per ton, being lower than the average of the whole works, and only using the same quantity of coal on 5cwt. as the ordinary furnaces did for 4cwt. Mr. Alleyne is now taking down this rotating bottom and putting up one to hold a ton, which will be worked with the same quantity of coal as is now used for 8cwt. We understand that this system works very well with puddled steel, as it stirs the iron so vigorously and steadily. In puddling by hand, the puddler cannot do this when the mass gets pasty; some parts are decarbonized too much and others not enough. With the machine, however, perfect uniformity can be attained. We may certainly pronounce this invention to be a practical success.

THE SILICATED CARBON FILTERING TAP.

THERE are various methods of obtaining pure water; by some it is filtered in the cistern, and by others it is purified after having been drawn. But these means are not within the reach of all; in fact, those who as a rule are obliged to use water of the greatest impurity, are just those who can least afford to pay for such methods of rendering it wholesome. Now, however, they can do it by using the silicated carbon filtering tap, which is just the thing for the proprietors of small tenements in poor localities to have fixed to their cisterns. The filtering medium is placed in the front part of the tap, which is removable. To clean the tap (which may be done without running off the water), it is only necessary to unscrew the front part and blow strongly through it. By this means all the impurities are brought to the surface of the filtering medium, and may be washed off before replacing the tap. Upon sanitary grounds it is impossible to over-estimate the advantage of thus being able to obtain a supply of pure water in a poor district, where the water is exposed to every kind of contamination. We would therefore draw the attention of the medical officers of such districts to this simple and efficacious preventive of disease. As we have referred to filters, we may here mention that an improvement has lately been introduced by the Silicated Carbon Filter Company, of Church-road, Battersea, London, in their filters. They use india-rubber instead of cork for the sockets of the taps, and thus prevent leakage of water from the softening or cracking of the corks, an evil which all filter users will be glad to see remedied.

Correspondence.

THE SQUARE OF THE CIRCLE. AND THE GREAT PYRAMID OF GIZEH.

LETTER VIII.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In reply to the interesting letter of your correspondent, Mr. S. R. Bosanquet, in your issue of 27th December ultimo, the following extract from "Hutton's Philosophical and Mathematical Dictionary," 2 vols., 4to, London, 1815, will show to him and to your readers in how far there is a relation betwixt my discovery that the square of the circle is four-fifths of its tangent square, and the discovery of Hippocrates, of Chios, of the quadrature of the lune, respecting which Mr. Bosanquet correctly and properly quotes the argument of Aristotle:—

"Though the quadrature of the whole circle has never yet been effected, many of its parts have been squared. The first of these partial quadratures was that of the lune or lunule, given by Hippocrates, of Scion or Chios. The lune of Hippocrates is this. Let A B C (diagram 8) be a triangle right angled at C, and semicircles be described on the three sides as diameters; then the triangle T (A B C) is equal to the sum of the two lunes L^1 and L^2. For the greater semicircle is equal to the sum of the other two. From the greater semicircle take away the segments S^1 and S^2 and there remains the triangle T; also,

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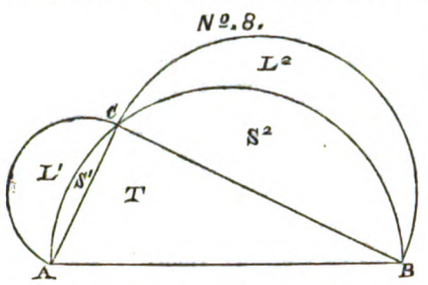
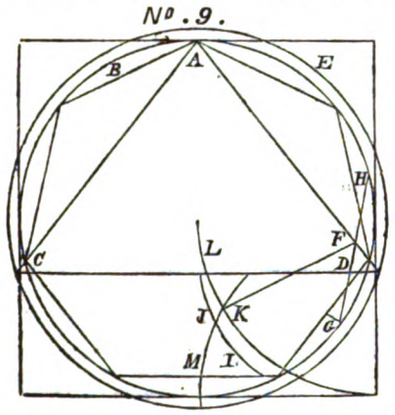
from the two less semicircles take away the same two segments S^1 and S^2 and there remains the two lunes L^1 and L^2; therefore, the triangle T is equal to the two lunes L^1 and L^2." The same demonstration is given in Montucla's Great Mathematical History in French, where, in vol. 1, the first and second diagrams are in elucidation of the quadrature of the lunule by Hippocrates.

In referring Mr. William Hayden, in reply to his letter of 21st December ultimo, in your issue of 3rd



current, to my letter No. VII., which appeared in the same issue, as to what may result from his perseverance in proof of the truth and value of my discovery that four-fifths of its tangent square is the strictly accurate area of any circle; I would only urther remark that if he will look back to my letter No. III,, in your issue of 18th October ultimo, he will observe that he has made a somewhat disingenuous and unacknowledged use—perhaps unwittingly—of my own diagram No. 7, in his last diagram as well as formerly.

I now go on with the result of the evidence contained in Colonel Howard Vyse's record of the measurements of the angles and lines of the Great Pyramid of Gizeh, quoted in my last letter. I, therefore, draw attention to the accompanying diagram, No. 9. It will there be seen that the exterior



lines of the Pyramid, viz., its base and sides, form a physical representation of the major part, or four-sevenths of the ancient "diatessaron" or perfect fourth in music, which was considered the only perfect or complete harmonious illustration of infinite symphony. Hence the antique myth of the music or motion of the spheres or planets placed by the ancient Egyptians as follows:—1, Saturn; 2, Jupiter; 3, Mars; 4, The Sun; 5, Venus; 6, Mercury; 7, The Moon; and our own musical gamut of seven notes or tones. The "diatessaron" is described by Hutton as "the perfect fourth, or a musical interval, consisting of one great tone, one lesser and one great semitone; the lengths of the strings to sound the 'diatessaron' are as 3 to 4." The sides of a perfect pyramid proceed as in diagram 9, from its apex in the zenith angle at A of the inscribed heptagon of the circle B, each over two-sevenths, or taking both sides, four-sevenths of the circle B, which may be assumed to represent a sphere. Passing through that circle in the angles of its inscribed heptagon at C and D, the side lines reach the base of the pyramid on the circumference of the circle E. The circles B and E represent relatively the annual circles of revolution of the moon and sun, that of B being the lunar year of 12 months, and that of E being the solar year also of 12 months. The values of these circles are calculated on the true ratio of the diameter to the circumference discovered by me, and explained in my letter No. IV., in your issue of 25th October last, viz.:—diameter 5, circumference 16; and the unit of measurement is the whole breadth of the Grand Gallery of the Great Pyramid, viz., 6ft. $10\frac{1}{4}$in. British. This is the grand unit of measurement of all parts of the Pyramid, as I shall afterwards show; and in these two circles by its means are represented relative periods of revolution of $354\ \frac{36708}{100000}$ days and $365\ \frac{25}{100}$ days. In order to explain my meaning here I have been obliged in some measure to anticipate the facts of my subsequent letters. But without going further into those, it will be already clear to your readers from the given measurements in the angles and lengths of the base and sides of the Great Pyramid that there is no other possible geometric explanation of them than that I have now, I believe, adduced for the first time and theorized from, viz., the lines given in the stated manner by the equilateral heptagon inscribed in a circle, and when applied to a pyramid is a sphere. And if it has been hazarded on many previous occasions that the Great Pyramid is one of the pillars of Sothis or columns of Hermes which Plato travelled from his Athenian home to Egypt to see, and to learn astronomy and geometry from, at the hands of the Egyptian priests, and, previous to him, on the same errand, Pythagoras; I am not aware that the astronomical fact of this Pyramid representing the old Egyptian luni-solar year, which was in use before the time of Osiris or Hyperion, has ever been pointed out in the manner of which I have now attempted a commencement, and which in following out in the interior of the Pyramid its further numerical relations are emphatically stamped.

In respect to the points to which I have already drawn attention in this wonderful structure, I think it not out of place to quote what (putting aside for the time what the Greek and Roman historians say) one of the oldest known reliable authors relates on the objects of its builder, as well as the remarks of one of our cotemporary and most distinguished philosophers after his receipt of Colonel Vyse's measurements of 1837.

Masoudi, who died in the 345th year of the Mahommedan era or Hegra, writes as follows:—"In the Eastern (the Great) Pyramid were inscribed the heavenly spheres and figures representing the stars and planets in the forms in which they were worshipped. The king also deposited the instruments and the 'thuribula' with which his forefathers had sacrificed to the stars, and also their writings; likewise the position of the stars and their circles." "There were different degrees among the priests who were employed in metaphysical speculations, and who served the seven planets. Every planet had two sects of worshippers, each subdivided into seven classes. The first comprehended priests who worshipped or observed seven planets, the second those who served six planets, the third those who served five planets, the fourth those who served four planets, the fifth those who served three planets, the sixth those who served two planets, the seventh those who served one planet. He (the king) filled the passages with talismen, with wonderful things and idols, and with the writings of the priests containing all manner of wisdom—the names and properties of medical plants, and the sciences of arithmetic and geometry, that they might remain as records for the benefit of those who could afterwards comprehend them. He ordered pillars to be cut, and an extensive pavement to be formed, &c." Notice will be taken of this extract when the objects of the Grand Gallery of the Pyramid are demonstrated. The other writer is Sir John Herschel, who was furnished by Colonel Howard Vyse with certain facts and measurements, especially the horizontal angle of the entrance passage, and the angle of the sides of the Pyramid with its base. Sir John Herschel's words in replying are—"The supposed date of the Pyramid 2123 years before Christ, added to our present date 1839, form 3962 years (say 4000), and the effect of the precession on the longitude of the stars in that interval having been to increase them all by the above named quantity (55deg. 45min.) of longitude, it will follow that the pole of the heavens at the erection of the Pyramid must have stood very near to the star, a Draconis; in short, speaking as in ordinary parlance, the entrance passage may be said to have been directly pointed at, a Draconis, at its inferior culmination, at which moment its altitude above the horizon of Gizeh (latitude 30deg.) would have been 27deg. 9min. No other astronomical relation can be drawn from the table containing the angle (26deg. 41min.) and dimensions of the passage. The exterior angles are remarkably uniform, but the angle 52deg. is not connected with any astronomical fact, and was probably adopted for architectural reasons." I shall offer some remarks on this passage also, when I proceed to sum up the evidence of the different measures of the Great Pyramid, to eliminate the entire theoretic significance which I attach to them as a whole astronomically and in connection with the Biblical seventh day as a day of rest and refreshment, of completion, of fulfilment and return. I only now observe that the entrance passage pierces the side of the Pyramid connecting two angles of the inscribed heptagon, at a point F, exactly 49 feet perpendicularly above the base of the Pyramid, by Colonel Vyse's measurements, where one of the sides of the inscribed heptagon G H cuts the side of the Pyramid. For reasons to be afterwards explained, the inscribed heptagon was multiplied by 4, and thus was produced 28 sides, of which the side G H is one. The length of the entrance passage is determined by the circumference of a circle I of equal diameter with the circle B, and the centre of such circle being advanced 1-28th along the circumference of the circle B. The angle of it is determined by its having to pass from the circumference of the circle I at J, through the point of junction at K of the two circles L and M, each equal to the circle B, the original circle having the value of the annual rotation of the moon in units of the whole width of the Grand Gallery of the Pyramid, as already expressed. In conclusion, it will be seen that the whole of the values of the angles, and lengths of lines of sides, base, and entrance passage of the Pyramid, depend upon the quality impressed upon the circle by the power of its inscribed heptagon. I ought to add that Colonel Vyse gives the length of the entrance passage when entire, from its entrance at the side of the Pyramid 49 feet perpendicular above the base of the structure to the level of the horizontal passage leading to the subterranean chamber hewn in the solid rock, as 343ft. 10in. British. I fear I have already trespassed sufficiently on your space. In my next I shall endeavour to complete the description of the lines and angles of the passages and rooms of the interior of the Pyramid already known.—I am, Sir, yours, &c., WILLIAM HARVEY.

London, January 22.

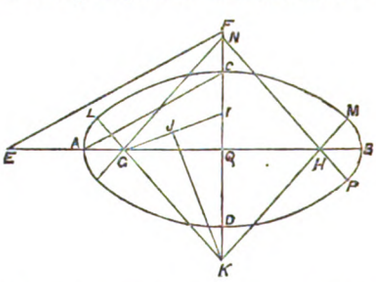
HEAT.

SIR,—May I request the insertion of a few remarks upon a subject upon which so many theories have been unsuccessfully brought forward. The subject is heat. As it is the key to the knowledge of the universe, a few observations upon a question of so much importance may not be unacceptable to your readers. It appears to me to be a subject that is beyond the grasp of the philosopher of the present day—the chemist. It eludes an analysis. Great in its simplicity, it is rejected by science. Nature exists but in unceasing change. Heat is the decomposition of mattter. Light is its modification. By this theory, and by this alone, can the phenomena of the universe be explained. The unceasing source of power that retains the planets in their orbits is at the expense of that orb which forms the centre of the system. In the constantly increasing magnitude of the planets increases also the distance from the central power, until such influence having become enfeebled they assume or reassume an active form, and become the centres of systems of their own. The two bodies from which we can form the most correct ideas are the earth and its attendant satellite. In the one we inhabit, what do we behold beyond (comparatively speaking) the formation of recent ages? An igneous rock, beneath which still glow the fires of a former system. And if we turn our eyes towards its satellite, where can we find a greater picture of exhaustion? A truer representation of a world burnt out? It is not my intention to enter further into a question of such magnitude in a communication such as this, my purpose being to draw attention to that which I conceive to be the key to the knowledge of our existence.—I am, Sir, yours, &c., H. SALOWAY.

6A, George-street, Dover-road.

METHOD OF DRAWING AN ELLIPSE.

SIR,—Having had my attention drawn to the subject of practical geometry by the recent correspondence in your pages concerning the circle, I beg to forward you a method of drawing any ellipse with common compasses, which was proposed by me in 1849. The figure produced is of course a compound one, made up of four arcs of circles, very pleasing to the eye; and I think the rule will commend itself as much to the geometrician for its comparative correctness, as it does to the mechanical draughtsman for its facility in practice. It is as follows:—Let



A B be any major axis and C D any minor; produce A B towards E, and C D towards F; make A E equal to C Q, and draw E F parallel to A C; then set off A G, B H, and C I, equal to F C; join G I, bisect it in J, and at J erect a perpendicular cutting C D (produced) at K. Next make Q N equal to Q K; and G, H, N, K will be the centres of the four circles required. Through G and H draw K L, K M, N O, and N P, all equal to K C; then the curve drawn through the points A, L, C, M, B, P, D, and O will be the ellipse required. I will have your readers to demonstrate the correctness of this method, and prove its utility or otherwise for themselves, observing only that the ellipse produced by it is not mathematically perfect, but is nearer the true figure than that produced by any other process I know of.—I am, Sir, yours, &c.,

Lee-crescent, Birmingham, January 9. JOHN CRANE.

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FLOW OF WATER.

SIR,—I have a cistern 120ft. by 40ft. by 7ft., supplied by a water course with an inclination of 1 in 16 running 1in. deep. At the lower end I have an opening for letting out the water for use 7¼in. wide. When the cistern is quite full I find raising my sluice 1in. I get a sufficiency of water. Supposing there to be no waste, how long may I count on being supplied with a sufficiency; and what is the formula for working out this.—I am, Sir, yours, &c.,

Matale, PLANTER.

November 28, 1867.

[As you have not given the breadth of the watercourse it is impossible to calculate the rate at which your cistern is supplied, consequently the question resolves itself into the following. Given a cistern containing, as yours does, 218,400 gallons, the contents of which are let out by an opening 7¼in. by 1in., how long will it be before it is run dry. You should have given the exact height of the opening, but in absence of the precise data we consider the discharge to take place under a variable head, commencing with 7ft. as the maximum.

The formula to work by in this case would be

$$T = \frac{2A}{m S \sqrt{2g}} (\sqrt{H} - \sqrt{h})$$

where T = time in seconds, A = the area of the cistern, S = the orifice, H = the greatest head, h = the least, m = 0.60 and g 232.16. As the value of h is not given the discharge and the time it would occupy cannot be ascertained, unless it is assumed equal to zero. In the latter case, a fortnight would nearly empty your reservoir.]

GIFFARD'S INJECTOR.

SIR,—Will you be good enough to inform me in what volume of the MECHANICS' MAGAZINE the original description of Giffard's Injector appeared.—I am, Sir, yours, &c., W. H. M. ELLIS.

University Club, Dublin. January 22.

[Our correspondent will find a full description of Giffard's and other injectors in a paper read by Mr. Lewis Olrick before the Society of Engineers, and published in the MECHANICS' MAGAZINE for December 22 and 29, 1865. A further paper on the most recent improvements in the injector was read by Mr. Gresham before the same society at the close of last year, and will be found in our issue for January 3, 1868.—ED. M. M.]

PETROLEUM FURNACES.

SIR,—In your late remark on my apparatus for burning petroleum, that the boiler at Woolwich is not likely to be relit in its present state, you are quite right. I wish to make an alteration before it is again in action, but I assure you it is not altogether extinguished. I had been persuaded, in order to add to the force of the process, to put retorts and superheaters; these succumbed to the force of the flames and dropped. I have to take them out and put in my own simple apparatus, that exposes no iron to the fire. The expense of doing this is the only cause that prevents the boiler being in full action. I unhesitatingly pronounce that any method for burning liquid fuel that exposes iron to the flames, is wholly useless for any practical purpose. In your description of Mr. Crow's apparatus, you mention that he had conducted an experiment with creosote that produced 18·91lb. of water evaporation per 1lb. of creosote. This is quite true, but it was with my apparatus, not his. I gave him the use of my boiler at Woolwich for an entire day; creosote was burnt under his superintendence, and the result, as returned by the engineer of the yard, was as stated, one that could never be obtained by any apparatus exposed in the midst of the flames.—I am, Sir, yours, &c., C. J. RICHARDSON.

34, Kensington-square, W.

Meetings for the Week.

MON.—Society of Arts.—Dr. Lotheby on "Comparative Digestibility of Foods; Functions of Different Foods; Construction of Dietaries," at 8 p.m.

Royal Geographical Society.—E. D. Young, Esq., an "Account of the Livingstone Search Expedition," at 8.30 p.m.

TUES.—The Institution of Civil Engineers.—Colonel O'Connell on "The Relation of the Fresh Water Floods of Rivers to the Areas and Physical Features of their Basins," at 8 p.m.

WED.—Society of Arts.—Dr. Mann on "The Climate and Industrial Prospects of the Colony of Natal," at 8 p.m.

THURS.—Royal Institution.—Professor Tyndall on "The Discoveries of Faraday," at 3 p.m.

FRI.—Royal Institution.—Rev. F. W. Farrar on "Public School Education," at 8 p.m.

Royal United Service Institution.—Major General Michael W. Smith, C.B., on "Cavalry: How far its Employment is Affected by Recent Improvements in Arms of Precision," at 3 p.m.

SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Snilles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—R. P. B.—C. H.—F. C. S.—G. W. H.—J. T.—W. M.—J. S.—Messrs. W. F. and A.—W. H. H.—J. N.—J. G. N. A.—G. G.—Messrs. C. M. and Co.—R. G. S.—N. M.—R. T.—S. E.—R. G. S.—J. P.—W. H. M. E.—J. A. N.—G. F.—C. J. R.—T. P.—L. C. H.—J. R.—D. G. B.—R. F.—N. J.—H. J.

Naval, Military, and Gunnery Items.

THE operation of the Contagious Diseases Act, 1866, will shortly be extended by the Government to the garrison districts of Shorncliff, Colchester, and Cork, as well as the Curragh.

AT Orenburg, on the borders of Turkistan, a military school has been established for 200 pupils, 120 of whom are to be selected from the sons of Tartar and Kirghis chiefs.

CAPTAIN Le Messurier, with some well-borers and a staff, has arrived at the Abyssinian camp, and his first experiment, made on the 11th, about a mile from the shore, was highly satisfactory. The want of water is the greatest drawback to the efficiency of the Commissariat and Transport Train departments.

MESSRS. W. Denny and Brothers, of Dumbarton, are building two composite gunboats, each of 300 tons; an iron screw of 1,760 tons, named the "Saturno"; another iron screw of 3,000 tons, not yet named; another iron screw of 1,760 tons, not yet named; an armour-clad twin screw of 1,200 tons, and two iron screws of 1,100 tons each.

AT Chelsea Hospital Capt. Robert Grier, aged 75 years, died on Sunday. He entered the army in February, 1810, as Ensign in the 44th Regiment, and shortly afterwards went on service to the Peninsula. At the battle of Fuentes d'Onor he was wounded in the right shoulder; at the siege of Badajoz he led the advance of the feigned attack which ultimately became the successful one, and commanded the "forlorn hope" when the place was carried. He was in the campaign of 1815 severely wounded in the ankle at Quatre Bras. Capt. Grier had the war medal with three clasps, and the Waterloo medal. He was placed on half-pay in March, 1817, as Lieutenant, and was appointed a Captain of Invalids in September last.

HER Majesty's steam sloop "Shearwater," from the South Pacific, brought home a couple of men picked up in the Straits of Magellan on October 11 last, and who had subsisted during the preceding six weeks on mussels and other precarious food which they were able to gather from the rocks. The men when discovered were scarcely recognizable as Europeans, having been so thoroughly metamorphosed by their mode of existence and exposure to the severity of the weather, as to be taken for the native aborigines, if any were in existence. They both belong to H. M. sloop "Chanticleer," cast away in the ship's dingy in a gale of wind while in attendance on a shooting party of the officers of that ship, and reported to the Admiralty as dead. They were discovered by a similar party of excursionists from the "Shearwater."

THE "Kronstadt Wiestnik" observes that warlike preparations in France have latterly extended to the naval forces. The most marked activity is observable in the Government ship-yards. At this moment no less than 39 ships of different sizes are building for the Admiralty. Four of these are rams, on the "mixed principle," being half of wood and half of iron. One ram, "The Ocean," is to carry eight guns of the heaviest calibre in battery, and four others in towers. On the same system four corvettes are also being constructed to carry two guns on each side, and four others in as many immovable towers. These vessels will be comparatively small, and provided with powerful machines so as to attain great speed in the water. The French men-of-war steamers number 348; add to these 116 sailing vessels and the 39 in course of construction and we have a total of 503.

LATEST accounts from the Clyde show activity in the shipbuilders' yards. Thus we learn that Messrs. C. Conwell and Company, of Overnewton, have launched a composite screw of 800 tons, built for the China trade. Engines are being supplied to this steamer, which has been named the "Columbine," by Messrs. J. Howden and Company, of Scotland-street Engine Works, Glasgow. Messrs. W. Denny and Brothers have launched an iron screw named the "Saturno," built for the Austrian Lloyd's Steam Navigation Company. The dimensions of the "Saturno" (which is the seventh vessel of a similar class supplied by the same firm to the Austrian Lloyd's) are:—Length, 275ft.; beam, 34ft.; depth, 26ft.; burden, 1,760 tons new measurement. The builders will supply engines of 250-horse power on the direct acting service condensation principle. Messrs. Blackwood and Gordon, of Port Glasgow, have launched a screw steamer named the "Dungevan Castle." Her dimensions are 142ft. by 21ft., and 11ft. 6in. Her engines, which are of 70-horse power, are also made by Messrs. Blackwood and Gordon.

Miscellanea.

THE statue of the late Sir Robert Peel is placed in New Palace-yard, Westminster, but it is not yet decided when it is to be uncovered.

IN the six years 1861-66 the railway companies of the United Kingdom paid no less than £1,378,167 for legal and Parliamentary expenses.

THE "Serapis," just arrived from India, has brought a magnificent young tiger, in charge of Captain Wake, for the Zoological Society's Gardens.

THE "New York Herald," stating that at a recent funeral after a railroad accident, the hymn, "I would not live away," was sung, suggests that it be printed on the back of passengers' tickets.

THE American Patent-office reports that the whole number of patents issued during the year 1867 was 15,016, being an increase of 3,515 over the number of patents issued in 1866.

AN American paper states that in Windham County, Connecticut, the keeper of the gaol goes from house to house with a gang of prisoners (the refractory trammelled with a ball and chain), and jobs of wood-sawing for the people are attended to.

WE learn with much satisfaction that Joseph Whitworth, Esq., LL.D., F.R.S., &c., has consented to preside at the forthcoming anniversary festival of the London Association of Foremen Engineers, to take place on February 15, at the City Terminus Hotel, Cannon-street.

AN interesting memoir of Dr. Gale, of non-explosive gunpowder notoriety, from the pen of Mr. John Plummer, is in the press. The history of Dr. Gale, who is totally blind, forms a remarkable and encouraging chapter in the annals of self-help, and can hardly fail to gain considerable popularity.

THE trowel prepared for presentation to his Royal Highness the Duke of Edinburgh on the occasion of laying the foundation stone of a new town-hall at Melbourne, is made entirely of gold, both blade and handle. Where the two join, the trowel is ornamented with pearls and turquoises; at the other end, the handle has on it a duke's coronet, set off with diamonds and emeralds.

IN consequence of the death of Mr. Godson, Mr. W. M. Williams is appointed chief superintendent of the South-Western Railway. Mr. Verrinder, superintendent at the Waterloo terminus, and Mr. Tyler, of Exeter, are appointed assistant-superintendents, in conjunction with Mr. Williams. Mr. G. W. Hill, district superintendent at Windsor, succeeds Mr. Verrinder as superintendent at Waterloo.

LAST week the highway in front of the Red Lion Hotel, Dunstable, gave way suddenly, making a large hole some 6ft. deep and 10ft. or 12ft. in circumference, as though a well was being sunk. Old men say that a "middle row" stood on that spot years ago, and that dumb wells stood about in a line with the present centre of the highway. That is supposed to be the reason of this extraordinary subsidence.

A COMMITTEE of the Liverpool Chamber of Commerce has reported to the meeting of the council that they had made inquiries into rumours, which had caused much anxiety, that considerable quantities of gunpowder were stored in Liverpool, and they had ascertained that there was no cause for alarm, and that the arrangements for storing and delivering gunpowder were sufficient to prevent accident.

THE "Ackbar" of Algiers says, that in consequence of the abundant rain which has lately fallen in Algeria, vegetation around the capital has made immense progress. Buds and flowers are bursting forth with incredible rapidity. At Mustapha-Superior the greater part of the fruit trees are in blossom, and on others the fruit itself is beginning to be formed, and they have eaten plums of a second growth perfectly ripe; and this in the month of January!

THE visitors to the South Kensington Museum during the week ending January 18, were on Monday, Tuesday, and Saturday, free from 10 a.m. to 10 p.m., 6,825; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,689—total, 8,514. Average of corresponding week in former years, 9,568. Total from the opening of the Museum, 7,152,324. Patent-office Museum.—Number of visitors for the week ending January 18, 3,012; total number since the opening of the Museum free daily (May 12, 1858), 1,232,208.

WE regret to announce the death of Mr. Frederick Slight, for many years the secretary of the London and Brighton Railway. He was appointed to that

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office abont 20 years ago, and continued to act as secretary down to the time of the important inquiries of the investigation committee last year. The anxieties connected with the financial embarrassments of the concern, are believed to have resulted in a premature decay of his powers. Mr. Slight was only 43 years old at the time of his death.

IN order to try the results of the French International Monetary Commission, which sat at the Ministry of Foreign Affairs, for the purpose of ascertaining if a uniform coinage could be adopted by all the civilized nations of the earth, a gold piece has just been struck as a common standard of money in France, England, and the United States. On the obverse is the effigy of the Emperor Napoleon, crowned with laurels, without any inscription; and on the reverse the following:—"5 dollars—25 Francs," and beneath—"Or: essai monetaire." This piece is also of the value of an English sovereign.

AN interesting discovery of ancient silver coins and ingots of the Gaulish period has been made at Goutrem (Eure). They are believed to belong to period of the Volsci-Tolosati, inhabitants of ancient Toulouse. The coins seem to have been cut off the ingots, and, without regard to the form of the piece, stamped as money, attention being paid only to their weight. A considerable number of them, and some of the silver bars, have been secured for the Museum of Rouen, already remarkable for its collection of ancient coins, and illustrations of early Gallic metallurgy.

A CORRESPONDENT writes:—The engine-drivers on the Enfield branch of the Eastern Counties Railway received from the passengers a few days since a testimonial of ten guineas, as an expression of their goodwill towards them, and satisfaction with their services. The amount was collected in half-crowns, and the men were much pleased to receive so kindly a token from their passengers. At this time of the year every one seems to be remembered, except the most important on the railway—viz., the drivers, and my reason for asking your insertion of this note is that others may think of their humble friends, and go and do likewise.

IN reporting on the preventable diseases of the industrial classes, the "British Medical Journal" calls attention to the condition of certain workers among metallic and mineral dust. The amount of consumption and other lung diseases caused by the inhalation of irritating particles, is excessive among engineers, machinists, and stonecutters. Of the men belonging to the Amalgamated Society of Engineers the larger proportion of deaths are due to different varieties of preventable lung diseases. An ample field is open to persons of some mechanical ingenuity and philanthropy in perfecting the necessary contrivances for protecting the air passages from the particles which, by their irritating action, give rise to these diseases.

AT the ordinary general meeting of the Institution of Civil Engineers, on Tuesday, the 14th inst., Mr. C. H. Gregory, President, in the chair, the following candidates were balloted for and duly elected: as Member, David Phillips; and as associates, T. P. S. Crosthwait, W. C. Faber, G. Farren, Major Furlong, R.E., T. E. Owen, Middleton Rayne, H. Y. Richardson, Jagannath Sadasewjee, James Stewart, Captain Hector Tulloch, R.E., and C. Wawn. It was also announced that the Council had admitted as Students of the Institution, Henry Adams, C. A.. Alberga, W. P. Birch, J. M. Campion, Lindsay Heath, A. W. Hemans, O. H. Howarth, W. H. King, F. H. Landon, A. H. Le Breton, F. H. Mollett, G. P. Pocock, G. H. Roberts, E. L. Robertson, D. S. Shaw, J. H. Waller, and Francis Wilton.

AT the ordinary meeting of the Royal Microscopical Society held at King's College, December 8—James Glaisher, Esq., F.R.S., president, in the chair—two gentlemen were elected fellows of the society. The president announced that a very valuable present had been received from Dr. G. C. Wallich, consisting of his entire collection of slides, numbering in all 1,031, a book containing his original drawings of microscopic objects, and a quantity of unmounted material. A paper was read by Professor Rupert Jones, F.G.S., on Fossil Bivalve Entomostraca, which were shown to be abundant throughout the whole geological series, but especially entering into the composition of various kinds of limestone. Charles Stewart, Esq., and Charles Tylor, Esq., were appointed auditors, and the annual meeting of the society was announced to take place on February 11.

IN accordance with instructions received from the Secretary of State for War, some important trials in connection with the consumption of gas, and which promise to be of great advantage to the public, were completed at the gas works of the Royal Arsenal, Woolwich, on Tuesday last. It has been found that by combining bitumen with coal in gas retorts that the gas is evolved with great rapidity, and that it gives an illuminating power from one burner equal to twenty-five spermaceti candles. The experiments, which have been conducted by Captain the Hon. Arthur Cocklin, C.B., of the Steam Reserve, Sheerness, have been so satisfactory that 200 tons of bitumen have been ordered by the War Department for use in the Arsenal.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order oj the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—1678, 1706, 1735, 1742, 1749
BUILDINGS AND BUILDING MATERIALS—1732
CHEMISTRY AND PHOTOGRAPHY—1808
CULTIVATION OF THE SOIL, including agricultural implements and machines—1709
ELECTRICAL APPARATUS—1720, 1750, 1755, 1770, 1771, 1772
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—1666, 1675, 1683, 1685, 1688, 1695, 1700, 1712, 1719, 1725, 1726, 1733, 1734, 1743, 1744, 1752, 1758, 1774, 1795, 1807
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1698, 1729, 1751
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1792, 1796, 1805
GENERAL MACHINERY—1665, 1671, 1677, 1680, 1684, 1690, 1691, 1692, 1693, 1696, 1702, 1704, 1705, 1707, 1716, 1728, 1753, 1756, 1760, 1761, 1768, 1769, 1777, 1779, 1781, 1783, 1799, 1801, 1802, 1809
LIGHTING, HEATING, AND VENTILATING—1668, 1673, 1748
METALS, including apparatus for their manufacture—1701, 1714, 1739, 1747, 1767, 1784, 1803
MISCELLANEOUS—1663, 1667, 1669, 1674, 1676, 1679, 1686, 1689, 1694, 1703, 1708, 1710, 1711, 1713, 1715, 1718, 1722, 1730, 1731, 1738, 1745, 1746, 1754, 1759, 1763, 1765, 1766, 1775, 1776, 1780, 1782, 1786, 1788, 1789, 1790, 1797, 1800, 1804
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1672, 1681, 1682, 1699, 1721, 1723, 1724, 1727, 1736, 1737, 1740, 1762, 1773, 1793, 1798
SHIPS AND BOATS, including their fittings—1697, 1778
STEAM ENGINES—1661, 1787, 1791
WARFARE—1664, 1670, 1687, 1757, 1785, 1806

1630 A. ALBRIGHT. *Covering buckles, saddle-trees, turrets, hooks, and other metallic trimmings for carriages and harness with a coating of vulcanized or hard rubber, gutta-percha, or prepared gum.* Dated June 1, 1867.

The buckle, or other article to be covered, is first enveloped with a coating of rubber or rubber paste, and is then enclosed in a suitable two part flask; the said flask is then put into a boiler or "vulcanator," and "vulcanized" to the desired degree of hardness, in the manner in which vulcanizing is usually practised. When gutta-percha, or other material, is used instead of the rubber, the mode of application is somewhat similar.—Patent abandoned.

1631 E. TAYLER. *The facilitating the composition or arranging of type of various founts, for displaying jobs or other works usually required to be done in printing offices.* Dated June 1, 1867.

This invention consists of a double sack or frame in which the cases or trays for holding the type are placed on a small frame revolving on pin joints or axles passing into or through two or more wheels resting on an axis, and one or more disc or discs, and the angle of the said cases or trays are alterable at pleasure by the movement to or fro of the position of one or more wheels, whereby the elevation or depression of the said disc or discs is effected, thereby raising or depressing the further or upper side of the small frame holding the said cases or trays.—Patent abandoned.

1632 T. HORREX. *Improvements in machines for hatching eggs.* Dated June 3, 1867.

The patentee adopts a flat case of metal or other material (to hold water or other fluid mixed) in or upon a box, frame, or stand, in an inclined position, and at one end of the box or frame, and under the lower end of the flat case holding the water, which is rounded for the purpose, he places a small lamp or gas burner; but he prefers a small tray of tin or other metal partly filled with oil, upon which is floated a wick, and placed under the lower or rounded end of the flat case holding the water, so as to heat the water or fluid therein. Under the other or higher end of the flat case holding the water he places a box or tray of a wedge-like form for the eggs to be placed in. By the box or tray being of this shape or form, the eggs can be placed close to, or at a distance from, the under surface of the flat case holding the water or fluid, by slightly pushing the box or tray forward, or withdrawing it in a wedge-like manner, by which means the heat of the eggs can be regulated. Around the top of the box or tray he fastens tubing, or list, or other material, to prevent the heat escaping, and he partly fills the box or tray with sand, or other material, to assimilate it to the ordinary hen's nest.—Patent completed.

1633 W. PIDDING. *Improvements in reels or receivers upon which threads, silks, or other fibrous material, in connection with needles (threaded or otherwise) are arranged, as also in the arrangement of needles threaded with any fibrous material, for the purpose of facilitating the use or uses of the same for all purposes of needlework.* Dated June 3, 1867.

Provisional protection has not been granted for this invention.

1634 E. MCLEAN. *Improvements in the construction of pianofortes and harmoniums.* Dated June 3, 1867.

This invention consists in making the top or lid of the case of such instruments of an arched form, in contradistinction to the forms hitherto employed, thereby leaving a cavity for the sound over the wrest plank. The top may be arched in the direction of its length or of its breadth, or the said arch may be a semicircular, elliptical, undulating, or other suitable form, but when of an undulating form, it is, according to this invention, made with a surface on the underside of a comparatively uninterrupted hollow curved form, the curve being only slightly returned at the sides or ends, or both; openings or holes of an ornamental, or other form, may be made in the ends or sides, or both, of this arched top, for the emission of the sound, and the exterior may be ornamented in a variety of ways.—Patent completed.

1635 W. H. RICHARDSON. *Certain improvements in the manufacture of iron and steel, and in the means or apparatus for effecting the same.* Dated June 3, 1867.

This invention has for its object the purification of iron when in the liquid state for the purpose of obtaining an improved metal from which castings may be produced, from which steel may be manufactured, and also for the purpose of cheapening the cost of, as well as the time occupied in, producing such metals or materials, and consists as follows:—After the ore is reduced in the blast furnace to the state of molten crude metal, the furnace is tapped, and the liquid metal run off into a vessel or receptacle where a blast of atmospheric air—which may be of a pressure of 4lbs. on the square inch, and upwards—is introduced into its mass through a hollow or tubular rabble or stirring rod of dimensions suitable to the mass of metal under treatment, similar to that shown and described in the drawings and specifications of letters patent granted to the present patentee the 4th December, 1866 (No. 3189), and which may be operated by hand or otherwise.—Patent completed.

1636 J. F. BROWN. *Improvements in looms for weaving.* Dated June 3, 1867.

The essential feature of this invention consists in the application to power looms of a certain apparatus, by means of which an instantaneous stoppage of the loom may be effected. In carrying this invention into practice the ordinary fast and dead pulleys are dispensed with, and in their place a frictional clutch is substituted, one-half of which is fixed on the driving shaft in the same manner as the ordinary fast pulley. The periphery of the clutch, or of one clutch plate, is formed so as to receive the driving belt, and thus constitutes or fulfils the office of a driving pulley. A clutch handle is provided for the purpose of pressing against or withdrawing the clutch on one clutch plate from the clutch box or other clutch plate, so that, by pressing the fixed half of the clutch against the revolving half, the frictional contact thereby produced instantly stops the loom, so that the gearing or mechanism for actuating the cloth beam is prevented from winding up the cloth.—Patent abandoned.

1637 C. L. J. CARVILLE. *Improvements in the construction of boilers.* Dated June 3, 1867.

These improvements comprise—First, the formation of capacities or spaces of strong corrugated sheet metal, so as to form vessels or boilers affording a free circulation for water and the generation of steam, as described. Second, the joining or uniting of the said corrugations at certain distances. Third, the employment in steam boilers of vessels or capacities made solely according to this invention, or in combination with steam generators of ordinary construction. Fourth, an arrangement for supplying heated water to steam boilers. Fifth, the production of superheated steam. Sixth, the employment of valves whereby the direction in which the heat circulates may be regulated as required or desired. The different parts of boilers made according to this invention are formed of two sheets of metal, or of a single corrugated sheet, and united in such manner that the two cavities or hollows are opposite one another, and thus form a capacity or boiler; and in order to maintain these parts at a desired distance apart, there are two projections or flanges opposite one another which are united by girders, bolts or screws.—Patent completed.

1638 D. BARKER. *Improvements in the construction of chambers for drying artificial fuel and other substances.* Dated June 3, 1867.

According to this invention the outer walls of the chambers are built of brick, or of other material or materials adapted for the purpose, angle iron plates being introduced into or attached to the walls, the same forming rails for the support of the movable trays hereinafter mentioned; and also for the support of bars to which are suspended the steam or hot air pipes when the same are employed for the purpose of heating the chamber. The blocks of fuel are placed upon iron trays furnished with wheels, the trays being connected with each other by dove-tailing or otherwise. The trays are introduced into and removed from the chamber by means of an endless band, or other analogous or suitable arrangement.—Patent abandoned.

1639 S. HARWOOD. *Improvements in the construction of walls, buildings, and other similar structures.* Dated June 3, 1867.

This invention relates to certain improvements in the construction of walls, buildings, and other such structures composed of layers of blocks or slabs of material in the nature of cement compositions, whereby complete ventilation is effected, and great strength afforded to the structure with a less weight and quantity of material than has hitherto been the case. The inventor proposes to form the blocks or slabs by means of moulds, the materials consisting of concrete, pure Portland cement, Roman cement, or any other cement or lime, or lime and cement, or other known compounds suitable for the manufacture of hard and durable blocks of artificial stone, and to build the wall or other structure of a hollow or cellular form by placing or laying the blocks or slabs in courses side by side with a space or interval between the rows, which may be two, three, or other number, and by binding the courses with similar blocks or slabs, either touching each other or with a space between each—Patent abandoned.

1640 R. W. PAGE. *Improvements in the construction of hand garden engines and hydropults.* Dated June 3, 1867.

This invention relates to a novel construction of garden engine for pumping and forcing water for use by hand, the engine being also useful as a hydropult for extinguishing fire, and for other purposes. It consists of a cylinder of brass, or other suitable metal, provided at one end with a stuffing box through which a piston rod or plunger is made to work, actuated by the right hand of the operator; the other end of the cylinder is fitted to an air-tight globe or vessel, to the opposite side of which an outlet pipe is fixed by a screw or otherwise, in order to cause the water to flow as a jet or stream. The piston rod has an inverted cone of metal fixed thereon near the globe, and the extremity of the rod is provided with a fixed metallic perforated disc or plate fitting the bore of the cylinder. Between the cone and disc the cap leather is placed on the rod loosely; it fits the cylinder, but its base is perforated

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with an orifice larger than the diameter of the piston rod, to which a suitable handle is attached. At the side of the cylinder, and close to the handle, a short metal branch or nozzle is fixed, containing a conical inlet valve set in a corresponding seat; the base of this conical inlet valve is provided with a dome or semicircular plate of metal placed at right angles or vertically on or across the centre of the base of the conical valve, which fits or partly fits into a hemispherical recess in the branch when the valve rises from its seat. The narrow end of the valve is furnished with a triangular guide or sliding rod working in the circular bore of the branch for the sake of steadiness, and an india-rubber or other tube of suitable length is joined to the branch, and the other end is furnished with an inverted cup covered with wire gauze, which cup is to be inverted in a cistern or other vessel if the engine is to be used in a greenhouse or hothouse, or in a vessel of water if to be used in a garden or other situation, the gauze preventing the entrance of any foreign substances which might interfere with the action of the valves or piston. The air globe or vessel is provided interiorly with a short flexible tube communicating with the outlet pipe or rose; this tube is weighted at the end so as always to fall to the bottom of the reservoir or globe, in order that it shall always be beneath the level of the water. The action of the engine will be obvious from the above description.—Patent abandoned.

1641 J. INSHAW. *Improvements in electrical clocks, which improvements may also be applied to other electrical instruments.* Dated June 4, 1867.

This invention consists of the improvements hereinafter described in the commutators or contact breakers of electrical clocks and other electrical instruments, by which improvements great simplicity in the construction of the said commutators or contact breakers is effected, and great certainty in their action secured. The patentee describes the invention in connection with a commutator or contact breaker of an electrical clock. On the rod of the electrical pendulum of the clock are two tappets, between which a vertical wire is situated, the said wire being connected with a horizontal slide, so that by the motion of the pendulum the said tappets, acting on the said vertical wire near each end of the stroke of the said pendulum, communicates an intermittent reciprocating motion to the said slide, and effect the interruption and completion of the electrical circuit, as hereinafter explained. The said horizontal slide has near one end of it a raised portion which, in the traversing motion of the said slide produced by the pendulum, is brought under and into contact with the lower end of a vertical wire connected with one of the plates or elements from which electricity is derived. The said slide works in two supports. One of the said supports in which the slide works is connected with the other of the plates or elements from which the electricity is derived, and between the said support and the vertical wire, and connected therewith, are the coils which actuate the pendulum of the clock, as well as the coils of any other clocks the motion of which is regulated by the pendulum of the first-named or primary clock.—Patent completed.

1642 M. CAVANAGH. *Improvements in adjustable lock spindles.* Dated June 4, 1867.

This invention has for its object improvements in lock spindles with a view of rendering the several parts thereof more complete and suitable for being applied and accurately adjusted to any thickness of door, and consist in employing with the ordinary tapped square spindle a regulating swivel screw nut, and sliding boss or nozzle, in combination with fixing studs and coupling socket turning upon the mount of the movable knob or handle, by the arrangement of which, on the said spindle being adjusted to the required thickness of door, through the medium of the swivel nut, the said studs on the boss are caused to take into a notched concentric inner groove in the said coupling socket, whereby the knob or handle is firmly held or retained upon the spindle, in like manner to the bayonet fastening.—Patent completed.

1643 J. WADDINGTON and B. LONGBOTTOM. *Certain improvements in moulds to be employed in casting Bessemer steel and other metals.* Dated June 4, 1867.

This invention is designed to render the moulds employed in casting Bessemer steel or other metals more durable by so forming them that the lower portion which first becomes deteriorated may be removed and a new portion substituted. Hitherto such moulds have either been made of one solid piece, or divided vertically in halves, the better to release the ingot. The improvements consist in dividing the moulds horizontally, that is, so as to make a top and bottom portion; the edges of these parts which meet together are grooved or so formed as to fit into each other, and the upper and lower parts are secured together by bolts passing through lugs outside the mould. When preparing a mould for use, a cement is filled in between the joint, and a temporary plug is passed inside the mould to prevent the cement squeezing into the mould; the bolts are then drawn up tight, and the spare cement squeezes out on the outside of the mould. Thus, when the interior surface of the lower portion becomes worn or eaten away by the splashing of the metal, it can be replaced by another one, the upper part serving many lower ones.—Patent completed.

1644 G. DAVIES. *Improvements in the construction of paddlewheels.* (A communication.) Dated June 4, 1867.

This invention consists in the combination of a series of main floats, and a series of auxiliary floats, in connection with two wheels, the whole being constructed and arranged substantially as hereinafter described. Between these two wheels, and attached to them at their rims and spokes, is a series of floats composed of metal or wood; these floats form an obtuse angle with each other at their centres, and are attached at their outer ends on each side to the wheels, being arranged at equal distances apart. In revolving the paddle-wheel for the purpose of propelling a vessel, the said wheel is to turn in such a direction that the outer ends of the floats shall first enter the water, and the force of the latter shall be exerted against the inner or concave side of the bucket. Extending from the spokes of the side wheels are two auxiliary wings or floats attached at their inner ends to the main floats, and set at a reverse angle to the same for the purpose of enabling the wheel when its motion is reversed to propel the vessel astern, these auxiliary floats also serving as braces or supports for the main floats—Patent completed.

1645 T. LAIDLAW. *Improvements in the manufacture of yarns used for weaving textile fabrics, and in the machinery employed therefor.* Dated June 4, 1867.

This invention has for its object the production of yarns on which a spot is formed at intervals by the more close overwinding of one yarn upon the other, the intervening spaces being twisted in the usual spiral manner, and is carried out as follows:—A wheel is fixed on the driving shaft of the twisting frame, and it actuates another wheel on which a wiper or cam is fixed, which wheel, during one part of its rotation, comes in contact with the end of a rod or bar; it forces the rod forwards, causing it to operate upon a lever that actuates the feeding gear, so that during the time the wiper or cam acts upon the rod, a spiral twist is produced, and when the lever is drawn back by means of a spiral spring, a spot is produced.—Patent completed.

1646 E. MELDRUM. *Improvements in the purification of paraffine.* Dated June 4, 1867.

This invention consists in purifying paraffin oil by treating it, whilst in a cold unmelted state, with naphtha.—Patent completed.

1647 J. H. JOHNSON. *Improvements in racks or holders for whips, canes, and other like articles.* (A communication.) Dated June 4, 1867.

This invention relates to racks for holding whips and other articles, and consists in the combination with a skeleton or perforated frame of wood, or other suitable material, of an elastic binding or holding device arranged in the perforations of the said frame in such manner as to hold any object placed or inserted in the perforated frame. The rack thus constructed can be put to various uses.—Patent abandoned.

1648 J. M'OWEN. *Improvements in fire-grates.* Dated June 4, 1867.

In house fire-grates of the usual construction there is a grate on which the fire rests, and through which the ashes drop. Now, the nature of this invention consists in the application and use of two grates, the top one of which is a fire-grate for the fire to rest upon, and the bottom one is a coarse grate, and between or under the grates the patentee places a sliding valve which can be opened or closed at pleasure. By these means more or less air can be supplied to the fire by opening or closing this valve.—Patent completed.

1649 H. W. HART. *An improved construction of raft.* (A communication.) Dated June 4, 1867.

This invention relates to a novel construction of portable raft which combines lightness and buoyancy with an extended supporting surface. The raft may be described as a disc of canvas forming the floor attached to and extended over a number of conical shaped air-tight floats, set radially around a vertical hollow cylinder, and connected thereto by links. The interior of this cylinder is divided up in any convenient manner to enable it to receive and secure from injury fresh water and provisions.—Patent abandoned.

1650 D. HANSON. *Certain improvements in furnaces, and in apparatus to be employed in the construction of steam boilers.* Dated June 5, 1867.

According to one part of this invention, the patentee uses a furnace so constructed that, by introducing the end of a tube or ring into it, a certain width of it is heated all round the circumference, instead of only part. For this purpose he arranges the furnace in such a manner that the flame and heated gases on their way from the fire-place to the chimney surround and envelope the whole circumference of the tube as far as it projects into the furnace, and thus heats it. The combustion of the fuel in the fire-place may be promoted by using the blast from a fan blower or by causing a draught by a steam jet, or by other well known means usually adapted for this purpose. In front of the furnace the tube is supported on rollers to which a revolving motion is imparted by suitable gearing, and which again transmit motion to the tube that rests on them; by this means every part of the circumference of the tube in rotation is exposed to the greatest heat over the fire-place, and thus the whole circumference is heated gradually and equally all round. When the tube is heated it is taken out of the furnace and is fixed to the face plate of a flanging machine (which forms another part of this invention) with the heated edge outwards. This face plate is carried by a shaft which may be inclined to a required angle, and this shaft is also provided with suitable bearings in which it is caused to revolve, the revolving motion being imparted to it by gearing. The heated edge of the tube or ring is then taken between an upper and lower roller die, so shaped that, when pressed together, they bend or turn down the edge of the tube and form a flange all round the circumference as the tube revolves. These roller dies are so arranged that they can be adjusted to the length of the tube, and that they can be pressed together by steam or hydraulic pressure, by racks and pinions, or other well known means. A further part of this invention consists in an improved machine for bending metal plates. The patentee employs three pairs of horizontal rollers, which are so arranged that only the lower roller of the middle pair remains in a fixed position, while the top roller can be raised or lowered, and that the two outer pairs of rollers can be raised or lowered either singly or together, and also that the axes of the outer rollers can be made to stand at an angle relative to the axis of the centre pair; and, further, that the top rollers can each or all be removed. Three or more rollers can be arranged to work together at one time. According to the relative position of the rollers to one another, when a plate is passed between them, it is either straightened or curved. On one side the gearing is arranged for driving the rolls. Lastly, the invention consists in accomplishing horizontal and vertical riveting by one machine, instead of having a separate machine for each of these operations, as heretofore. To give the necessary motion to the riveting machine he uses such suitable gearing cams and levers as are usually adapted for this purpose, but he so combines and arranges these levers that they may be worked for both or either operations from the one cam shaft, or other suitable transmitter of power.—Patent completed.

1651 J. GAUDET. *Improvements in night and fog signal apparatus for preventing accidents on railways.* Dated June 5, 1867.

The object of this invention is so to arrange apparatus that the signalman (in case of fog or derangement of the ordinary signal apparatus or other cause) may set up one or more lever arms or projections at suitable distances upon the line or permanent way of railway, such lever arms or projections being placed in a position to act upon a lever or other instrument, carried by the locomotive or guard's van, in order to communicate a signal by means of a bell or otherwise to the driver or guard, for the purpose of inducing caution or to stop the train.—Patent abandoned.

1652 N. RAUSCH and E. L. DARLET. *Improvements in the manufacture of artificial fuel.* Dated June 5, 1867.

This fuel is composed by mixing any kind of ordinary coal with argillaceous or any other earth or earths possessing similar or analogous properties, or, by preference, with peat earth together with chloride of sodium and mucilage, the latter being formed by boiling flax or linseed, or, by preference, Carragheen moss, or other moss or lichen possessing analogous properties, in water to the consistence of a thin syrup. The proportions in which these several substances are combined together may be varied according to the nature of the coal under treatment, and the degree of cohesion which it is desired the fuel shall possess.—Patent completed.

1653 T. H. SAUNDERS. *A new hygienic oil or gas stove.* Dated June 5, 1867.

This invention is not described apart from the drawings.—Patent completed.

1654 C. BOULAY. *Improvements in galvanic batteries.* Dated June 5, 1867.

The patentee claims the construction of galvanic batteries or elements in which each of the electric motive metals or bodies is situated in direct contact with a suitable exciting material or materials, or mixtures of them, in the dry or slightly moistened state, the moisture being transmitted by little and little to the said exciting materials from a suitable solution, or from partly dissolved crystals from which the exciting materials are separated by a porous partition plate or diaphragm, the entire element being covered by a layer of any suitable cement, as described.—Patent completed.

1655 G. WHITE. *Improvements in the manufacture of hydrate and carbonates of soda.* (A communication.) Dated June 5, 1867.

These improvements relate, first, to the application in this manufacture of either the hydrated oxides of iron or zinc, or carbonates of these latter. Second, to certain modes of recovering hydrated oxides of iron or of zinc from the sulphur of iron or of zinc resulting from the said treatment. For manufacturing hydrate or soda or caustic soda, either hydrated oxide of iron or of zinc is added in atomic proportions, according to the laws of chemical equivalents, to an aqueous solution of sulphuret of sodium, whereas if carbonate or bicarbonate of soda is to be obtained, carbonate of iron or of zinc is added to the said solution. In both cases a precipitate of sulphuret of iron or of zinc is formed, and if the hydrated oxide has been made use of, a solution of hydrate of soda is obtained, whereas if the carbonate has been employed, a solution of carbonate or bicarbonate of soda is the result; from these solutions the caustic soda or the carbonate or bicarbonate of soda may be obtained. From the precipitated sulphuret of iron or of zinc hydrated oxide of the said metals subservient for another operation may be obtained.—Patent abandoned.

1656 L. B. SCHMOLLE. *Improvements in crinoline skirts.* Dated June 5, 1867.

This invention consists in constructing crinoline skirts to slope away in a curved line towards the bottom or both sides from a point in front below the waist, instead of making the skirt of the same length all round.—Patent abandoned.

1657 I. EVANS. *Improvements in spring hooks.* (Partly a communication.) Dated June 5, 1867.

This invention consists in making double hooks, or hooks having double heads and beaks, the one passing the other, and the beaks in opposite directions, so that the head of the hook is in two thicknesses, thus forming a spring hook which may have a swivel or loop attached to it according to the use for which it may be intended.—Patent completed.

1658 I. M. MILBANK. *An improvement in breech-loading firearms and cartridges adapted to such arms.* Dated June 5, 1867.

This invention is not described apart from the drawings.—Patent completed.

1659 J. ADAMS. *Improvements in machines for dating or printing of railway and other tickets.* Dated June 6, 1867.

This invention is carried out as follows:—Upon a small iron frame the inventor fixes two upright standards, in one of which are drilled two holes, and in the other one hole; into two of these holes is fitted a horizontal shaft, having an arm or crank fixed on to one end, and a similar arm or crank is fitted in to the other hole, and upon these two arms or cranks is fitted another upright having a box or case for carrying the type for printing; at the bottom in front of the iron frame is fitted a recess or mouthpiece to receive the tickets to be dated, and working upon two uprights beneath the type box is placed horizontally a movable ink tray, so that when the ticket is pressed in to the mouthpiece, it moves forward, the ink tray then lowers itself, and the type comes down parallel upon the ticket, and dates it; the machine is then brought back to its former position by means of a steel spring fixed on to the horizontal shaft working in the upright standards.—Patent abandoned.

1660 B. TEMPLAR. *Improvements in fastenings for window sashes.* Dated June 6, 1867.

This invention consists in making the fastenings of window sashes self-acting, so that when the window is closed, the sashes are securely connected together, and cannot be opened from the outside. Another part of the invention, which is applicable to fastenings of the ordinary construction, as well as to these improved fastenings, consists in making the casement plate of the bracket of the bottom sash to overlap that of the other, to prevent the introduction of a knife blade or other instrument in order to throw back the catch.—Patent completed.

1661 E. BLAND. *Improvements in steam engines.* Dated June 6, 1867.

This invention consists in the use and application of the common girdiron valve in such a way that the steam and exhaust valves are placed in separate compartments, and as near to the inner side of the cylinder as the thickness of the metal of the cylinder side will allow. The admission valves are placed at or near the ends of the cylinder, and at any convenient part of the cylinder's circumference, and the exhaust valves are placed also at or near the cylinder ends, and in any other part of the cylinder's circumference that is not occupied by the inlet valves that may be convenient. The object of using the above-named valves, and placing them in the positions mentioned, is to prevent undue waste of steam by having as little space as possible between the valves and the interior of the cylinder.—Patent completed.

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1662 J. LIVESEY. *Improvements in paper folding machines.* Dated June 6, 1867.

Provisional protection has not been granted for this invention.

1663 T. BROWN. *Improvements in artificial limbs.* (A communication.) Dated June 6, 1867.

The first part of these improvements relates to the knee joint of an artificial leg, and to the means of holding the said joint in any desired position, and consists, chiefly, in the employment of a T-shaped bracket or standard, which takes the place of the tibia, and the lower or T-shaped end of which is provided with journals which are fitted to work freely in oblique boxes secured in the interior of the knee pan. When the knee joint is bent, as in sitting, it is retained in position by the action of a pear-shaped button with a spherical head which works in a socket formed in the head of an oscillating vertical sliding rod or bolt. —Patent completed.

1664 T. WILSON. *Improvements in the construction of breech-loading firearms, and in the manufacture and construction of cartridges for breech-loading firearms.* Dated June 6, 1867.

This invention is not described apart from the drawings. —Patent completed.

1665 R. MAYNARD. *Improvements in chaff-cutting machinery.* Dated June 6, 1867.

According to this invention the patentee constructs chaff cutting machines with a multiplicity of knives. He fixes at least five knives on the arms of a vertical wheel, which is made to revolve against a mouth of a greater width than is at present used in machines for this purpose. Through this mouth the straw is expelled in the usual manner. The invention further includes a riddle combined with the chaff cutter, the said riddle being made of strips of thin metal bent to a zig-zag form, and soldered one to the other, so as to form a surface with holes of a hexagonal form. For facility of removal from place to place, he mounts the machine, fitted as described, on travelling wheels.—Patent completed.

1666 E. ELLIS. *Improvements in twist lace machinery.* Dated June 6, 1867.

The object of this invention is more effectually and conveniently than heretofore, to act upon the fabric in a twist lace machine after it has been produced and taken up by the ordinary points, so as to drag or bias the fabric correctly to the form or pattern required, such drag or bias of the fabric being either to the right or to the left, or upwards or downwards, as may be required.—Patent abandoned.

1667 G. R. TURNER and W. T. ALLEN. *Improvements in the manufacture or construction of gates and fences, part of which invention is applicable to straining wires and to other straining purposes.* Dated June 6, 1867.

This invention consists in combining with end uprights formed of T angle or tube iron, or other iron or metal, of sufficient strength to bear the resistance of the intermediate portion of the gate, and with one or more intermediate rails, likewise of the necessary strength, horizontal bands or strips of hoop iron, &c., strained or drawn to a tension and secured round the ends, or from end to end. The invention consists, second, in straining or producing a tension in the cords, so that the strain of one strand counteracts the strain of another strand or length, the strain being kept equally divided.—Patent abandoned.

1668 T. STURGEON. *An improvement in street and similar lamps.* Dated June 7, 1867.

This invention consists in using, instead of the four glass sides which form the upper part of street and similar lamps, pieces of tin or other substance possessing a bright reflecting surface, so that the light which at present passes through the glass in the upper part of the lamp will be reflected down again into the street, and thus increase the effective illuminating power of the lamp.—Patent abandoned.

1669 C. E. GIOJOLA, J. H. GRAY, and P. MARTINENGO. *Improvements in inkstands.* Dated June 7, 1867.

This invention relates more particularly to fountain inkstands, and has for its objects, first, to maintain a uniform level of ink or other writing fluid at any required height in the dipping cup; and, second, to provide a more facile means for filling, emptying, and cleansing the body or reservoir of the said inkstand. For effecting these objects the patentees carry a tube horizontally into the body or reservoir from the aperture through which the ink ordinarily flows into the dipping cup. This horizontal tube and dipping cup may form an integral part of the inkstand, or be fitted thereto. Immediately over the horizontal inner tube they form a vertical air duct or pneumatic tube. This air duct or pneumatic tube is open at the bottom end, and terminates a short distance above the top of the horizontal inner tube of the dipping cup: it is also provided with an aperture at or near the top through which the air passes down the tube to the surface of the fluid in the body of the inkstand.—Patent completed.

1670 A. ELVINS. *Improvements in breech-loading firearms.* Dated June 7, 1867.

This invention has reference to breech loading firearms with hinged barrels, and consists, first, in an improved arrangement for actuating "the extractor" on the falling forward of the barrel or barrels. For this purpose the inventor forms or fixes upon the breech-piece, below the barrels, and a short distance behind the axle pin, a projecting finger which passes up into a recess in the under side of the barrels. Another part of the invention has reference to an improved "snap action" for securing the barrel or barrels when closed up. For this purpose a recess or slot is formed in the part of the breech-piece below the barrels, and a cylindrical bolt passes through the side of the breech-piece across such slot, being provided outside the breech-piece with a lever, whereby it can be turned round to a certain extent.—Patent abandoned.

1671 A. L. BRICKNELL. *Improvements in rotary pumps.* Dated June 7, 1867.

This invention has for its object improvements in rotary pumps, and consists in giving a tapered sectional form to the annular space enclosed between the two flanges carried by the rotating cylindrical centre piece of such pumps. —Patent completed.

1672 J. OFFORD. *Improvements in means or apparatus for signalling between different parts of railway trains.* Dated June 7, 1867.

This invention relates to means whereby railway passengers may call the attention of the guard when his presence is required. The inventor employs a lamp, which, under ordinary circumstances, is below the roof of the carriage, but which is provided with suitable guides to enable it to be pushed up at pleasure and show light over top of carriage.—Patent abandoned.

1673 H. CROWE. *Improvements in hot water apparatus for heating purposes.* Dated June 7, 1867.

These improvements consist in concentrating the heated currents of water arising from the heating surfaces of the boiler, and directing them into a separate compartment at the upper part of the boiler, and in making the outlet for hot water from this compartment, and after circulating the hot water through the pipes returning it cooled to the bottom of the boiler to a cavity, vessel, or compartment under or around the boiler and ashpit.—Patent abandoned.

1674 E. S. ATKINSON. *Improvements in the manufacture or treatment of oakum or other fibrous substances for caulking ships and for other similar purposes.* Dated June 7, 1867.

The patentee claims the saturation of oakum and other substances with an infinite variety of the products of distillation of mineral and vegetable substances, not binding himself to any special quantities or mixtures.—Patent completed.

1675 D. ROBISON. *An improved arrangement of reeds to be used in looms for weaving.* Dated June 7, 1867.

This invention consists in so constructing the reeds used in looms for weaving that the warp threads shall not rub or wear against each other during the shedding of the warp, as is at present the case, and this object is carried into effect by using one or more reeds placed one behind the other, so that the split of one reed intersects or divides the split of another situated either before or behind it, and it is preferred to call this arrangement of the reeds "bosoming;" and the one or more reeds so used are combined together into one and the same rib or frame, and placed in the lag of the loom in the ordinary manner.—Patent abandoned.

1676 J. PETRZYWALSKI. *An improved camera obscura, to be called the Photomegascope.* Dated June 7, 1867.

This improved apparatus consists of a square or other shaped wooden or metal box formed of two parts, one sliding within the other, which facilitates the adjustment of the focus, and forms a dark chamber, at one end of which is a sheet of ground glass, whilst at the opposite extremity the object to be reflected is placed; at one, but preferably on each side of the object, a lamp is placed, a similar one being in front thereof; the rays of the three lights being concentrated by reflectors on the object, the said rays are reflected on the ground glass on an enlarged scale by powerful lenses mounted in the usual way for such purposes, and fixed in a sliding panel in front of the lamps and object.—Patent completed.

1677 E. T. HUGHES. *Improvements in sewing machines.* (A communication.) Dated June 7, 1867.

This invention is not described apart from the drawings. —Patent completed.

1678 W. W. and J. WOOD. *Improvements in the mode of fitting the tubes in the flues of Cornish and other steam boilers* Dated June 7, 1867.

According to this invention the patentees make the cross or diagonal tubes with a flange at each end in one and the same piece with the cross or diagonal tubes; or otherwise both the said flanges are to be attached to the flue or fire box of the boiler inside. They make the flanged ends of the said cross or diagonal tubes at an oblique angle to the centre line of the said cross or diagonal tubes, so that when the tubes are fixed in position in the flue of a steam boiler, the said cross or diagonal tubes will not be at right angles to the centre line of that flue.—Patent completed.

1679 J. SHELDON. *Improvements in brushes, and in apparatus for manufacturing the same.* (A communication.) Dated June 7, 1867.

This invention consists, chiefly, in securing each bunch or tuft of fibres by a separate wire staple, the points of which are bevilled or inclined on the outside in such a manner that, when driven into a hole or perforation in the stock, its points have a tendency to spread crosswise and take a firm hold of the same.—Patent abandoned.

1680 A. BARRY. *An improved mode of, and means for, communicating motion to cranes, and regulating and controlling the operation of the same.* Dated June 7, 1867.

The improvements consist in the employment of an adjustable guide roller or rollers in combination with a driving belt which communicates motion from the engine to the crane. The system is particularly applicable to cranes whose motive power is obtained from the explosion of gas, and whose work is light, and requires much nicety of regulation.—Patent completed.

1681 J. OFFORD. *Improvements in wheel carriages and other vehicles.* Dated June 7, 1867.

This invention relates, firstly, to improvements in wheels whereby they are rendered somewhat elastic, and yet sufficiently rigid to give the required strength. For this purpose, according to one arrangement, the inventor forms the axle box with one fixed and one loose flange, and between such flanges he fixes a metallic ring or tube, around which he places a ring or tube of vulcanized india-rubber, or other suitable elastic material. He also places a washer of vulcanized india-rubber, or other suitable elastic material, against each flange, and between such elastic washers—and around the elastic ring or tube are placed the ends of the spokes, which are tapered so as to meet together and form a solid block, as is now well understood.—Patent abandoned.

1682 W. TRIBE. *Improvements in velocipedes or manumotive or pedomotive carriages.* Dated June 7, 1867.

According to this invention the power exerted by the operator is so utilized as to compress or coil a helical spring or springs.—Patent abandoned.

1683 R. SCOTT, jun., J. NIXON, and J. BEAUMONT. *Improvements in the manufacture of certain descriptions of woollen cloths.* Dated June 7, 1867.

This invention relates more particularly to that description of goods known as "tweeds," the object being to produce a clouded, speckled, spotted, or variegated appearance on the face of the cloth. This is effected by making the yarn in a peculiar manner. The clouded appearance is produced by placing in a carding engine two or more slivers of different colours side by side on the "back" or bank" of the machine.—Patent abandoned.

1684 J. WARBURTON. *Improvements in apparatus for registering and recording the quality of gas.* (A communication.) Dated June 7, 1867.

The inventor introduces in the exit pipe a platinum disc, with a fine hole in it, through which the gas passes. Other clocks work arrangements for recording the passing gas. Cannot be described without drawings.—Patent completed.

1685 J. HORTON. *Certain improvements in the manufacture of flyers employed in spinning and twisting fibrous materials.* Dated June 8, 1867.

This invention relates to the manufacture of such flyers as are called "tube flyers," and are principally employed in such machines as "roving," "slubbing," "intermediate," and "Jack frames," and the invention is designed to form the tubular leg or legs of such flyers in such a manner as to obviate the usual tendency of the tube to crack or split in the direction of its length, whilst being curved into a tube from a flat surface.—Patent abandoned.

1686 H. PARKER. *Improvements in the construction of tobacco pipes.* Dated June 8, 1867.

This invention cannot be described without reference to the drawings.—Patent completed.

1687 F. GLISENTI. *Improvements in the manufacture of gun barrels.* Dated June 8, 1867.

This invention consists in manufacturing gun barrels by casting in a suitable mould a strong hollow cylinder of cast steel, which is then drawn out into a tube of the required length and size over suitable mandrils, and between suitable rollers, which tube is now put in the lathe, carefully centering it in respect to its bore, and then turning the outside true cylindrically.—Patent abandoned.

1688 J. COLLIER, R. HOWARTH, and W. CRYER. *Improvements in machinery for knitting healds.* Dated June 8, 1867.

This invention relates to the "healds" or harness used in looms for weaving, and consists in a novel method of forming two or more "healds" or eyes simultaneously, whereby a saving is effected in the time usually required to make a complete set of healds.—Patent abandoned.

1689 J. C. RALSTON. *Improvements in machinery or apparatus for making candles by dipping, and in the self-feeding of the tallow vessel or mould thereof.* Dated June 8, 1867.

This invention is carried out as follows:—The dipping apparatus is mounted in a suitable framing, at one end of which there is a large drum turning in bearings at the upper part of the framing. A rake is dipped or suspended from the drum by belting attached to the same, and provided with a counterpoise. The rods from which the wicks are suspended are placed in blocks, each set of blocks being successively lowered by the dipper into the tallow mould at the lower part of the apparatus, by rotating the drum by the aid of straps passing over pulleys mounted on its axis at either side of the framing. The rake or dipper carrying the rods and wicks is then raised out of the mould by turning the drum in the contrary direction, a sliding frame pushing each set of blocks with rods and wicks from the rake or dipper through grooves made in the upper stages of the framing on to a dropping frame at the opposite end of the machine. The sliding frame is provided with counterbalance weights, and is actuated by a belt passing around a small drum to a second sliding frame placed in a line with the grooves of a lower stage at the other end of the apparatus; the said drum is mounted in bearings on the framing, and is provided with toothed gearing operated by a winch handle.—Patent completed.

1690 H. WILLIS, G. RICE, and A. MAXFIELD. *Improvements in sewing machines, and in apparatus connected therewith.* Dated June 8, 1867.

Among the features of this invention are the following: —It consists, first, of the following arrangements for driving sewing machines worked by hand, which arrangements may also be applied to driving sewing machines worked by the foot. The inventors make the driving wheel with an internal rim, which may either be rough or smooth, and on the shaft to be driven is a pulley, the periphery of which is covered with india-rubber or other substance which, when the pulley is pressed against the interior of the rim of the driving wheel, will produce sufficient friction to cause the pulley to take motion from the driving wheel. In order to produce a sufficient degree of friction between the driving wheel and pulley, the axle of the driving wheel is made to work in a slot, so that it can be pressed with greater or less force against the pulley, and thrown into and out of gear at pleasure. Or they fix a ring of india-rubber, or other substance capable of producing sufficient friction, on the internal surface of the rim of the driving wheel. The working surfaces of the driving wheel and those of the pulley may either be plain or bevilled, but by preference they make them bevilled. The improvements include further arrangements for producing the motion of the needle. Also, further, in making the rotating shafts work in centres or conical bearings, instead of the usual cylindrical bearings; and, further, in arranging the parts of the machine so that it will produce three different kinds of stitch at the pleasure of the operator.—Patent abandoned.

1691 J. HARGREAVES. *Improvements in obtaining motive power.* Dated June 8, 1867.

The patentee claims the use of the waste gases from blast and other furnaces to form with atmospheric air or oxygen an explosive mixture, and the employment of the said mixture to provide motive power by its explosion within any suitable engine, as described.—Patent completed.

1692 J. TURNER and R. B. DUNNETT. *An improved stamping machine.* Dated June 8, 1867.

This invention relates to a machine for stamping or impressing devices or characters on paper and other fabrics and substances in ink or colours, or in sunk or raised characters, and to that class thereof in which the die and the handle by which it is moved are made to describe a curve in passing from the inking or colour pad, or place of rest, to the part where the fabric or substance is stamped or receives the impression.—Patent completed.

1693 O. BARRETT and H. LEGGOTT. *An improved knife cleaner.* Dated June 8, 1867.

In performing this invention the inventors employ one, two, or more cylindrical brushes, which they enclose in a box or casing of suitable size and form, and mount in bearings so as to be capable of rotating therein. In the construction of these brushes, strips of leather, buffalo hide, or other suitable substance, is introduced betwixt the bristles, and in some cases they introduce metal springs to support the said leather or other substance. Also, at or near one end of each brush they form a groove or space to receive a thin diaphragm or partition which forms a division in the box or casing and the brush, one part for cleaning the blade and the other the hilt of the knife.—Patent abandoned.

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1694 N. THOMPSON. *Improvements in unions or apparatus for connecting together pipes or tubes, and for stopping the ends thereof.* Dated June 8, 1867.

For the purposes of this invention the inventors employ a socket open at each end, and containing within it a packing consisting of a short length of india-rubber tube, or other suitable material. The ends of the two pipes or tubes to be connected are butted together at or near the centre of the socket, and within the packing, into which the ends of the pipes or tubes are just able to enter loosely; the packing is then compressed so as to make it fit closely both to the pipes or tubes, and also to the socket, and so a tight joint is made.—Patent abandoned.

1695 A. PARKES. *Improvements in ornamenting surfaces of paper, woven fabric, and other material, to render them suitable for bookbinding, and other similar uses.* Dated June 8, 1867.

This invention consists, essentially, in embossing the paper, fabric, or material, so as to form on the surface numerous small hollows or undulations and then coating the surface with a thin varnish consisting of dissolved pyroxyline or parkesine and fish scale lustre.—Patent completed.

1696 B. E. PEPYS and J. WARBURTON. *Improvements in apparatus for securing cords and straps, such as are used for raising and lowering window blinds, ventilators, carriage windows, and for other similar purposes.* Dated June 8, 1867.

This apparatus consists of a plate or base which is fixed in an upright position at the side of the window, or otherwise, as may be required. On the plate or base are guides through which the cord or strap is passed to keep it in its place in the apparatus. There is, also, on the plate or base, a bracket to which a movable plate is hinged, and it has fixed to it a weighted handle, and this weight, in hanging down and tending to place itself vertically under the hinge or joint, presses the edge of the movable plate with which it is connected up towards the fixed plate or base, and the cord or strap becomes pressed between the two, with the movable plate nearly, but not quite, horizontal.—Patent completed.

1698 J. CROMPTON. *An apparatus for and mode of revivifying malt liquors and other beverages, and for warming them.* Dated June 10, 1867.

This invention has for its object to revivify malt liquors and other beverages when they have become flat or stale, and the apparatus employed for the purpose consists of a pump, the piston of which is moved up and down, or to and fro, by a lever or handle, a fine spout or nozzle being connected to the pump. The liquor to be revivified is placed under the nozzle, and by moving the handle a portion of it is drawn into the pump. The vessel containing the liquor is then held below, and at some distance from the nozzle, and by again moving the handle the liquor so withdrawn and fresh air are forced into the liquor in the vessel, thereby restoring the briskness to, and putting a head or froth on, the liquor. An elastic ball or other equivalent may be used instead of the pump above referred to.—Patent abandoned.

1699 W. FRENCH. *Improvements in roughing horses and other animals.* Dated June 10, 1867.

For this purpose, in addition to the ordinary nail holes, the patentee forms the shoes with tapered holes of a triangular or other suitable shape, one of such holes being in each heel, and likewise at various other parts of the shoe, and the holes are to be made in an oblique direction, so as to come out at the outer part of the upper edge of the shoe, so that the ends of the stud nails may be hammered down against the shoe.—Patent completed.

1700 J. MACINTOSH. *Improvements in the application of plastic and fibrous materials to the manufacture of moulded or formed articles.* Dated June 10, 1867.

In performing this invention the inventor saturates or coats felt, or other fibrous material, with paraffin, stearic acid, or the pitchy residuum obtained when distilling paraffin or other vegetable substances in a melted or plastic state by any suitable means. The felt or other fibrous material so treated, on cooling, has its fibres cemented firmly together, and is waterproof. When warm, it can be pressed into any form or shape, which it retains on cooling, and may be increased to any thickness by the addition of fresh layers.—Patent abandoned.

1701 T. ROBINSON and J. PIERCE. *Improvements in apparatus employed in the manufacture of zinc.* Dated June 10, 1867.

The inventors employ horizontal retorts of ordinary size, and set and heat them in the usual way; but instead of leaving the inner part of each one at, near, or in the mouthpiece in front of the charge, horizontally or nearly so, they insert or form a baffle piece, the top of which is of about the same level as the charge of ore or other material in the retort.—Patent abandoned.

1702 A. L. DOWIE and R. M'INTYRE. *Improvements in apparatus for punching, cutting, and embossing.* Dated June 10, 1867.

One important feature of this invention is the punching or cutting out of a label, ticket, or other article from sheets of paper, metal, or other material by a plunger which is both a punch and an embossing die, in combination with a duplex resisting piece having raised parts for the punching action, and depressed parts for the embossing action (or *vice versa*), the depressed parts being by preference movable so as to be elevated by springs or positive movements to throw out the embossed article on the die being raised. Another feature of novelty consists in combining with the embossing details a pair of rollers actuated therefrom, and having cutting rims or flanges for cutting the sheets into strips, and at the same time feeding it forward to the embossing die.—Patent abandoned.

1703 J. H. KERLY. *Improvements in fastenings for brooches.* Dated June 10, 1867.

In performing this invention the inventor provides a safety catch, by the aid of which the tongue is prevented from escaping from the fastening. On securing the brooch, the tongue is first depressed so as to slip under a catch which is bent up at its point to facilitate the entrance of the tongue, this action at the same time depressing a spring catch jointed to the brooch plate on the opposite side which is constantly pressed upwards by a small spring.—Patent abandoned.

1704 F. B. DEEBING. *Improvements in engines for boring rock, cutting coal, and boring, cutting, or working in other materials, and in stands or frames for such engines, the improvements in engines being partly applicable to other purposes.* Dated June 10, 1867.

This invention is not described apart from the drawings.—Patent completed.

1705 J. CONOLLY. *Improvements in machinery or apparatus for obtaining motive power, and applying the same to vehicles on common roads, and to other useful purposes.* Dated June 10, 1867.

In performing this invention the inventor proposes to employ a series of cog wheels set on shafts, and in bearings in the sides of a fore carriage, which may be made with a carriage or truck behind for the conveyance of passengers or goods; or it may be made separately, and attached to such carriage or truck.—Patent abandoned.

1706 T. HOLT. *Improvements in the construction of steam boilers.* Dated June 10, 1867.

This invention consists in the use of a novel arrangement of flattened tubes or chambers which form the passages or flues for the flame and heated gases to pass through.—Patent completed.

1707 W. ORR. *Improvements in machinery or apparatus for separating liquids or moisture from substances, and also for revivifying and cooling animal charcoal and other substances, and for treating sugar.* Dated June 10, 1867.

The patentee claims, first, the general arrangement and construction of centrifugal machines, as described, or any mere modification thereof. Second, the special internal arrangement of the centrifugal machine for the purpose of throwing the substance to be desiccated against the baskets after passing through the revolving top plate, substantially as described. Third, the construction of baskets with open bottoms through which the substance falls out when desiccated, as described. Fourth, the construction of centrifugal machines, so that the contents are discharged therefrom on a diminution of the centrifugal force, but without stopping the rotation of such machines, as described. Fifth, the construction of fire clay retorts in short lengths in combination with metallic ends (as shown in the drawings) to be used in connection with kilns as at present usually constructed. Sixth, the mode of supporting fire-clay retorts by means of bars built into or supported by the walls (as shown in the drawings). Seventh, placing the slabs (as shown in the drawings) in charcoal kilns in such a position that deposits of soot may fall down the internal surface and accumulate in the box for removal (as shown in the drawings). Eighth, the use of downward printing slabs forming the roof of the furnace for the purpose of dividing the ascending currents of heat, and throwing them into the chambers on either side, in combination with kilns constructed under this invention. Ninth, the placing of a flat top boiler over the flue of charcoal kilns for the purpose of drying the charcoal previous to its being placed in the retort; also for supplying hot water to the centrifugal machine. Tenth, the barrow with water spaces for rapidly cooling the charcoal, and to be used in connection with kilns as at present or otherwise constructed. Eleventh, the use and application of scoops, ploughs, or loose hinged projections or trails attached to the agitators of the "blow up," for the purpose of preventing the accumulation of undissolved matter in the lower part of the vessel or pan. Twelfth, the application of the special arrangement (as shown in the drawings) of valve to the sugar "blow up" or meeting pan, having the stuffing box as a fulcrum for the spindle acted upon by the sliding weighted bearing in the bracket. Thirteenth, the internal arrangements of the bag filter or cloth filter, so that the bags are kept floating in the liquid with a slight pressure, whilst the dirt is conveyed out of them. Fourteenth, the method described of cleaning the bags without unpacking the filters. Fifteenth, closing the communication between the bags and sludge chamber by means of valves, so that the sludge may be removed without emptying the bags. Sixteenth, heating solid solutions through pipes in a steam chest before being run into the charcoal. Seventeenth, superheating sugar solutions through pipes in a steam chest before entering the vacuum pan.—Patent completed.

1708 R. LOGAN. *Improvements in securing and adjusting windows, blinds and shades, doors and shutters, and in the apparatus employed therefor.* Dated June 10, 1867.

This invention relates to the regulation of the opening of blinds, and consists in employing one or more racks having ratchet teeth on them, which racks are attached to some convenient part of the framing. The movable part of the window blind, shade, shutter, or door has one or more ratchet palls fixed to it, and which is or are acted upon by a spring, and by it forced into the recesses of the teeth.—Patent completed.

1709 R. HORNSBY, J. BONNALL, and H. SHIELD. *Improvements in thrashing machines and other machines for dressing and separating grain, and in rotary screens to be used therein, and for other purposes.* Dated June 11, 1867.

In thrashing, dressing, and separating machines the sieves or riddles over which the grain is passed have a short vibratory or shaking movement communicated to them, and to admit of this the sieves or riddles are hung by means of links or hangers capable of turning on studs or pins; this, however, involves the use of a great number of centres, which require lubrication. According to this invention, a tube of vulcanized india-rubber is placed on each of the studs or pins, and the eye of the link or hanger is made sufficiently large to receive the india-rubber tube within it; then, when the link or hanger is in its place, the india-rubber is compressed by means of a nut screwed on the end of the stud or pin, which causes the india-rubber to bind tightly both to the stud or pin and to the interior of the eye of the link or hanger. The elasticity of the india-rubber tube will then allow sufficient movement of the link or hanger around the stud or pin without any friction or rubbing taking place between the parts. With cylindrical or rotary screens for thrashing, dressing, and separating machines and other uses, it is desirable to be able to increase or diminish the spaces between the wires, so as to make the screen either coarser or finer, as may be required, by stretching or compressing the cylindrical or rotary screen longitudinally. According to this invention, the circumferential wires are bound to other wires or rods, as in an ordinary screen, but in place of arranging these wires or rods to pass direct from end to end of the screen, they are arranged in a helical direction, so as to pass partly or entirely around the screen as they run from end to end of it. This invention cannot be fully described apart from the drawings.—Patent completed.

1710 H. A. BONNEVILLE. *Improvements in vessels, more particularly such as are used for the reception or deposit, or both, of offal, excrement, urine, or other fecal or waste matter or substance.* (A communication.) Dated June 11, 1867.

This invention is not described apart from the drawings.—Patent abandoned.

1711 C. TOFT. *Improvements in cruet frames, liquor frames, pickle frames, and other frames for holding bottles and vessels, and in the bottles and vessels to be held in the said frames.* Dated June 11, 1867.

The patentee makes in the body of the bottles or vessels to be held in the frame an annular groove or depression, the said groove being deepest at its middle. The neck is thereby formed a shoulder on the bottle or vessel, by means of which the bottle or vessel is supported in the frame. Patent abandoned.

1712 J. GRAHAM. *An improved mixture or composition for bleaching vegetable fibres.* Dated June 11, 1867.

The patentee claims mixing salt, treacle, and lime with black soap so as to form a mixture or composition as described for bleaching vegetable fibres, as described.—Patent completed.

1713 H. FLETCHER. *Improvements in the manufacture of artificial fuel.* Dated June 11, 1867.

The patentee manufactures this artificial fuel from "slack" or small coal mixed with pitch, or other adhesive material. The coal may be made dry and hot before the pitch or other adhesive material is added, and the heated compound is ground, granulated, or pulverized, and then thoroughly admixed simultaneously in a suitable machine. The admixed material is then reheated to render it more adhesive, and afterwards it is put into moulds and pressed into blocks. Or the coal may be used in a cold state and the pitch or other adhesive material added.—Patent completed.

1714 J. H. JOHNSON. *Improvements in rolling and shaping metals, and in the machinery or apparatus employed therein.* (A communication.) Dated June 11, 1867.

This invention relates to a peculiar combination and arrangement of rolling mill for rolling X-shaped and other forms of pillars, guides, or bars. According to this invention, four rolls are employed of any desired form, according to the shape of the article to be produced. The top and bottom rolls are driven in the usual or other convenient manner; whilst the other pair of rolls, which revolve horizontally, and are situate on each side of a central vertical plane, which passes transversely through the top and bottom rolls, are rotated solely by friction contact with the metal to be rolled. After each pass of the metal, the top roll, and two horizontal rolls are moved inwards slightly by means of powerful adjusting screws, or other suitable mechanical contrivance, so as to nip the metal equally on all four opposite sides. The horizontal rolls are contained in strong movable frames or supports, which are capable of sliding vertically at the main standards or frames of the rolling mill, so that as the top roll is lowered, the two horizontal rolls are not only be made to approach each other, but to descend slightly, in order to keep them always in a central position between the top and the bottom rolls.—Patent complete.

1715 G. P. HILL. *Improvements in boxes, drawers, and other like receptacles.* Dated June 11, 1867.

This invention relates to boxes for holding trimmings and other fancy goods, and consists in so constructing them that a portion of the contents of the said boxes (sufficient for commercial or trading purposes) may be exhibited to view when the said boxes are closed.—Patent abandoned.

1716 J. THOM. *Improvements in apparatus to be employed in expressing oils and fatty matters.* Dated June 11, 1867.

This invention relates to a former patent granted to the present patentee, dated December 1, 1863 (No. 39), whereby a saving in the wear and tear of bags is effected and a larger quantity of oil is expressed from the same amount of oil-yielding substance. The patentee makes the raised or bevilled sides of his pressing plates or faces of such a width that when the bag is bulged outwards laterally by the pressure thereon, the edges of the plates will, by reason of their increased width, have a tendency to cut or or injure the bags.—Patent complete.

PROVISIONAL PROTECTIONS.

Dated September 7, 1867.

2538 J. and T. Bayley, jun., Lenton, Nottingham, leather dresser. Improvements in the manufacture or production of leather.

Dated October 14, 1867.

2834 M. Fitzpatrick, Duke-street, Lincoln's Inn, engineer. Improvements applicable to railway trains for the prevention of accidents arising from collisions or other casualties on railways.

Dated October 18, 1867.

2926 J. Hill and S. Shelley, Manchester. Improvements in looms and in the method or process of preparing weft that will enable the plain loom to weave check or stripe goods.

Dated November 22, 1867.

3506 R. Leighton, Shoe-lane, City, bookbinder, and T. Kirkham, Cambridge Villa, Gilston-road, West Brompton, civil engineer. Improvements in the method of sewing sheets of paper forming books and pamphlets, and in machinery for effecting the same.

Dated December 12, 1867.

3537 A. V. Newton, Chancery-lane, mechanical draughtsman. An improved method of manufacturing cast steel and malleable iron. (A communication.)

Dated December 13, 1867.

3553 L. Christophe and J. Montigny, Brussels, mechanicians. An improved tubular cannon for firing volleys or charges of grape shot.

Dated December 16, 1867.

3578 W. Jackson and J. Dyer, Birmingham. Improvements in the construction of valves and valve cocks.

Dated December 18, 1867.

3601 H. A. Bonneville, Porchester-terrace, Bayswater. An improved apparatus to manufacture the rims of hats. (A communication.)

Dated December 20, 1867.

3622 G. Davies, Serle-street, Lincoln's Inn. Improvements in circular knitting machines. (A communication.)

Dated December 24, 1867.

3656 C. Pottinger, Anstruther, Fifeshire, shipbuilder. Improvements in motive power engines, part of which improvements are applicable to the arrangement and construction of pumps for raising and forcing liquids, fluids, and other substances generally.

Dated December 26, 1867.

3668 J. Lightfoot, Lower House, Burnley, Lancashire, chemist. Improvements in printing certain textile fabrics and yarns.

3669 N. Greenhalgh, Sharples, W. Shaw, Heaton, cotton

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spinners, and J. Mallison, Halliwell, yarn agent. Improvements in steaming certain yarns, and in apparatus employed therein.

3671 E. C. Jetot, E. Hortensius, C. Cros, and M. M. A. d'Eimar de Jabrun, Rue Royale St. Honore, Paris. A hat protector or apparatus for preserving hats and caps from rain, dust, or otherwise.

Dated December 27, 1867.

3673 J. Edge, Tipping Iron Works, Bolton-le-Moors, Lancashire, engineer. Improvements in the rag-rolls or beaters of rag-engines, beating-engines, or other similar machinery employed in the manufacture of paper.

3675 T. J. Ellis, Abingdon-street, City, civil engineer. Improvements in the construction and arrangement of apparatus for carburetting gas and atmospheric air.

3677 J. M. Rowan, Glasgow, engineer. Improvements in moulds or apparatus to be used in casting steel.

3679 H. Higgins, Salford, machine maker, and T. S. Whitworth, manager. Improvements in machinery for preparing, spinning, and doubling cotton and other fibrous materials.

3681 A. V. Newton, Chancery-lane, mechanical draughtsman. Improvements in soles for boots and shoes. (A communication.)

3683 A. Dunn, White-street, Southwark, and A. Liddell, foreman. Improvements in the manufacture of metallic casks or vessels.

Dated December 28, 1867.

3685 J. Goodfellow, Atlas Works, Blackburn, engineer. Improvements in metallic pistons for steam cylinders, air cylinders, or pumps.

3687 W. Fryer, Birmingham, plumber. Improvements in self-closing taps.

3689 W. E. Newton, Chancery-lane, civil engineer. Improvements in butt hinges. (A communication.)

3691 C. Morfit, Sudbrook Park, Surrey. Improvements in means or apparatus for cutting soap.

3693 L. Hasluck, Tottenham-court-road, watch maker. A mechanical tell tale, alarm, printing, and reporting clock.

3695 J. Jowett, Parkhead, Lanarkshire. Improvements in furnaces.

Dated December 30, 1867.

3697 J. E. Gowen, Langham Hotel, Portland-place. An improved mode of and means for raising sunken vessels.

3699 T. and J. Robertshaw, Ovenden, near Halifax, spinners and manufacturers, and J. Greenwood, overlooker. Improvements in looms for weaving.

3701 G. Glover, Ranelagh-road, Pimlico. Improvements in lamps or apparatus for burning naphtha, benzole, and similar liquids to represent a candle. (A communication.)

3703 J. Aschermann, Paris, manufacturer. An improved machine for cutting the hair or fur from skins, for hat-making and for the manufacture of felt.

Dated December 31, 1867.

3706 M. A. F. Mennons, Southampton-buildings, Chancery-lane. Improvements in the mode of and apparatus for combining the vapours of liquid hydrocarbons with oxygen and hydrogen, and burning the mixture as fuel. (A communication.)

3707 M. A. F. Mennons, Southampton-buildings, Chancery-lane. The manufacture of a vegetable substitute for animal hair from a product not hitherto used for that purpose. (A communication.)

3708 M. A. F. Mennons, Southampton-buildings, Chancery-lane. An improved mode of accelerating the induration of certain descriptions of concrete or artificial stone. (A communication.)

3709 T. Messenger, Marine Department, London, Chatham, and Dover Railway, Dover, engineer. Improvements in the construction of steam engines and boilers.

3710 G. McCulloch, Manchester. Improvements in thread-polishing machines.

3711 W. Barnes, Worcester, commercial traveller. Improvements in carriage lamps.

3713 V. L. Daguzan, Rue Sainte Appoline, Paris, painter. Improvements in the construction of paving.

3714 H. Bessemer, Queen-street-place, Cannon-street. Improvements in the treatment of crude or cast iron, and in the manufacture of malleable iron and steel.

3715 C. G. Hill, Alfred-street, Nottingham. Improvements in the preparation of floss silk and in the manufacture of ruches.

3716 W. Wilson, Newcastle, hat manufacturer. Improvements in the manufacture of hats and other felted articles of wearing apparel, and in machines employed for these purposes. (Partly a communication.)

3717 N. Smith, Kingston-upon-Hull, joiner. Improvements in stoves.

3718 A. Allan, Bower Bridge, Cumberland. Improvements in brakes applicable to carriages and other vehicles.

3719 J. H. Johnson, Lincoln's Inn-fields. Improvements in machinery or apparatus for spinning cotton and other fibrous materials. (A communication.)

3720 A. M. Clark, Chancery-lane. Improvements in road-sweeping machines. (A communication.)

3722 W. and T. Mitchell, Stacksteads, Lancashire. Certain improvements in carding engines to be employed in the process of manufacturing felt carpeting.

3723 J. G. Crompton, Stockport, leather manufacturer. Improvements in mechanism or apparatus to be employed in the manufacture of felt hats.

Dated January 1, 1868.

2 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. Improvements in fire and burglar proof safes. (A communication.)

5 W. Stroudley, Inverness. Improvements in re-railing or replacing carriages or waggons on rails of railway.

6 W. and J. W. Wood, of Monkbill, Yorkshire. Improvements in the manufacture of cardings and yarns.

8 H. Milward, Redditch, needle and fish hook manufacturer. Improvements in needle cases. (A communication.)

9 R. W. Morrell and P. Craven, Bradford. Improvements in machinery or apparatus for spinning and doubling fibrous substances.

10 W. J. Fraser, Commercial-road East, engineer. Improvements in furnaces or fireplaces.

11 J. Imray, Westminster Bridge-road, engineer. Improvements in locomotion.

13 A. Beard, Alyn Vale, Gwersyllt, Denbigh, ironmaster. Improvements in furnaces and firebars.

14 T. B. Daft, Cleves Lodge, Church-street, Chelsea, civil engineer and naval architect. Improvements in the construction of iron ships and vessels,

15 J. Ramsbottom, Leeds, engineer, and T. M. Pearce, Bradford, commission agent. Improved engines and generators for the same, to be worked by heated air, steam, or other gases or vapours.

16 B. Vette, Berlin. Improvements in the manufacture of "crossovers," scarves, and other articles of apparel known as frame and knitted woollen goods.

17 D. Foster, Sheffield, engineer. Improvements in the manufacture of anvils (of all kinds) for smiths, and every description of top and bottom faces for hammers for drawing-out purposes.

Dated January 2, 1868.

18 M. A. Hamilton, Southampton-buildings, Chancery-lane. An improved churn.

19 E. J. and W. A. Kruss, opticians, Hamburgh. A new or improved camera or lantern for reflecting opaque objects.

20 E. Izod, Grocers' Hall-court, City. Improvements in the finishing of stays, and in means or apparatus employed therein.

Dated January 3, 1868.

21 J. Cox, Birmingham, electro-plate and gilder. Certain improvements in fastenings for sleeve-links, which said improvements are also applicable to the fastening of brooch pin points, belt and other clasps, gloves, stay, and legging busks, and other dress and jewellery fastenings.

23 T. P. A. Key, Clifton Mount, Rotherham. Improvements in scaffolding to be used for the erection of houses in the streets of populous places.

25 J. D. and B. Dellagana, Shoe-lane, City, printing machine makers and stereotype founders. Improvements in printing machines, and in the manufacture of electrotype blocks to be used in such machines.

26 M. E. Roy, Upper Norwood, and Lonisa Prevett, Penge, Surrey. An improved receptacle for containing needles, thread, and other articles.

Dated January 4, 1868.

28 J. T. Emmerson and J. Murgatroyd, Heaton Norris, Lancashire, millwrights and engineers. Improvements in the manufacture of iron, and in the application thereof to certain useful purposes.

30 W. J. Blinkhorn, St. Helen's, Lancashire, candle manufacturer. Improvements in the manufacture of snuffless dip candles, and in apparatus employed therein.

31 W. E. Newton, Chancery-lane, civil engineer. An improved mechanical arrangement for converting power into speed, and speed into power, and for multiplying and transmitting motion for all purposes where such movement can be applied and used. (A communication.)

32 P. Spence, Newton Heath, Manchester, manufacturing chemist, and W. A. Smith, Manchester, merchant. Improvements in storing meat for transport, whereby it may be preserved, and in apparatus connected therewith.

33 W. H. Atkinson, Aldersgate-street, City, manufacturing chemist. Improvements in the preparation and use of compositions for cleansing and sweetening casks and other vessels, such compositions being also applicable to other purposes.

34 A. Albini, New Broad-street-buildings, City, Italian Navy. Improvements in cartridge belts or pouches.

35 W. B. Gray, Whiteabbey, Antrim. Improvements in spinning and twisting machines.

36 G. Mudge, High-street, Notting-hill, ironmonger. Improvements in adjustable lock furniture.

37 J. Nixon, Westbourne-terrace, Middlesex. Improvements in apparatus for transferring coal or minerals from railway waggons into barges.

Dated January 6, 1868.

39 E. R. Southby, Lanark, chemist. Improvemnnts in separating paraffin from its solutions, and in apparatus therefor.

41 T. Stokes, Kidderminster. Improvements in the manufacture of piled fabrics in imitation of the fleece or fur of animals

42 J. R. T. Mulholland, Belfast. An improved construction of "creel" or bobbin-holder.

44 F. Chamberlain, Bredecot Court, near Worcester, engineer. Improvements in steam boiler and other furnaces.

Dated January 7, 1868.

49 C. Hutchinson, Tufnell-park-road, Holloway. An improved liquid metre tap.

51 H. McEvoy, Birmingham, manufacturer. Improvements in fastenings for drapery, articles of dress, or wearing apparel.

53 W. T. Tongue, Wolverhampton, factor. Improvements in lamps for burning paraffin and other hydrocarbon oils.

55 G. Smith, Liverpool, brass and Britannia metal finisher. Improvements in apparatus for lubricating machinery.

57 H. Smyth, Little Trinity-lane, City, manufacturer. Improvements in umbrellas, parasols, and sunshades.

59 G. Davies, Serle-street, Lincoln's-inn. Improvements in the mode of combining wrought and cast-iron or other metals for various useful purposes. (A communication.)

61 J. L. Norton, Belle Sauvage-yard, Ludgate-hill, City, and W. H. Bailey, Albion Brass Works, Salford, brass founder and steam gauge manufacturer. Improvements in apparatus for indicating and recording the fluctuations of the pressures and temperatures of liquids and fluids.

63 G. E. Donisthorpe, Leeds, engineer. Improvements in the construction and mode of fixing joints, catches, or other fastenings for brooches and other ornaments, and ornamental mountings and fittings for furniture and articles of vertu.

65 B. J. Heywood, Lorraine-road, Holloway. An improved construction of coffee roaster.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated January 9, 1868.

90 O. H. M'Mullen. An improved mashing machine

LIST OF SEALED PATENTS.

Sealed January 17, 1868.

2107 T. D. Walker
2113 A. Paton
2114 J. Hargreaves
2123 C. F. Whitworth
2124 A. Budenberg
2126 W. G. Creamer
2132 T. A. Breithaupt
2190 A. M. Clark
2207 S. M. Martin and S. A. Varley
2235 B. Harlow
2996 J. H. Johnson
3044 J. Smyth and S. Kirby
3275 W. J. and A. Coleman.

Sealed January 21, 1868.

2135 J. Walker
2140 J. H. Johnson
2142 H. A. Dufrene
2145 S. Bonsall
2146 S. Bonsall
2147 Sir W. Thomson
2148 W. Geeves
2150 W. Simpson and W. Howitt
2151 W. Betts
2153 R. B. Roden
2156 S. Turton
2162 J. Brown and W. Lillie
2164 A. Mackie
2169 J. Edge
2172 G. B. Northcote
2177 W. E. Gedge
2182 H. Chamberlain
2196 B. F. Stevens
2206 A. James
2224 J. Quin
2225 R. Newhall
2252 J. T. Hatfield
2364 A. Lees and W. H. Rhodes
2368 A. M. Clark
2497 A. M. Clark
3090 A. M. Clark
3385 W. R. Lake
3403 W. R. Lake

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," January 21, 1868.

2421 E. A. Dana. Fuzes.
2533 J. Smith. Combing silk.
2538 J. and T. Bayley, jun. Leather.
2543 C. Burn. Propelling railway carriages.
2555 J. Medhurst. Ships' rudders.
2559 J. H. Brown. Compressed leather.
2567 J. Pottle. Cucumber box.
2583 J. Wilderspin. Horse rakes.
2596 S. Dalton. Iron.
2599 W. G. Brownson. Telegraphic apparatus.
2602 H. A. Bordin. Preventing sea-sickness.
2608 P. Dumont. Soap. (A communication.)
2615 T. Turner. Mounts for maps.
2619 D. Gardner. Mattresses.
2625 T. Adams and G. J. Parson. Slide valves.
2641 W. Potts. Ventilating rooms.
2645 F. T. M. A. Guyon. Typographic apparatus.
2664 J. Baird. Treatment of jute.
2683 A. M. Clark. Boots and shoes. (A communication.)
2701 W. Woodcock. Warming buildings.
2710 A. Taylor. Ornamental fabrics.
2717 E. T. Horsley. Production of a glazed surface on cast iron.
2739 J. H. Johnson. Railway wheels. (A communication.)
2799 J. H. Johnson. Braid. (A communication.)
3164 G. T. Bousfield. Setting types. (A communication.)
3192 G. T. Bousfield. Machines for sewing fabrics. (A communication.)
3207 J. D. Scally. Treating casks.
3235 G. R. Solomon, jun. Ticket register.
3358 A. V. Newton. Making extracts from bark. (A communication.)
3363 S. A. Chase. Carriage trucks.
3406 S. Sharrock. Posts for electric telegraphs.
3602 M. H. Collins. An improved lamp.
3624 L. L. Tower. Faucets for measuring liquids. (A communication.)
3633 J. Davidson. Machinery for manufacturing cartridges.
3662 W. E. Newton. Alcohol meter. (A communication.)
3665 S. and F. Lennard. Warp fabrics.
3697 J. E. Gowen. Raising sunken vessels.
3715 C. G. Hill. Floss silk.
3722 W. and T. Mitchell. Carding engines.
27 M. J. Frisbie. Feeding fuel into furnaces.
31 W. E. Newton. Converting power into speed. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

50 T. Richardson and M. D. Rucker
125 T. Bourne
137 J. Betteley
141 F. H. Lakin
142 S. J. Best and J. J. Holden
143 J. Robinson and J. Smith
144 C. T. Judkins
147 W. Jeffreys
154 J. Coulter and H. Harpin
152 W. E. Newton
155 W. R. Foster
160 M. B. Mason
161 E. D. Farcot
165 J. A. Shipton and R. Mitchell
170 D. Munro and T. Wright
173 J. Hewes
180 W. Clay
189 M. Robinson
197 J. B. Wood
418 A. Fryer

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

152 C. W. Lancaster, J. Brown, and J. Hughes
167 C. W. and F. Siemens
175 J. Chatterton and W. Smith
185 W. Wilson

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending January 11, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1497	0 10	1603	0 8	1650	2 6	1698	0 8	1722	0 4	1743	0 4
1536	4 0	1611	1 8	1657	0 8	1700	0 4	1724	0 4	1744	0 4
1537	0 8	1621	1 6	1661	0 8	1701	0 4	1726	0 4	1745	0 4
1567	0 8	1622	0 6	1662	0 4	1702	0 4	1727	0 4	1746	0 4
1578	0 6	1623	0 8	1671	0 8	1703	0 4	1728	0 10	1747	0 4
1581	0 8	1624	0 8	1678	0 8	1705	0 4	1732	0 4	1748	0 4
1584	0 10	1625	0 8	1682	0 8	1711	0 4	1737	0 4	1752	0 4
1595	0 10	1629	1 4	1689	0 10	1712	0 4	1738	0 4	1753	0 4
1597	0 8	1642	0 8	1691	0 4	1713	0 4	1749	0 4	1757	0 8
1598	0 10	1643	0 8	1692	0 10	1719	0 10	1741	0 4	2167	0 8
1600	2 4	1644	0 10								

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JANUARY 31, 1868.

PATENT CASES IN THE COURT OF CHANCERY.

THERE is perhaps no branch of our jurisdiction which more requires reform than patent jurisdiction. A patent is neither more nor less than a right granted to an inventor, in return for the disclosure of a new process, to bring an action against an infringer. The mode in which patent cases are tried will therefore give the tone to the entire working of the law. It is this defective mode of trying such cases that originated the outcry a few years ago against patents; and though the public may be held to have been convinced of the necessity for protecting inventions, yet a defective patent jurisdiction can be regarded as a standing danger to the very existence of patent rights. Nothing less than a radical reform, embodying a rational infusion of the technical element—either by means of scientific assessors, or by a jury of experts—will really suffice. In the meantime, however, we feel bound to notice, with that impartiality which is true friendship to the whole body of inventors, what we consider a most injurious course on the part of the Court of Chancery. The late decision of Lord Cairns affirms an order of the Master of the Rolls that a defendant in a chancery suit has no right to require that the questions of fact involved in the litigation shall be tried by jury. It seems inexplicable to us that any court should refuse such an application made by a defendant. It would have been intelligible had the plaintiff made the application, for he had the choice of the tribunal, and the court might fitly have marked its reluctance to lend itself as a mere instrument for the enforcement of the private rights of any patentee, by not affording him facilities for the trial of his cause otherwise than according to the usual course of the court. But when it is the defendant who makes the application, and when it is made to a branch of the court which may be known to have a very strong conviction upon the subject of the patent, the refusal—to be justifiable—must be based upon views of the rights of patentees and the disabilities of defendants, which, if indeed they exist in chancery, form a sufficient reason for putting an end to the jurisdiction of that court in respect to patents. We may here remark that there must be some great inducement to patentees to resort as they now do to Chancery rather than to the common law courts. The hitherto uninterrupted success of Betts' patent in Chancery, contrasted with its chequered career during the litigation in Betts v. Menzies; the equally marked success of Bovill's patent in Chancery, and the resistance of that patentee to let the question of fact go before a jury—not to dwell upon the circumstance that one verdict has actually been given against that patent—are significant.

It would be improper to express an opinion as to the merits of these two patents whilst they are still before the courts. It is enough to mention these well-known instances of the better fortune attending patentees in equity than at law. The explanation is simple enough. It is very much in the nature of things that a judge in Chancery, having once heard the evidence offered in one cause upon a patent, and pronounced judgment upon it, should regard his decision upon the evidence in the first case in the same light as he is justified in regarding his decision upon the question of law, namely, as authorization in all future cases until reversed on appeal. So strongly does this feeling operate, that instances have been known of patentees offering terms to the defendant in the first suit upon a patent, to induce him to submit to an injunction, in order that the injunction, thus fraudulently obtained, may be paraded before the public and the court as a decision establishing the validity of the patent. It is wearisome to hear in the Court of Chancery discussions as to what a judge in an earlier case thought of a particular piece of evidence—discussions which, before a jury, would be impossible. Surely, what any body else thought of any given evidence is as irrelevant as the figures in an old almanac.

It is, however, by means of these discussions that a Chancery suit upon a patent, if really heard at all, extends to such portentous proportions. The patentee knows full well what an admirable investment he makes by spending even £10,000 on a successful Chancery suit. What hope can any future defendant have of resisting his pretensions? In order to get the former decision reviewed on appeal he must incur the vast expense of repeating all the evidence which was ineffectual on the previous occasion. He must incur the heavy burden of an injunction and payment of the patentee's full costs in the courts as the price of being at liberty to bring the validity of the patent into effective discussion. Compare this with trial by jury. The proceedings in former litigations are absolutely shut out from consideration; both parties conduct the trial upon equal terms, and twelve men of the world, if not of experience in the manufacture to which the patent relates, give an unbiassed common-sense judgment upon the evidence. There is great and increasing dissatisfaction because a patentee can prevent his antagonist getting the opinion of a jury or of a court of common law upon the patent, because the Court of Chancery seems to regard this protection of the patentee as the principal, if not the sole, object in administering the patent law. It is quite true that a more satisfactory tribunal than a jury for trying a patent cause can be imagined; but it is doubtful whether the Court of Chancery is, at any time, a better one for ascertaining the truth as to the facts. And it is certain that any defendant compelled to try a cause without a jury in a branch of the court in which the patent has already been upheld, cannot do so with any reasonable expectation that the trial will be impartial. In the mean time, any law whatever is practically out of reach of the patentee who is unable to begin a contest involving the expenditure of tens of thousands.

THE ADMIRALTY.

IF we were asked to name that department of the public service which more deeply concerns the honour, safety, and prosperity of this country than any other, and which is probably more flagrantly mismanaged than any other public department at home or abroad, we should have no hesitation in naming the Board of Admiralty. It has never been our practice, nor is it now our intention, to cry "wolf," merely because various other organs of the press are at the present time directing their concentrated fire upon that knot of hapless gentlemen who comprise our Admiralty Board. We write upon this important subject with a full sense of the responsibility resting upon us, and with the sole object of promoting the interests of the public service; we are simply anxious to do all that lies in our power to prevent, if possible, the consummation of a policy—if such it can be called—which we believe to be not only ill-judged and wasteful, but scandalous in the extreme.

It appears to us, and we think it must so appear to every intelligent reader, that our fine fleet of wooden screw frigates and line-of-battle ships has not become absolutely useless to us, in consequence of the introduction of ironclad ships into the Navy. So long as other naval powers have ships of war in their service minus armour-plating, and so long as the merchandize of this and other countries is carried in ships of the description now employed for the purpose, so long will the wooden ships of our Royal Navy be capable of rendering service to this country. Seeing the length of time required for the production of an ironclad ship, and bearing in mind the present numerical weakness of our ironclad fleet, we are of opinion that it would be little short of a criminal policy for the Admiralty to adopt, with reference to our wooden ships, the shameful course of, to quote the words of a contemporary, "simply giving them away in one or two favoured quarters for about the value of their nails."

We, therefore, say, let the sound, serviceable, and modern wooden ships of the British Navy be still retained in the service, and kept in such a forward state as to be capable of taking the sea at the shortest possible notice, for the purpose, should the necessity unfortunately arise, of grappling with the wooden war ships of our enemy, and also for the protection of our mercantile marine in every part of the world. England must have ships for other work than meeting powerful ironclads in line of battle. We may here mention, in support of these views, that we know a distinguished officer of high rank in the British Navy who considers it would not be difficult, but comparatively easy, to take a three turretted ironclad cupola ship with an ordinary 50-gun wooden frigate. But, be this as it may, nothing can be more absurd, more suicidal, than to literally throw away our wooden fleet, because of the introduction of ironclads. We might as reasonably throw or give away all our artillery, except a few of the largest guns recently manufactured. It should be borne in mind that during the late civil war in America the southern ports were blockaded by wooden ships; also, that the "Alabama" was built of wood. We cannot say that we are enamoured of any of the proposals for plating our wooden ships with iron, believing that they cannot be converted into effective sea-going ironclads, not excepting Mr. Henwood's plan, which we have carefully examined, and which we are confident would not realize the satisfactory results claimed for it by its proposer. We believe it to be the wiser policy to keep a good wooden ship as she is, and at her present cost, rather than convert her into a mere makeshift of an ironclad at a greatly increased cost.

Although we thus advocate the retention in the service of our effective wooden ships of war, it is not to be inferred that we are insufficiently alive to the necessity for increasing as rapidly as possible our ironclad fleet. We do not think with a certain eminent ship builder, that it is necessary for England to possess a fleet of ironclads large enough to cope with the combined fleets of every naval power in the world; but we do think it essential that we should possess a fleet sufficiently large and powerful to be able to compete with the fleets of any probable combination of hostile powers. Entertaining these views, it is with deep regret that we contemplate the comparatively small amount that has been devoted during the present financial year to the augmentation of our ironclad fleet. Out of more than ten millions sterling voted for the Navy, the sum of seven hundred thousand pounds only has been appropriated to the construction of ironclad ships. This is a state of things which will assuredly be brought before Parliament on an early day, and we shall be greatly mistaken if, during the next year, twice the amount above named is not applied to the purpose referred to. There must surely be great shortsightedness, something radically wrong, in the disposal of the immense yearly sums voted for our Navy to account for such feeble practical results.

In concluding these remarks, we will refer for a moment to the ship now building at the Thames Ship Building Company's works for

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the King of Prussia. This fine ironclad ship was originally designed for the Sultan of Turkey by our present Chief Constructor of the Navy, of course with the permission of the Admiralty. This ship is now rapidly approaching completion, and, after a minute personal examination of the ship herself, we are convinced she will, when completed, be the most powerful ironclad yet afloat; but she has been allowed to pass into the hands of a foreign power simply because the authorities at Whitehall could not (?) or would not supply the funds necessary for her purchase. Turkey could not find the money to complete her, and we could not find the funds to purchase her in a half completed condition, the seven hundred thousand pounds before named being all that could be spared out of the ten millions for the increase of our ironclad fleet. This transaction did not take place in the dark; there was no surprise in the case; the ship has been lost to the country for the simple reason that her cost was not provided for at the commencement of the year, and the accounts could not be altered, and she has in consequence been allowed to pass from us. We purpose in a future number to give a full description of this formidable ironclad.

CONSUMPTION OF SMOKE.

THE important question of smoke consumption is gradually obtaining that attention it has long demanded. We have from time to time urged upon the public the folly of not consuming their smoke, and the advantages which accrue where it is consumed. We have also shown how very simple a matter it is to burn the superfluous carbon, and thus relieve our atmosphere from a most unwelcome burthen. The remedy is simple enough, and is well known and appreciated in Cornwall. There, too, the value of coal is known, and this is the secret of the great economy of fuel in that county, and of the consequent smokeless appearance of the chimney shafts. There the engineman whose engine shows the highest duty obtains a premium; so not a pound of coal is wasted, not a puff of smoke is seen, except, perhaps, at the moment of firing. And all this is only due to judicious stoking. Instead of a indiscriminate use of fuel, it is used carefully and sparingly. The coal is fed on to the front of the furnace and there baked, the gaseous products being consumed in their passage over the clear fire behind. The baked coal is gradually pushed to the rear to make room for fresh fuel, and thus we get the high returns of duty from the Cornish engines—that is, those at work in Cornwall. Nor does the benefit stop here; the air is, of course, purified, and the proprietors are pecuniarily benefited by this system of slow and gradual stoking. It will take a long time, we fear, to drill this lesson of practical economy into some of our manufacturers; they will, of course, admit the correctness of its principles, and, perhaps, endeavour to induce their enginemen and stokers to follow out the system, but the chances are they will not succeed. Let them offer premiums for economy, and we believe they will attain their end. Give a man ever so slight an interest in the results of his labour, and he will be sure to use his head as well as his hands, even in the mechanical work of stoking.

Beyond this there are, of course, means open to those who like to pay for them in the shape of smoke consumers. There are also many little dodges in stoking disclosed in practice which can be adopted with some furnaces. For instance, one steam power user leaves his furnace door slightly open, and thus prevents smoke. But steam users ought to be cautious on this point, for the Government smoke inspector insists that all furnace doors shall be closed, and then summonses the hapless wight whose chimney smokes. At least, he did so in one instance, but fortunately the magistrate possessed common sense, and dismissed the summons, and censured the inspector. With regard to mechanical appliances, we may mention that some experiments have recently been carried out in the boiler furnaces at the Shelton Bar Ironworks, Hanley. At first, two furnace doors were fitted up on the Smedley principle. Instead, however, of the doors being made self-acting by attachment to clockwork, they were regulated by the fireman by means of weights, pulleys and chains. Although these doors answered very well, they were found to be unnecessarily expensive and susceptible of improvement. Three other doors on a new principle were, therefore, fitted to as many furnaces. These doors are made thus:—Instead of movable horizontal bars admitting the external air into the furnace through a grating of heated vertical bars, there is a balance door for the admission of the air, which, by means of horizontal louvre bars, is driven direct upon the fire. It is found in practice that there is nothing gained by making the doors automatic. As the fireman must always be in attendance on a set of boilers, he has only to touch the balance weight, by which he can set the door to any desired angle for the admission of the air current. Moreover, by fixing the internal range of bars on the louvre plan, the fuel receives the full force of the oxygen as it rushes in through the open door. It is also found that a door on this principle can be made for about one-fifth the cost of the Smedley door. The results of careful trials have proved so satisfactory that all the boiler furnaces of the Shelton Works are to be fitted on the same plan.

China and earthenware manufacturers have usually been considered as licensed to smoke away as hard as they can, on account of the great difficulty they would have in preventing the emission of smoke from their ovens. It now appears, however, that this difficulty can be surmounted, for we understand that Messrs. Edwards, the earthenware manufacturers of Burslem, have fitted one of their ovens and all their kilns and boilers with Dix's patent smoke-consuming door. In this instance the principle of louvre bars has been adopted, and they are so worked by means of a vertical lever that the supply of air can be regulated at pleasure. In the case of the oven no smoke is produced after the first lighting of the fires. As a point of practical economy it is found that one ton of coal per oven is saved, and that the length of time required for firing an oven of ware is reduced by two hours. The heat can be regulated with the greatest nicety, and thus there is much less waste from over or under firing. This is a very important fact, not only for the trade but for the public, who are always sufferers from the smoke nuisance.

Besides mechanical means, there is the use of different kinds of coal, and some people who can distinguish and appreciate their differences, will use that kind which produces the least smoke. And this reminds us of some experiments which are being carried out by the North London Railway Company with the view of reducing the smoke made by their engines. It is very important that this line should take as little part in the smoke nuisance as possible, for it passes in part through closely populated localities, and its traffic is heavy and frequent. Mr. William Adams, the locomotive engineer of this line, informs us that they are now burning in their locomotives South Wales coal, which is nearly, but not quite, smokeless. They find that when the fires are newly made up, if the blower or jet is not used, some smoke will be formed. The use of this coal has not been of sufficiently long duration to enable an accurate estimate of its economy to be formed as compared with the Derbyshire coal previously used. The price of the Welsh coal is higher than that of the Derbyshire, but a smaller quantity of the former is required, so that the cost of working will probably prove to be about the same as formerly. But, then, great advantages are gained, especially on a line like the North London, for although their engines are fitted with the best known appliances for consuming smoke, a little carelessness on the part of the drivers, in using bituminous coal, will cause a great deal of smoke to form. The adoption of this coal by others would help them over the smoke-consuming difficulty, by giving them no smoke to consume, and although an economy of some hundreds per annum would be a very pleasant thing, they ought to be well satisfied with equal cost with the advantage of getting rid of all complaints about the smoke nuisance.

PEAT FUEL.

WE have noticed during the past week that several contradictory statements have appeared in the "Times" relative to the manufacture of peat fuel, under Mr. C. Hodgson's patents, to which we alluded in our last number, and which was described recently by the President of the Institution of Irish Engineers, and has been contested on the score of want of originality by Messrs. Gwynne, of Essex-street. There is nothing more uncertain or contestible than the facts bearing on the first invention of any useful art or manufacture, and nothing practically of so little importance to the public at large as to be made aware of who was the first enunciator of an idea for the accomplishment of which no practical means were at first brought forward. In the case in point, the abstract idea of compressing peat in a dry, instead of in a wet state, as tried by Wye Williams and many others since, has been erroneously supposed to have originated with Mr. Hodgson, but was never claimed by him; and although now claimed by Messrs. Gwynne, under an obsolete patent of theirs in 1853, from which they state that they granted a licence to Mr. Hodgson's father, in reality belongs to a much older patentee, whose rights have also expired. The question, however, at the present moment, is not who did or did not first propose to dry peat, and then compress it, instead of compressing it first and drying it afterwards, but who is really in possession of a method practical in all its details of cheaply drying that substance (which is economically by far the most important of the two operations), and afterwards compressing it. For the accomplishment of these objects means were proposed under patents taken out in 1849-50 by Green, in 1852 by Kingsford, and in 1853-4 by Messrs. Gwynne. But none of the plans so suggested were successful, and the subject remained in complete abeyance till the adoption, at a comparatively recent date, by Mr. Charles Hodgson, of the system of applying continuous pressure in a cylindrical tube, and his employment of the simple means of obtaining and drying the raw material witnessed by the members of the Institution of Mechanical Engineers during their visit to Ireland. We have noticed many efforts for the utilization of Irish peat during the last forty years. Perhaps no subject is more essentially connected with the development of the resources of Ireland, and at the same time of interest to the mechanical engineer. The matter is one of peculiar interest, from the great difficulties which have had to be overcome. We may safely say that in having brought the manufacture to a really practical issue, which, from our own knowledge, and from the experience of the President of the Irish Institution, we find to be the case. Mr. Hodgson has made a considerable stride beyond the points of difficulty at which previous inventors stopped short. The fuel, thousands of tons of which have been manufactured, and of which samples have long been in our possession, has been employed in Messrs. Guinness' and other breweries and manufactories, besides

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being extensively used as household fuel in Ireland; and it would be hard to overrate the importance, in a national point of view, of the full development of such an industry.

PREVENTION OF COLLIERY EXPLOSIONS.

BRITAIN is pre-eminent for its colliery explosions; they occur at almost regular intervals with fearful loss of life and destitution to the families bereaved. The Davy and the Geordie lamps may lessen somewhat the frequency of their recurrence, but we are a long way from having done what we might have done, and must do, to prevent them. Though we are pre-eminent, we do not stand alone in these dreadful catastrophes. Germany also has her share, though a small one when compared with ours. There has just been a terrific explosion of firedamp at the colliery of Neu Iserlohn, near Bochum, in the centre of the Westphalian coal field. About 120 men were at work at the time in the pit; at the time of the last account received the greater part of them had been brought to bank, and, as might be expected, nearly all of them dead, and those that were not dead were frightfully injured. We do not give this as a piece of news, for all our readers will have seen a notice of it elsewhere; but we pass over these things now without paying much heed: they are so common. We wish to press it upon the scientific mechanician, as suggesting a problem to be solved—the prevention of such desolating explosions. Within the last few years these explosions have been even more frequent than usual, and that has somewhat awaked us to the necessity of trying to devise some means of prevention.

The whole problem resolves itself into simple ventilation. Several plans have been set forth, some good and some indifferent, but all of them expensive. Owners of collieries will not adopt expensive preventive measures, because they are not sure of their efficacy, and would rather wait till some less expensive experiment is suggested. We have seen one plan, that has not been published, which we think would be effective, and certainly would be comparatively inexpensive; but we will describe it, that our readers may form their own opinion about it. In applying this system of ventilation there is no need to sink new shafts; the existing shafts can be made to act as both up and down-cast shafts. We will take one gallery from the shaft up to the working face, and describe the application of the plan to that which, with slight modifications, according to circumstances, can be applied to the rest. Where these galleries are made only sufficiently wide for the convenience of working they would have to be widened, but that would be no detriment to the plan, as it would be easier to mine along the side of an existing gallery than to drift a new one. We will suppose the size of a gallery suited to the application of this plan to be about a yard and a-half wide. Let this gallery be divided into two passages, one a yard wide and the other half a yard, more or less—the wider passage to be applied to the traffic, and the narrower as an air or gas passage. In drifting this gallery the division between the two passages would have to be marked out and levelled, and a channel cut for the base plate of the partition. This base plate might be a board of two inches thick and six inches wide, and a convenient length would be about six feet. This would serve as a shoe for the partition, pieces of wood two inches square being nailed or screwed on to each side of the board to form a two-inch groove in the middle for the partition to slide into. On the boards, which may be placed to support the roof, a similar groove must be made, but only one side of it at first, till the boards of the partition are in their place.

The side pieces which form the groove on the base plate may be made to break joint with the plate, and so join the whole together. The boards to form the partition must be 2in. thick, and any width. There must be a half-inch groove down the centre of each edge about an inch deep, into this groove laths must be made to fit tightly, so as to make the partition air-tight when in position. This partition must be carried on as the working proceeds, and must be kept as near the working face as convenient. This air passage must be carried to the bottom of the shaft where the similar passages from all the galleries will meet, and thence proceed to the top of the shaft in one passage, at the mouth of which must be placed a fan to draw out the air or gas. It would be well if the galleries could be made with a slight descent towards the shaft, so that the choke-damp might flow down as water, and at the shaft a well or reservoir should be made to receive it, whence it could be drawn by a pump which, of course, must communicate with the reservoir by a pipe distinct from the fire-damp passage. The air or gas passages being constructed as the work proceeds, and the fan and pump being in motion, this would be the result. The air or gas passage would be continually exhausted, pure air would flow down the shaft and along the traffic passage up to the working face, and there turn round the end of the partition, and carry with it all the noxious gases, and thus keep the traffic passage and working face perfectly pure.

The miners would thus work in pure air, and might used naked lights, or the mine might be lighted with gas without fear of explosion. Every part of the ventilating apparatus being exceedingly simple it could not get out of order, with the exception of the engine at the top of the shaft. To prevent accident here, two complete engines and boilers might be kept to work on alternate weeks, so that one would always be in order. The 2in. boards for the partition or diaphragm would be the most expensive part of the material in an extensive mine; but then these partitions would serve as props also to support the top of the gallery. This system, it seems to us, would give perfect ventilation, and at a comparatively small cost, with simplicity of construction, and it would not be at all liable to get out of order. We offer it for the consideration of those who are conversant with the ventilation of mines.

REGISTERING ELECTRICAL THERMOMETER.

DEFINING the temperature of a body as the energy or force with which the heat within it, acts in transferring and communicating a portion of itself to another body, instruments employed for the accurate determination of that temperature are called thermometers. A distinction must be made between these instruments and those termed calorimeters, the latter being intended for ascertaining the actual quantity of heat imparted to, or abstracted from any substance. In one sense, every body is a thermometer, for since all known substances expand by heat and contract by cold, it is only necessary to provide means for measuring those expansions and contractions, and from the effect, the extent of the cause may be calculated. Very recently, Général Morin, whose name is well known in connection with scientific experiments and researches, has laid before "L'Académie des Sciences" an account of a thermometer designed for registering the variations in temperature of any given locality, or of the atmosphere, at regular intervals of time, which may be varied to suit the requirements of the case. It consists of an electro-magnetic apparatus, somewhat similar to that of M. Becquerel, and is composed of thirty rods of German silver and iron, fixed separately and parallel to one another in grooves sunk in the surface of a wooden cylinder having a diameter of a couple of inches. The ends of these rods project beyond the edge of the cylinder, and are soldered with tin, each to its alternate neighbour, thus constituting a pile of fifteen elements. According to the intensity desired to be given to the current which is set up, so soon as the opposite extremities of the rods are at different temperatures, so is their number increased or diminished. This current is caused to traverse the two coils of an ordinary multiplier, which carries a magnetized needle suspended by a silken thread, and the normal position of which is in the plane of the magnetic meridian. The axis of the needle is prolonged below and carries at its lower extremity another needle of copper very delicately balanced, and intended to record the deviations of the one above it. To effect this result, immediately under the copper needle a horizontal disc is placed eight inches in diameter, and furnished with a sheet of paper. The disc is mounted upon a vertical axis to which is imparted a regular movement of rotation, through the agency of clockwork. In addition to the rotatory motion, one in a vertical direction is also communicated to the disc carrying the sheet of paper, at intervals of every quarter of an hour. At these periods an ascending and descending motion is given to the disc, the first being accomplished by the descent of a balance weight which is raised by the second motion, both of which are effected by the spring of a special drum attached to the chronometric motor.

The action of the little apparatus is very simple. Every quarter of an hour the disc, together with the sheet of paper, rises towards the recording needle, which punctures it, thereby indicating at that instant the position of the magnetized needle above it. Upon the descent of the disc, the point is disengaged from the paper and the needles restored to a continuance of the oscillations from which they were momentarily suspended. The sheet of paper furnishes, consequently, an accurate register of the periodical deviations of the magnetized needle, and by connecting the different points traced upon its surface, a curve can be readily obtained which will indicate the relative march of the temperatures at the opposite extremities of the electrical thermometer. If the instrument be graduated by marking upon the paper the normal position of the needles, or that in which there is no current established, the corresponding curve will be a circle, indicating the zero of the deviations, or the difference in temperature at the extremities of the rods. When one of these extremities is maintained at a constant temperature—that of melting ice, for instance—the deviation of the needle will indicate the temperature of the medium into which the other is plunged. Similarly to all delicate and sensible scientific instruments, the electrical thermometer must be sheltered, by means of a double case, from all external influences which might tend to vitiate the accuracy of its results. Due precautions having been taken to insure the fulfilment of these conditions during an experiment, it will be found that, when the temperatures of the opposite extremities vary by regular degrees, the curve formed by joining the points traced upon the paper will present a uniform curvature resembling that represented in fig. 1. If, on the contrary, the opposite extremities of the thermometer be exposed to sudden and frequent changes of temperature, the corresponding curve will present the appearance shown in fig. 2, and be broken into a number of abrupt and irregular sinuosities. From the ordinates of a series of curves the general law of the variation of the temperatures may be deduced. Before using any instrument of the character in question, it is indispensable to ascertain its "index error," to employ a term well known to optical and mathematical instrument makers, and to make an allowance for it in all succeeding operations. This was effected by Général Morin, by direct experiment which we shall not pause to describe, as it in no manner affects the utility of the apparatus. The

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original object of the inventor in designing the electrical thermometer was to obtain by its means the difference of the temperatures inside and outside a ventilating flue, at regular periods during the day and night. This difference, if the ventilation of an apartment were perfect, would be constant, since the movement of the air would be also constant. It is easy to perceive that, supposing one of those instruments were placed in a hospital, a simple inspection of the curves traced upon the paper would at once afford all the information necessary respecting the condition of the ventilation. The sensibility of the apparatus can be augmented to almost any

FIG. 1.

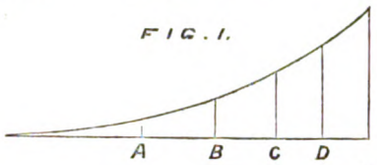

FIG. 2.

extent, either by employing needles of a very high degree of sensibility, or by multiplying the elements of the pile, but this feature is not carried to a great excess, since many practical disadvantages attend the use of scientific instruments, which are too readily susceptible of the effects they are intended to record. In the hands of skilful experimenters, the electrical thermometer is calculated to be of great importance in ascertaining and registering physical facts, more especially those relating to meteorology. Général Morin states that he borrowed the idea of obtaining a record of the deviations of the magnetized needle in the manner effected, from Mr. David Napier, who, as some of our readers may recollect, exhibited in the London Exhibition of 1851 a compass for the purpose of registering the progress of a vessel by means somewhat similar. A model was purchased by the French authorities, and placed in the collections of the Conservatoire, where it is at the present time.

RAILWAY ROLLING STOCK OF THE UNITED KINGDOM.

IN the course of last year there was doubtless a considerable increase in the rolling stock of the railways in the United Kingdom, but it was less, it may be supposed, than the increase in 1866, when the projects for new lines reached the last culmination. The almost total cessation in the construction of new lines, and the pressing necessity for economy in expenditure for working expenses and other departments, renders it extremely improbable that there will be any considerable increase in the number of engines and other rolling stock in the current year, in addition to renewals and making good for tear and wear. The returns of the stock at December 31, 1866, which are just published, represent substantially what it is likely to be for some years to come, with slight increase. At that date the rolling stock of the railway companies and of the proprietors of railways in Great Britain and Ireland, was as follows:—Locomotives, 8,125; passenger carriages, 19,228; other vehicles attached to passenger trains, such as fourgons, carriage trucks, horse boxes, post-office vans, break vans, &c., 7,276; waggons and trucks for the conveyance of live stock, minerals, and general merchandize, 236,791; other carriages and waggons, 6,156; total, 277,576. The locomotives are 711 more numerous than they were in the previous year; 1,654 passenger train carriages have been added; 16,540 waggons and trucks; or a total addition of 18,905 engines and vehicles. It is difficult to realize the enormous stock represented by these figures. If it were possible to make up the whole into one train, placed buffer to buffer, it would be about 1,000 miles long, and would reach for hundreds of miles more than the distance between Land's End and John O'Groat's House. It would be headed by about 50 miles of locomotives and tenders, about 100 miles of passenger carriages, and 850 miles of mineral, live stock, goods and miscellaneous waggons, trucks, and vans.

The amount expended upon locomotive power during the year was £5,253,843, or 27·93 per cent of the working expenditure, being an increase of £541,581 as compared with the previous year. The expenditure for maintenance of way and works was £3,466,668, or 18·43 per cent. of the working expenditure; for repairs and renewals of carriages and waggons, £1,539,332 was expended, or 8·18 per cent. The total expenditure under all heads was 49 per cent., or an increase of 1 per cent. as compared with the previous year. The working expenditure of the Irish railways amounted to 57 per cent. of the total receipts, or an increase of 10 per cent. as compared with 1864. There were 13,854 miles open at the end of 1866, or an increase of 565 miles as compared with the previous year. There were 274,293,668 passengers carried exclusive of season ticket holders, to whom there were 110,227 tickets issued, whose journeys would add at least 30,000,000 to the number of passengers. There were 3,741,086 passenger and 2,305,133 goods trains run; their total running was 6,046,219 miles, or 489,512 miles more than in the previous year. The mere increase is equal to above twenty times round the earth, and the total mileage run by trains above 250 times round the globe. The total receipts from all sources amounted to £38,164,354, being an increase of £2,274,241 as compared with the preceding year.

THE PROPOSED AMERICAN NAVAL BOARD.

THE Americans are seeking to establish a Naval Board of Survey, and this is not a new matter of consideration with our friends across the Atlantic. The question was mooted during the American war, but the general excitement of the times forbade its serious consideration, and the proposed measure fell through. As far back as 1842, the organization of the navy department was proved to be defective, and a remedy was sought by apportioning out the work among several bureaus. This, with the "old Navy Commissioners," as they were styled, would have assimilated that department to the French system, but the egregious blunder was committed of suppressing the Navy Board, thus creating a hiatus—a break in the connection—and completely destroying the system. It is the object of a bill, which has been introduced into Congress by Mr. Nye, to correct the mistake then made, and to furnish the centralizing power necessary to the harmonious working of the several bureaus. The Secretary himself, were he a professional man, would supply that power; but he is, and ever must be—with the Americans—a civilian and a statesman. Those of his duties, therefore, which are strictly professional, should devolve upon officers of rank and experience, who have ability to administer to the affairs of the navy. This is, in effect, what Mr. Nye's bill proposes to secure, and that the plan is founded in a wise, far-seeing policy, the practice of the French for the past forty years, with its excellent results, and the overwhelming testimony of English writers on the subject, fully prove. But Mr. Isherwood, Chief of the Bureau of Steam Engineering, strongly protests against supervision and interference. On the other hand, the American public appears determined to have some controlling influence brought to bear upon the actions of a chief who, by all accounts, has squandered public money, and has not always shown fair play to men in civil life who have been brought into competition with him. On this head we have only to refer our readers to the celebrated trials of the "Winooski" and the "Algonquin" which took place about two years since. Here two vessels were tied by the stern to the wharf and set to paddle away as hard as they could. A remarkable trial, truly, but remarkable only for its absurdity. In a few words, it would seem that the efficiency of the Chief is called into question, and there are ample reasons for this. A rigid scrutiny is demanded over the several departments, and this the Naval Board proposes to supply. The matter is now well in hand, and we advise Mr. Isherwood to submit to it with a good grace. That he does not, would appear from a humorous extract from an American contemporary, which we reproduce on another page. Mr. Isherwood's blunders are not unknown in England, for blunders are things which travel quicker than fame, which they often outlive. Let us ascribe these to an overworked mind, and counsel Mr. Isherwood to welcome a change which will relieve him of many anxieties, in that it will reduce his responsibilities.

RESTORATION OF THE CRYSTAL PALACE.

NO one who has visited the Crystal Palace can help expressing feelings of real regret, at witnessing the effects of the lamentable catastrophe that a short time ago befel that national rendezvous of amusement and instruction. It is not too much to assert that, in spite of age and experience, those who explored its almost innumerable attractions, seemed to renew the faith of their childhood. The "Tales of the Genii," the fairy fables of "The Arabian Nights," and the beautiful romantic legends of Washington Irving, were displayed in full realization, and the diversities of centuries, and the progress of epochs, might be discerned in the delicate symmetry of the "Halls of the Alhambra" and the barbaric majesty of "The Egyptian Court," Our readers will be happy in the prospect that these lately demolished portions of the Palace are in course of restoration. Finding it at present impossible to complete within a reasonable time the whole of that portion of the building and its contents injured by the fire, the Company have adopted a very wise course of action. They have determined upon finishing about one-third of the length of the part destroyed, and have restored the end of the building at that point, so that to the visitor the interior would present not the slightest sign of having been otherwise than it appears to the view. We are glad to perceive that this partial restoration includes the "Alhambra Court," which, without the slightest detriment to the beauties of its neighbours, may be pronounced as, "par excellence," the gem of that particular class of attractions. By adopting this judicious arrangement, the farther restoration of the length outside the present north end can be carried on without in any manner interfering with the remainder of the building. The interior of the restored portion is not yet completed so far as the courts and ornaments are concerned, but the whole of the girders, framework, and glass-work is finished, and in a few days the screen which has interposed between the restorations and the rest of the building will be removed. Outside, to the accurate observer, there will, of course, be a difference in the distance of each end from the centre arch, but to the casual visitor this discrepancy will not be apparent, and it will be very difficult to detect it in the interior. To those who are well acquainted with the structure, the vista, look-

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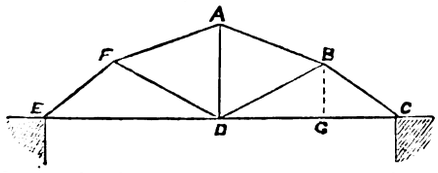
ing from the gallery at the south end, appears slightly different from its original aspect. The building seems somewhat "raccourci;" but we are perhaps speaking too critically. A fountain precisely similar to that placed opposite the Egyptian Court is fixed in the restored part, and only requires the water to be let in to be complete. Before the summer season commences, the proposed restorations will be accomplished, and, with the exception of the temporary unavoidable omissions, the Palace will assume that appearance which it presented previously to its partial destruction.

STRAINS IN ROOFS.

IN order to find the strains in such a form of roof as exhibited in the annexed diagram, we have to consider, first, in what manner the load is distributed. If it be uniformly distributed over the ribs or rafters, then we know that the resultants will pass through the middle of each rib. Taking the sum of the resultants, we get the supporting forces at C and E, each of which forces will



be equal to half the load. Now, in order to find the stress upon the rib B C, draw B G perpendicular to E C (the horizontal tie rod), then if the line B G be supposed to represent the vertical supporting force at C, which is equal to half the load, G C will be the horizontal stress on the tie rod E C, and B C the stress on the rib B C. Again, by similar reasoning, we can determine the stress on the rib A B; in this case, however, the vertical force is equal to the load on that rib. We have thus two horizontal stresses at B, viz., that due to the load on the rib B C, and that of the load on A B. If these thrusts balance each other, that on B C acting inwards at B, whilst that on A B acts outwards at that point, then the bracing is not required, but if either be the greater, the braces B D, F D, and A D, must be introduced to restore equilibrium. If the resultant horizontal thrust at B acts outwards, the brace B D will act as a tie; if inwards, as a strut; the stress upon A D will be of the opposite kind in each case. This is evident if we consider the condition of the roof opening outwards at F and B. The top at A would tend to settle down. The outward action being transferred to the braces B D and F D, is transmitted by them to the bar A D in the form of an upward thrust, which, reacting on the upper part at A, counteracts the downward tendency already mentioned. If the horizontal thrust be inwards at F and B, the opposite effects will ensue, but equilibrium will be again restored, the vertical piece A D in this case acting as a tie by holding down the roof at A.

The amount of the straining action on A D may be determined by constructing a parallelogram whose adjacent sides represent in magnitude and direction the stresses on the braces; the diagonal of this parallelogram will represent the stress required. The amount of the forces acting upon the braces B D and F D is found by constructing a right-angled parallelogram, the diagonal of which represents in magnitude and direction the resultant horizontal thrust at B, then the side sloping in the direction B D will represent the stress on the brace B D. W. J. M.

PHOTOGRAPHY.

NEW DRY PROCESSES—A NEW PHOTOGRAPHIC PERIODICAL—THE TOTAL ECLIPSE OF THE SUN —DIFFUSION OF FOCUS.

MR. M. CAREY LEA, of Philadelphia, has recently been making experiments to simplify the present dry processes. At present, Sayce's collodio-bromide process is the simplest of all. He adds nitrate of silver, very finely powdered, to a collodion containing bromide only, and the addition is made in such proportions that the whole of the bromide shall not be decomposed by the added salt. A fine precipitate of bromide of silver is thus held in suspension in the viscous collodion, and plates are covered with the solution in the ordinary way, then immersed in water for a few minutes, and afterwards dipped into a solution of tannin and dried. The trouble of preparing these plates is less than in any other dry process, the morphia process excepted, but many who have tried the latter find that the plates will not keep.

In searching for an improvement upon Sayce's process, Mr. M. Carey Lea acted upon the principle of adding the organic preservative to the collodion, so that after coating a plate it should only have to be washed in water, and dried, to be ready for use, no after-bath of tannin or other organic substance being necessary. The collodion was made in the following proportions:—Alcohol, ½oz.; ether, ½oz.; bromide of cadmium, 4gr.; bromide of ammonium, 3gr.; camphorated tincture of soap, 5 minims; and pyroxyline, 4 or 5 gr. Before use, 40gr. of very finely-powdered nitrate of silver were added in the dark to every 3oz. of the collodion, shaken up, and filtered. The film having been allowed a little time to set, was then immersed in water for a few minutes, taken out, dried, and the plate was ready for use.

It will be noticed that the organic matter in the above collodion consists of the camphorated tincture of soap, which would cause the formation of a little oleate of silver. The camphorated tincture of soap of the American pharmacopœia consists of:—Soap (in shavings), 2oz.; camphor, 1oz.; oil of rosemary, 2 drachms; alcohol (sp. gr. ·835), 16 fluid ounces. As a matter of scientific curiosity, but not as a good practical working process, Mr. Lea announces that to a collodion like the above, but without the tincture of soap, the following additions may be made just before use:—Gallic acid (60-gr. solution in alcohol), 24 drops; glycerine, 20 drops. The plate is simply coated with this collodion, and without further treatment exposed in the camera. After exposure, the slide is put aside for a few hours, and then, after being opened, a fully-developed picture will be found upon the plate. The pictures he has thus obtained are doubtless not of good quality, for he considers the process not to be practically useful.

The Government of India is now making great preparations to photograph the total eclipse of the sun this year, which will be visible in that country, and the time of almost total obscuration will be five minutes, so as to give plenty of time to take five or six negatives. The telescope is now in course of construction by Mr. Browning, and the elevation of its polar axis is very small, because it will have to be used so near to the equator. The instrument strongly resembles the one belonging to Mr. Warren De La Rue, at Cranford Observatory. It is a reflecting telescope, on the Newtonian principle, the image of the sun being thrown out at the side of the tube by a second reflector of speculum metal.

In the early days of photography, a great outcry arose for lenses which would give pictures of the utmost sharpness, showing, if possible, every hair in the head of a sitter. Of late, this qualification has not been so much desired, especially when the lens is intended to take large heads in portraits, because then the nose, and other projecting parts of the face, may be taken with the utmost sharpness, every pimple standing out in the most unpleasant manner, while the back of the head and part of the side of the face would be hazy and out of focus. Many methods of getting rid of this excessive sharpness in large heads have been devised. Mr. Robert Snell, and the late M. Claudet, independently of each other, suggested the plan of moving the lens during the exposure, so as to bring all the planes of the face successively into focus, giving moderate definition everywhere and minute definition nowhere. Mr. Dallmeyer manufactured a lens which gives diffusion of focus, without being moved during exposure, and it was made on a plan first published by Mr. John Traill Taylor. The latter gentleman also suggested a plan of getting diffusion of focus with a sharp lens, by stretching a piece of catgut from the camera to the floor, and playing upon it with a fiddlestick during exposure, whereby the vibrations would soften the sharp lines of the picture, and the music produced would bring an expression of delight into the face of the sitter. Another suggestion was, that the boards of the room should be loosened, and during exposure the operator should execute a hornpipe or Highland fling alongside the camera, whereby such motion would be communicated to the latter instrument that it could not take a sharp picture.

THE ADJUSTABLE BELGRAVIA SEWING MACHINE.

AMONGST the numerous sewing machines now before the public are many which possess undoubted special merits, but certainly the most perfect and complete of its kind is that known as the adjustable Belgravia machine. This apparatus consists, primarily, of a Wheeler and Wilson's machine, upon which some very important improvements have been engrafted by Mr. John Mabson, of Newcastle-on-Tyne. These improvements are no less than seventeen in number, and include various appliances for doing different classes of work. To enumerate and describe all these would not be to our present purpose; we may, however, refer to the principal among them. There is an adjustable cloth presser, a cloth plate, and a belt tightener, which may be classed amongst the improvements in the machine itself, whilst a self-acting creaser, and an embroiderer, may be considered, with others, as extra appliances which can be had separately from the machine. With regard to the capabilities of the machine, we may observe that it will make the Wheeler and Wilson, or lock-stitch, the Wilcox and Gibbs' stitch, the Grove and Baker stitch, the pearl stitch, the cable stitch, and, finally, the Belgravia embroidery stitch, which is made on the right or upper side of the material—a thing never before accomplished. The Belgravia stitch constitutes a very important improvement in this machine, and is made by a most ingenious mechanical arrangement. There are a pair of claws or thread guides resting on the presser foot, and which open at one stitch and close at the next. By this means the embroidery threads are crossed, and at each crossing are secured to the fabric, to be ornamented by the machine working the ordinary lock-stitch. Various thicknesses of the embroidery material may be used, and the pattern may be carried to any width. The most elaborate and intricate designs can be correctly followed, the pattern being distinctly seen through the crystal presser. We have seen a variety of articles worked by this machine; amongst others, is a striking likeness of the Queen stitched in outline with the lock-stitch, and enclosed in a border of rich embroidery. There were other examples of the most elaborate embroidery, done with threads of various colours; there were also muslin aprons which were tucked, creased, and embroidered at one operation. The ordinary Wheeler and Wilson machine, of which the patent has expired, obtained a gold medal last year at the Paris Exhibition. As this machine forms the basis of the Belgravia machine, it is a pity that Mr. Mabson was not ready with his improvements so as to have exhibited, for it is but reasonable to infer that the great advance he has made would have secured him the medal. As it is, however, we are glad to learn that at the Liverpool and Manchester Centenary Agricultural Show, held last year, Mr. Mabson was deservedly awarded the silver medal for "valuable improvements." His mechanical skill has enabled him to produce a machine which commands a wide sphere of usefulness, its work ranging from the simplest stitching to the most elaborate and finished embroidery. Viewed simply as a piece of mechanism, it is a singularly perfect and unique production, whilst its general utility cannot fail to make it a favourite with the public.

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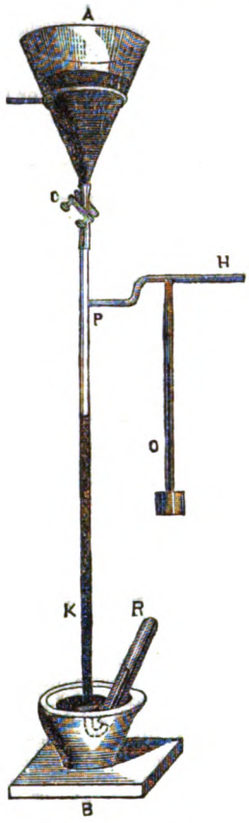
THE SPRENGEL AIR-PUMP.

AN air pump designed three years ago by Dr. Hermann Sprengel, without attracting much attention at the time, has lately come much into use by scientific men, and has several times called forth the approbation of the Royal Society. It may be readily constructed by anybody in its primitive form, and if philosophical instrument makers would but adopt the principle, they might turn out a much better and cheaper instrument than the present double-barrelled pumps. In its simplest form the pump consists of a funnel A, with a glass tube C K below. The joint C, between the funnel and the tube, is made of well-fitting black vulcanized india-rubber tubing, sold under the name of French tubing. This is free from metallic



oxides which render the tubing porous; it is necessary that the joints should be bound with copper wire, and afterwards coated with gutta-percha applied in a melted state. Everything depends upon a good joint. There is also a clamp at C, which closes the tube. Now when the funnel A is filled with mercury, and the metal is allowed to flow downward in drops through the tube C K, which is two and a-half millimetres in diameter, each drop of mercury acts as a piston, and drives some of the air out of the tube before it. The lower part of the tube may be turned up in a pneumatic trough or other vessel B, full of mercury, where the air or gas driven out may be collected. P H is a glass tube branching out from the main tube, and to this one a bottle or any other vessel to be exhausted may be joined. O is a barometer to show the extent of the vacuum produced, and R is a vessel collecting the air or gases forced out by the falling mercury. So efficacious is the action of this simple pump that the mercury in O will rise to the same height as in a barometer not connected with the pump, which therefore produces a perfect Torricellian vacuum. The Sprengel pump is, therefore, infinitely superior to the ordinary double-barrelled air pump.

There is no reason why pumps on this principle should not be introduced into the market, with ordinary plates and receivers conjoined therewith. The glass portions can be supported and protected by woodwork by simply sinking the tube and its branches in grooves, and screwing a second board over the movable ports. The vessel at the bottom which collects the mercury should have a tap to carry off all which rises above the proper level, so that the surplus may be employed to replenish the funnel. Thus may a very superior and cheap instrument come into common use.

The vacuum produced is so perfect that, when tubes on Geissler's principle are exhausted by the pump, they show no red bands on the spectroscope, not a single trace of nitrogen. A blue steel flame is given, due, perhaps to vapour of mercury. Faraday believed that electricity was but a peculiar condition of common matter, and that it, therefore, could not exist where matter was not present. Yet no vacuum has yet been produced where the discharge from a large coil machine will not pass, though Mr. Gassiott and others have made vacuum tubes which proved good insulators to a considerable extent. The best vacuum obtainable from the Sprengel pump gives the steel-blue flame.

MANUFACTURE OF MALLEABLE IRON.

MR. J. HARGREAVES, of Appleton Widnes, Warrington, has been some time investigating the causes of loss of metal when malleable iron is made from cast iron, with the object of reducing that loss as much as possible. The loss of weight caused by the abstraction of carbon, silicium, sulphur, &c., is of course unavoidable, so far as the elimination of those elements themselves are concerned. But when silicium is present, whether in combination with the iron, or in the form of sand adhering to the pig, the formation of oxide of iron is required to effect its separation, in the form of tap cinder, or basic silicate of iron, and this oxide is obtained at the expense of the metal. The sand which adheres to the pig thus causes a loss of from three to seven times its own weight of iron. Not only is there this loss caused by oxidization, but the time, labour, and fuel required to effect it is thrown away. It is, therefore, desirable that the presence of silicium, whether in the form of sand or otherwise, should be avoided To prevent the loss of metal from this cause (generally amounting from 3 to 6 per cent.), the iron is run from the blast furnace into beds of granulated or powdered iron ore. By this, not only is the loss of metal reduced, but the time, labour, and fuel required to puddle it are also appreciably diminished, the iron is somewhat improved, and the production of tap cinder diminished. This improvement has been patented. Makers of malleable iron will readily appreciate the improvement. To ironfounders it is also of importance, as they avoid the loss of weight and depreciation of quality consequent on the presence of sand, and a smaller amount of flux is required in the cupola. We understand that there is no expense required to put it in operation, except the difference between the cost of sand and small iron ore.

SOCIETY OF ENGINEERS.

(Concluded from page 67).

THERE is one subject, in connection with the construction of the sewers themselves which is of such vital importance that mention of it must not be omitted, and that is the subject of ventilation. It appears to have been to a very great extent ignored in all the early sewer works of this country, and it can never have occurred to the designers of those early sewer works that the volume of water poured into a sewer always displaces an equal amount of the mephitic air of the sewers. It may be taken for certain that deleterious gases are liberated in every system of sewers, from the very moment fæcal or other decomposing matters are admitted into them, to the time the sewage is utilized upon the land, or entirely dissipated by being poured into the sea. The very fluctuation of the flow of sewage through a sewer will give those gases a force, in an unventilated system of sewers, that will enable them to pass through any trap, and so into our habitations. On the other hand, the fluctuation in the flow of sewage is a valuable aid to a system of properly ventilated sewers. The happiest results have attended the introduction of a system of sewer-ventilation in Croydon: the average improved rate of mortality in Croydon has been reduced two per thousand by it; and in Liverpool, which has been proverbially an unhealthy place, the mortality has been reduced from 42 to 30 per thousand, chiefly by the ventilation of the sewers. With regard to the gases escaping from the ventilators, the principle of oxidizing them by charcoal, as recommended by Dr. Stenhouse, is easy of application, and has proved very successful in its results. There are other modes of disinfecting or dissipating the sewer gases that may be adopted in particular cases; but as the method to be adopted depends upon local conditions, no general rule can be laid down for the guidance of the engineer in the matter, and he must, therefore, in every case, adapt general principles to local circumstances.

Sewers remove by the aid of water those matters that are so pernicious to our health and life; and, therefore, the question of water supply, as one of the great aids to sanitary success, demands the earnest consideration of the members of our profession. The various questions concerning the provision of water for our fast increasing populations are of great moment, and the matters relating to the purity and the modes of preserving or effecting the purification of our water supplies are also of great importance. Men in all ages and countries have given a great amount of attention to the means of procuring good and abundant supplies of water. In bygone ages, works of great extent have been executed in order to convey life-giving streams from great distances to the crowded cities of their times, and many of those works have been of so colossal and durable a character as to outlive the very cities they were intended to supply. In our own day we find pressing necessity for water so great, that schemes are proposed of a magnitude surpassing those that have been before executed in any age or country. We have the scheme of Mr. Bateman to bring the water of the upper tributaries of the Severn from the Welsh hills, by a conduit, 183 miles long, for the supply of water to the three million inhabitants of London, and the inhabitants of the towns on the line of the aqueduct. By this scheme it is proposed to give a constant supply of water at sufficient pressure for all purposes, the lowest reservoir in the scheme having an elevation of 450 feet above Trinity high-water mark. It is ultimately intended to bring 200 million gallons of water per day into London, the present supply being about 100 million gallons per day; but at first it is only intended to furnish 120 million gallons per day, and it is estimated that the work will cost £8,600,000. We have also the scheme of Messrs. Hemans and Hassard, of tapping the lakes of Cumberland and Westmoreland, and impounding the water of that very wet locality, carrying it by a conduit 240 miles in length. The minimum elevation of the source of supply would differ but slightly from that of Mr. Bateman. The cost of this project to convey 250 million gallons of water per day to London is estimated at £12,200,000; if 200 million gallons only were required, the estimated cost is £11,200,000.

Then we have the scheme of Mr. Remington for collecting the waters of the Dove, the Wye, and the Derwent, from the hills of Staffordshire and Derbyshire, and conveying them to London, by an aqueduct 138 miles in length, and at sufficient elevation to distribute the water for all purposes. The quantity of water proposed to be supplied by this scheme is 83 million gallons per day, and the cost of the works are estimated at £5,000,000. We have also the scheme of Mr. Dale for supplying the populous towns of Lancashire and Yorkshire with 131 million gallons of water per day, to be taken from the lakes of Cumberland and Westmoreland; and it is estimated that this scheme will cost about £9,000,000. Other schemes have been produced for improving the modes of increasing and perfecting the local supplies of water, whose authors think that, by proper means, we may enjoy in their virgin purity those supplies of water that nature has directly placed at our disposal. Vast sums of money have of late been spent in establishing or extending systems of waterworks in our populous cities and towns, and the experience that has generally been gained leads us to draw some general conclusions applicable to all works.

Water supplies should be abundant and pure. The average quantity of water supplied to the population of 120 towns of the country is 25 gallons per head per day; in some of those towns the supply equals 50 gallons and upwards per head per day, and in others it is as low as 10 gallons per head per day. In studying matters relating to water supply, the purity of the supply is of paramount importance; the results of using impure water are generally more speedy and certain than those arising from impure air, as the poisonous matter taken into the stomach passes at once, by the process of venous absorption, into the system. Year by year is becomes more difficult to preserve the purity of our supplies of water. The greater the attention paid to the cultivation and manuring of land, and the continual increase of our population, tend materially to destroy the purity of our water supplies. It is an axiom, in seeking for water, that the purity of water and fertility of soil are never to be found together

The supply of water should be constant, and should be distributed at such an elevation as to command the highest houses. Such a supply is invaluable, and, in addition to the results to be gained in a sanitary point of view, the advantage of having water always at command for the purposes of extinguising fires, watering streets, flushing sewers, and dispensing with the drudgery and labour of carrying water, are very great. I cannot conclude my remarks on water supply without referring to the failures of reservoir dams, which unfortunately have of late been so common. The

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thrilling interest taken in these failures, due to the calamitous results arising from them, will, it is to be hoped, lead, in all future works, to more care and attention being paid to the construction of the work itself and to its position, with a view to secure immunity from such sad catastrophes. That sanitary works have answered the purpose for which they were intended, and that sewerage and water-works have been the means of accomplishing this end, is abundantly shown by the results, whereby the lives of thousands of our teeming populations have been saved, and much misery and suffering prevented, and, at the same time, the social and moral habits of the people raised by the means that have been adopted.

In concluding my address, it may be remarked that modern engineering had its birthplace in this country, and we trust that it will ever find its home in it. We cannot but feel justly proud of the great strides that our profession has made, and is still making, and of the great benefits it has conferred on the civilized world. A century and a half ago there were no modern engineering works of note—no canals, railways, harbours, or roads worthy of the name; but at the present day works of great utility and magnificence have been constructed, and there is no obstacle so great that it cannot be surmounted by the diligence and skill of our profession. If mountains obstruct our progress we tunnel them; if a valley or stream intervene between us and the object of our ambition, we bridge it. We set up barriers to curb the fury of the ocean, and we multiply the means of international communication, thus bringing man and his follow-man into closer communication and relationship. We make use of the great power of electric currents so that we are able to flash our thoughts from land to land with the instantaneous velocity of lightning. We perfect the machinery used in the manufactures of this country, and multiply the conveniencies and luxuries of civilized life, and bring them within the reach of all classes of our communities. We tap the living streams of water, and bring home the life-giving element to quench the thirst of our communities. We remove, in an expeditious and inoffensive manner, from the midst of our populations those matters thrown off by nature and destructive to life, and thus set a bound to the tide of disease and death. We bring up from the buried stores of nature materials that are used for the comfort of man, or are fabricated into countless forms, and without which we should be unable to carry out those great works which mark the progress of modern engineering, and stamp the age in which they are executed with their character. The great progress made by our profession shows that its members have been equal in ability to the varied tasks they have had to perform; but let us not trust to our prestige, but endeavour to open up new fields for labour that may improve our manufactures and facilitate our commerce, and so defy legitimate competition.

In the sanitary works of the country, in agricultural engineering, in the gigantic schemes for ship canals proposed in distant parts of our own empire, and likewise works of like magnitude proposed in other countries by our own countrymen, and in which English capital would be expended, we may find an outlet for our talent and employment for our industrial classes. We cannot be unmindful that our profession imposes upon us an important trust; we have received it in its full vigour from the hands of those who have gone before us, and it is now our privilege to extend its usefulness, and hereafter to hand it down to posterity, not only unimpaired, but improved and perfected. As our profession is dependent for advancement upon many branches of art and science needing the strength and skill of the mechanic, the scientific knowledge and attainments of the philospher, and as it is not the knowledge of a single individual, but the accumulated knowledge of individuals and ages that makes up the whole profession of an engineer, this fully demonstrates the necessity of individual members of our profession making themselves conversant with the works and labours of others, and, by promoting an interchange of thought and idea, adding much to the general store of information which will not only advance our profession, but promote the true interests of the individual member.

It is by the aid of societies like this that we are enabled to accomplish that good for our profession we must each and all earnestly desire. I am right in saying that this Society has made greater progress, judging from the number of its members and the variety of the papers that have been brought before it, than any other engineering society during the period it has been established. The benefits of the Society are ours to enjoy, ours to preserve, and ours to transmit; then let us each individually strive to advance its interests, remembering that in promoting those interests we are truly advancing our own best interests. Let us strive to sink all jealousies, remembering that the field is extensive enough for the operations of various engineering societies and individual members of our profession; let us have no rivalries, except that rivalry of vieing with each other to promote the true interests and advancement of our profession.

HAVRE INTERNATIONAL MARITIME EXHIBITION.

WE have occasionally referred to the progress of the above project, and we now give the programme.

The exhibition will be open from the 1st of June next to the 31st of October. The exhibition is organized under the auspices of the Municipal Administration of Havre and of a general Consultative Commission. The programme of the exhibition includes forty-three classes, divided into the five following groups:—Navigation, goods, fishing, aquiculture, complemental classes.

1. Navigation.—1st class, sailing vessels (models and plans). 2nd, steam vessels, ditto. 3rd, wood-built vessels and composite (wood and iron). 4th, iron-built vessels. 5th, boats of all descriptions. 6th, masting. 7th, rigging. 8th, sails. 9th, materials for fitting out ships. 10th, preservation of ships. 11, furniture for vessels, steamers, yachts, &c. 12th, ship stores. 13th, sailors' outfit and chest. 14th, instruments for navigation, steerage, lighthouses, and signals. 15th, hygiene, ships' medicine chests, and surgery. 16th, apparatus for loading, stowing, unloading, and transhipping. 17th, life-boats, and other contrivances to save life and property; swimming apparatus; various objects for the use of bathers. 18th, paddle propell rs. 19th, screw propellers. 20th, engines, impellers. 21st, steam boilers and generators, fuel. 22nd, various parts of machinery belonging to marine engines and accessories. 23rd, various works relating to ports; repairing ships.

2. Goods.—24th class, textiles: cotton, flax, hemp, &c., wools, horsehair. 25th, colonial goods for consumption; home produce (similar). 26th, corn, alimentary flours, fruits, and seeds. 27th, dyeing and chemical produce. 28th, greasy and oily substances. 29th, woods wrought or unwrought. 30th, all kinds of metals. 31st, different sorts of goods and produce of industry for importation or exportation. 32nd, instruments and apparatus applied by trade to establish the quality or discover the adulteration of goods. 33rd, packing: produce used for manufacturing objects necessary to pack up goods.

3. Fishing.—34th class, whale fishing, &c. 35th, cod fishing, &c. 36th, coast fishing. 37th, river fishing and pond fishing. 38th, speciality of tackle and instruments used in fishing; bait, salt, preparation of fish; models of establishments for preparing fish; fishermen and sailors' outfit and clothing.

4. Aquiculture.—39th class, fresh and salt water aquaria.

5. Complemental Classes.—40th class, art annex, special naval art, art properly so called. 41st, writings and books, maps and plans. 42nd, competition and experiments. 43rd, nautical sports; representations, the plan and action of which will be taken from historical events or fabulous and legendary subjects.

A Maritime and International Congress will take place during the time of the exhibition. The exhibition will be held in closed galleries, which were begun in the month of July, 1867, on the grounds situated by the sea-shore, opposite the roadstead on the Boulevard Impérial and the Boulevard François I. These grounds are granted by Government. It contains, besides the galleries, an enclosure in the open air; a floating annex will receive special exhibitions. The whole surface of the exhibition is about five hectares, or twelve acres and two roods English measure, not including the annex above mentioned. Objects admitted will be exhibited under the name of the inventor, builder, manufacturer, or author, &c., and generally of the producer or the manufacturer. They may also be exhibited under the name of the shipowner, merchant, holder, collector, tradesmen, or the consignee.

Exhibitors will have the privilege of selling in the enclosure of the exhibition, commodities manufactured on the spot. They will have also in special galleries, for this purpose, the right of letting customers taste their produce and retailing goods similar to those exhibited. Non-exhibitors will not have this right. The rewards adjudged to exhibitors, on the decision of the International Jury, will consist of pecuniary gifts and objects of art, gold and silver medals and honourable mentions; there will be several great prizes amongst the rewards. The jury will begin their operations as soon as the exhibition opens. The rewards will be delivered at a grand assembly of the general commission on Sunday, 26th of August, 1868. A moderate charge is made to exhibitors on account of the expenses incurred by the erection of the building, and for watching, insuring, and keeping the same in order. Goods and produce will be received upon the premises of the exhibition from the 1st of March next until the 1st of May. Demands for space will be received up to the 15th of February only, and applications for forms should be made to M. Alf. de Lavigerie, Special Commissioner for England, 40, Great Titchfield-street, Oxford-street.

[We may add that the Commission of the Exhibition has just received from the Minister of Foreign Affairs a communication to the effect that in reply to the applications which he had made to Austria, Sweden and Norway, Denmark, Holland, and Belgium to take part in the exhibition, he had received replies to the following effect—Austria was quite willing to lend her assistance, but considered the time fixed for the opening as too near. Sweden and Norway replied that having taken part in those of Arcachon and Boulogne she had no public funds to dispose of for the purpose. The answer of Denmark was to a similar effect. England has sent word that the question of sending delegates was under consideration, as was the case also in the remaining States applied to.]

UTILIZING FERRUGINOUS SALTS.

MR. ISHAM BAGGS, of Holborn, has, in conjunction with Mr. F. Braby, of Deptford, patented an invention which relates to the treatment and application of the waste wash which results from the operation of cleansing iron by hydrochloric acid for the purpose of depositing zinc and other metals thereon, ordinarily known as the galvanizing process, and which waste wash, although it has occasionally been employed for purifying coal gas, has hitherto been usually thrown away as being altogether useless. In order to neutralize the free acid which may remain in the wash scrap iron may be digested therein, or the free acid may be neutralized by any convenient or suitable means. The wash or liquor should then be filtered or decanted, and upon the subsidence or separation of the impurities, it should be boiled down to a moderate density for the convenience of carriage. The liquor thus obtained contains a proportion of iron in the state of muriate or chloride, and may be employed for various manufacturing and useful purposes, and especially for the manufacture of muriate of ammonia from gas liquor or other ammoniacal liquor or vapour, and which forms the subject of this invention, the muriate of iron, hitherto a comparatively waste and useless product, being thus employed and utilized instead of hydrochloric acid for the purpose of the formation and separation of muriate of ammonia from the gas liquor or other ammoniacal liquor or vapour. The solution of muriate of iron is simply mixed with the gas or other ammoniacal liquor, the ammonia contained in which is thus converted into muriate of ammonia, whilst the iron contained in the first-mentioned solution is converted into carbonate and sulphide of iron by means of well-known chemical reactions. The iron salts together with the tar contained in the gas or other ammoniacal liquor under treatment should be allowed to subside, and be then separated by any of the well-known means. A solution of muriate of ammonia is thus obtained, which should be concentrated by means of heat, crystallized, roasted, and sublimed.

The following is a convenient and useful mode of saving a large amount of the fuel which would otherwise be consumed in evaporating large quantities of gas or other ammoniacal liquor; lime in the proportion of rather more than an equivalent of the same to the ammonia contained in the liquor is added thereto at the commencement of the operation, and the mixture then subjected to heat, when after prolonged boiling nearly the whole of the ammonia will be driven off, and little will remain behind but the water, lime, and natural impurities. The ammonia so carried over may be either condensed with the water which accompanies it, or may be passed directly into the clarified waste wash, which it will immediately decompose with the production of muriate of ammonia and oxide of iron. Ammoniacal vapours may also be treated in accordance with this invention for the production of muriate of ammonia.

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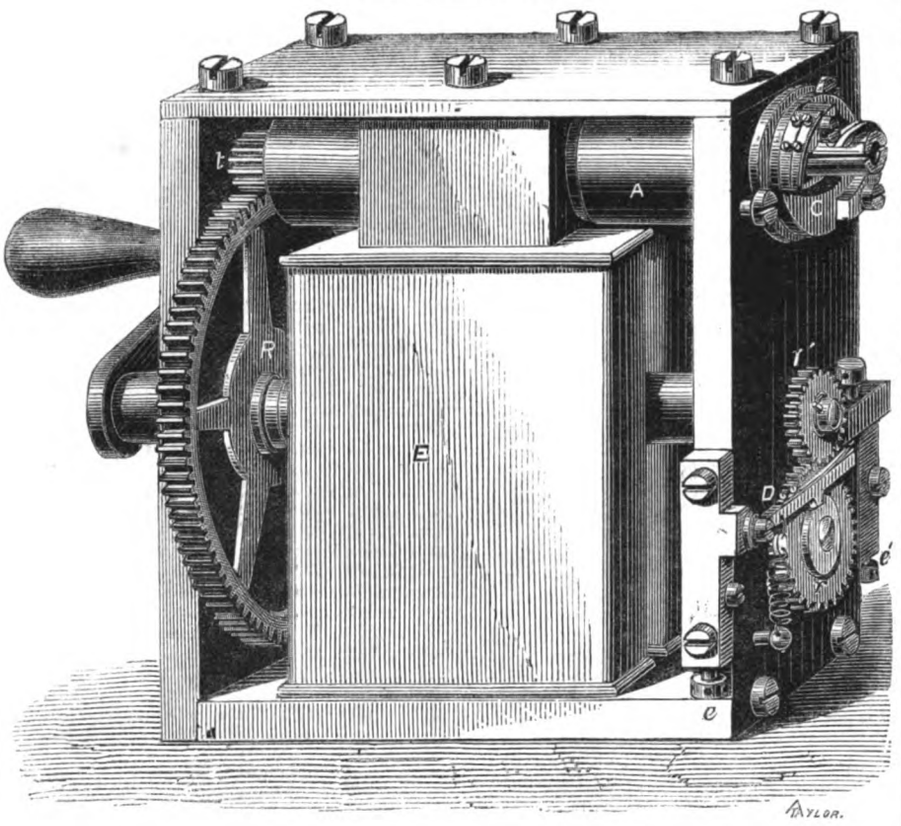
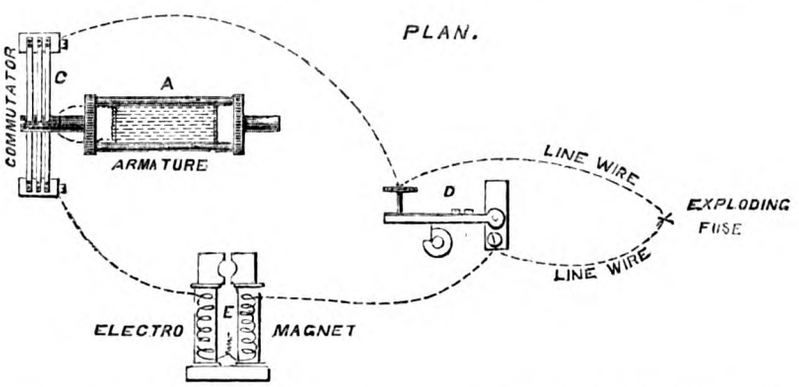
DYNAMO-ELECTRIC APPARATUS.

BY MR. C. W. SIEMENS,





SIEMENS' DYNAMO-ELECTRIC APPARATUS FOR BLASTING PURPOSES.

IT may be remembered that in our late summary of Electricity and Telegraphy, we referred to an instrument of Mr. Siemens, for the purpose of blasting, as being about the only practical application of the new mode of obtaining dynamic electricity by the use of great mechanical force, as originally shown in the large machine exhibited by Mr. Wilde. We now place before our readers some description of this apparatus—looking upon it as a very interesting practical application. The mechanical arrangement of this apparatus is similar to that proposed by Dr. Werner Siemens in 1857, for the production of electric currents, consisting of a cylindrical keeper hollowed at two sides for the reception of insulated wire wound longitudinally, which is made to rotate between a series of permanent magnets. In Mr. Wilde's machine (see the MECHANICS' MAGAZINE, No. 2246, October 18, 1867), these permanent magnets were attached to a "magnet cylinder" divided so as to represent the two poles. Within this cylinder was placed a similar armature to that mentioned above; this revolved at a high rate, and within a very small distance of the cylinder itself. The induced electricity obtained from the armature was passed through a commutator, and used to excite a large electro-magnet fitted with a magnet cylinder and a similar arrangement of armature to the permanent magneto-machine. The essential difference in Siemens' apparatus from that of Wilde's is the absence of the magneto-electric machine as the exciting agent. This is done away with, and a smag electro-magnetic machine alone employed, havin as its exciting agent its residuary magnetism only. The electro-magnet is provided with a magnet-cylinder, within which revolves a small Siemens armature. The coils of this electro-magnet are traversed by the current produced by the rotating armature after being, by means of a commutator, directed to flow in one direction only. At the commencement of rotation the armature is acted upon merely by the weak residuary magnetism of the electro-magnet, and consequently, only weak currents are produced in its surrounding coil. These weak currents passing through the coils of the electro-magnet in the same direction instantly increase the residuary magnetism, thereby again producing increased induction currents in the armature, and so on, until the iron of the electro-magnet has taken up the highest amount of magnetism which it is capable of holding. In this arrangement the coils are short-circuited, and so kept during the revolutions of the handle when current and magnetism are developed to their utmost extent. By now suddenly opening this short circuit, a very powerful current of short duration will pass through a line connected to the terminals.

In the above engraving A is the revolving armature into the pinion of which gears the wheel R; E is the electro-magnet, and C the commutator. Short circuit is established by the lever D, which drops into a notch after two revolutions of the wheel r^1, and thereby opens the circuit. The current therefore enters the line, the ends of which are fixed under the screws e and e^1. By the foregoing, the plan of connection will be readily understood. The wires passing from the armature through the electro-magnet by D. it will be seen how at D the short circuit is broken and a current sent into the line. The apparatus is placed in a wooden protecting case, so arranged that the instrument need not be withdrawn whilst being used. Putting the handle to the protruding square of the spindle of wheel R makes the apparatus ready for use. A small drawer is provided for the reception of the handle. The advantages (especially for exploding purposes) of an instrument thus handy, portable, and useful in all weathers over galvanic batteries and their concomitant inconveniences, as also over static-electric machines, which only act in very fine weather, are undeniable; and it was with a view of producing a useful never-failing instrument of that kind that this apparatus was constructed.

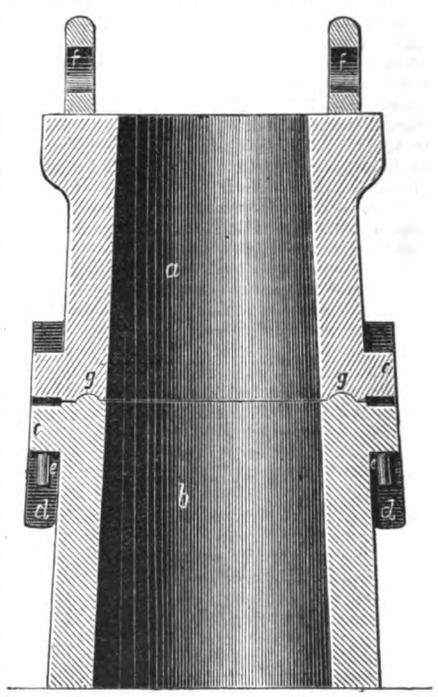
It is only necessary with this instrument that it should be once actuated either by magnetism or by a current from a single cell. After that there is always sufficient residuary magnetism to induce a weak current in the armature. The great practical advantage of this is immense, for we always have at command a never-failing supply of electricity for the special object required. The current induced by this apparatus is also well adapted for the release of clockworks or signal bells for railways, for the direct-action or single-stroke electric bells, and for the sending of currents in rapid succession into a line of telegraph. It has already been tried for the purposes of blasting, and has been found to work with great success. It is, we believe, capable of causing an effect at a greater distance from the instrument than other plans are capable of.

It is identical in principle to the large machine brought before the Royal Society on February 14, 1867, by Mr. C. W. Siemens, F.R.S., &c., and to which we have elsewhere already, on more than one occasion, made allusion.

We hope shortly to be able to give the results of some experiments with this apparatus relative to the various distances fuzes can with facility be exploded.

MOULDS FOR CASTING BESSEMER STEEL.

THE invention, illustrated in the accompanying engraving, is designed to render the moulds employed in casting Bessemer steel or other metals more durable, by so forming them that the lower portion which first becomes deteriorated may be removed and a new portion substituted. Hitherto such moulds have either been made of one solid piece or



divided vertically in halves, the better to release the ingot. These improvements have been patented by Messrs. Waddington and Longbottom, of Barrow-in-Furness, and consist in dividing the moulds horizontally, that is, so as to make a top and bottom portion. The edges of these parts which meet together are grooved or so formed as to fit into each other, and the upper and lower parts are secured together by bolts passing through lugs outside the mould. When

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preparing a mould for use, a cement is filled in between the joint, and a temporary plug is passed inside the mould to prevent the cement squeezing into the mould. The bolts are then drawn up tight, and the spare cement squeezes out on the outside of the mould. Thus when the interior surface of the lower portion becomes worn or eaten away by the splashing of the metal it can be replaced by another one, the upper part serving many lower ones.

Our engraving represents a vertical section of the improved ingot mould, showing the division of the lower from the upper portion, and the method of holding the parts together. *a* is the upper part of the mould, and *b* the lower, on both of which lugs or shoulders *c* are cast, and through the openings in the lugs the slotted bolts *d* are passed and are tightened up by means of the wedges or cottars *e*, cement being used between the joint, which is constructed in the form of a groove, and a rib fitting therein. When it is necessary to remove the old lower part *b* and attach a new one to the upper part of *a*, the wedges are removed and the parts separated. The upper part of the mould is thus reversed, the lugs *f* being downwards, the groove or recess *g* is filled with a cement made of fireclay and blacklead. The new part *b* is then lifted on to it, and a plug which fits half into *a* and half into *b* is placed in the inside of the mould to prevent the escape of the cement into the mould. The bolts are then drawn up tightly by the wedges, whereby the surplus cement is squeezed out, and the mould is ready again for use. We are glad to be able to add that these moulds are giving great satisfaction at the Barrow Hematite Steel Company's works, where they have a considerable number of tops with the fourth new bottom to each. Every bottom taken off has lasted over the average number of casts that the entire moulds did on the old system. The tops are now expected to last two or three more bottoms, thus showing a great saving over the old system of whole moulds.

STEREOTYPING WITH PAPER.

THIS process is now in common use in all the principal daily newspaper establishments in New York. The "Scientific American" states that it is conducted substantially as follows:—The stereotyper first dries the forme of types upon an iron steam table. The forme is then partially unlocked, and a hand brush is rubbed over the surface of the types, cleansing them preparatory to placing over the entire form a sheet or sheets of thin bank note paper, of the finest quality, previously wetted to ensure the required pliability: This paper being evenly laid over the types, the workman takes a long-handled brush made of short, stiff bristles, with which he beats the wet paper evenly, forcing it into all the depressions of the types, taking care not to break the paper. This work finished, a dampened sheet of thicker but more ordinary paper is placed over the first. This is also brush-hammered down upon the types, and followed by another sheet of paper, thinly coated with a preparation of whiting and starch. Again the brush is used to beat this home, after which a brown paper backing is put on, and then the forme of types, covered by the before-mentioned sheets of paper, is trundled to another steam table, where it is slid under a powerful screw press, several blankets folded over it, and all firmly held down until the paper matrix is dry-hardened, or "cooked," as the workmen express it. The papering process occupies three or four minutes, the cooking about twice as many. The matrix is now peeled off from the forme and prepared for casting, by sifting it with finely powdered borax, which, with a soft brush, is thoroughly rubbed into the sunken surface left by the types.

The surplus borax having been removed, the matrix (which now resembles hard but pliable pasteboard) is ready for the casting box, which is made of iron, either straight or curved, to suit the press bed. Handle irons hold the matrix in its proper place at the exact distance (about half an inch) necessary for the thickness of the stereotype plate, which is made by pouring a quantity of hot type metal into an open end of the casting box. This metal, dropping between one surface of the casting box and the sunken surface of the matrix, fills up the latter without burning it. A few moments are allowed for cooling, and then the matrix is stripped from the warm plate, which is subsequently prepared for the press, by trimming down all thick lines, or chiseling away any superfluous metal, paring off the edges, filing, and otherwise treating the stereotype after the usual manner. Circular saws driven by steam power, and hand cutting machinery of various kinds are used in finishing, the whole operation of stereotyping occupying from fifteen to twenty minutes. A second plate may be obtained from the original matrix, in about two minutes, and almost any number of castings can be taken by careful workmen. In some offices only one mould is taken, this being used for casting the number of plates required for several presses. The stereotype, being an exact reproduction, in solid plate form, of the million or more types originally put together by the compositor, is fastened upon the printing press, and used in place of the types.

The advantage of duplicating the plates is apparent. Two or ten presses, working similar plates, will print off in a couple of hours an edition of twenty or a hundred thousand copies, which formerly occupied so much more time that when ten or twelve-cylinder fast presses become slow, second and third editions were resorted to by editors desirous of giving the public the latest news. Previous to the use of stereotypes for newspaper purposes, duplicate formes were sometimes set up in type, an extra expense to the office adopting this course, which was incurred only whenever a pressure of important news was likely to prevent the formes going to a single press in season for working off the edition. Compositors can now work until three or four o'clock in the morning, and half an hour later half a dozen duplicates of their work may be seen on as many different presses, striking off the printed sheets, units of an immense edition of perhaps seventy-five or eighty thousand copies of some newspaper, all of which are frequently counted and delivered to the carriers and newsmen before the editors, compositors, or stereotypers can reach their homes and retire to rest.

MANCHESTER BOILER ASSOCIATION.

THE last ordinary monthly meeting of this Association was held in Manchester on Tuesday, January 7, 1868, Hugh Mason, Esq., of Ashton-under-Lyne, vice-president, in the chair, when Mr. L. E. Fletcher, chief engineer, presented his report, of which the following is an abstract:—During the past month 356 visits of inspection have been made, and 769 boilers examined, 529 externally, 13 internally, 9 in the flues, and 218 entirely, while in addition 3 have been tested by hydraulic pressure. In these boilers 206 defects have been discovered, 10 of them being dangerous. Amongst these defects we may mention the case of a multitubular boiler, constructed of steel plates, and with a single furnace tube, and which was found to fracture on more than one occasion at the transverse seams of rivets at the bottom of the external shell. This boiler, which had a length of 24ft., a diameter of 5ft. 6in. in the shell, and 3ft. 5in. in the furnace tube, was worked at a pressure of about 50lb. on the square inch, and set underground in a colliery, without any external brickwork flues. Boilers set without these flues are always found to give trouble to a greater or less extent at the bottom of the shell, from contraction, the tendency to which was augmented in the present instance by a severe draught of cold air, caused by the ventilation of the mine, which passed over the naked boiler. It is of the utmost importance that in boilers set in this way, the feed should be dispersed by means of a horizontal perforated pipe placed near to the surface of the water; but it is strongly recommended, in addition, that the hot air from the small flue tubes should be brought underneath the shell before passing away to the chimney, in order to equalize the temperature of the boiler throughout.

A case of external corrosion was met with at a colliery, in a Cornish boiler 22ft. 6in. long, and 5ft. 6in. in diameter. This boiler, which had not been previously examined by the Association, had just been removed from one pit to another, when the inspector found it lying entirely bare at the time of his visit, and made a thorough examination. He found the front plate at the bottom of the boiler wasted away round the blow-out elbow pipe to the thickness of 1-32nd of an inch, while the bottom of the shell was dangerously corroded from one end to the other where it had rested on the midfeather wall. In the second plate from the front end, the overlap and rivet heads were found to be nearly eaten away; the third was reduced to 1-16th of an inch in thickness; the fourth was as thin as a sheet of brown paper; in the fifth the rivet heads were gone; and in the sixth the thickness of metal was reduced to 1-32nd of an inch; and so on, while the inspector knocked a hole through in another part. The manager of the works was quite unaware of the danger, and was about to have the boiler reset in this state. Had such been the case, it could not possibly have worked on for any length of time without explosion, while it is highly probable that it would have burst the first time steam had been got up in it on its new bed.

Mr. Fletcher reports six explosions, by which ten persons were killed and thirteen others injured, while, in addition, the particulars may be given of four other explosions of prior date, which there has not hitherto been an opportunity of doing. Not one of the boilers referred to was under the inspection of the Association.

The following is a statement of explosions from November 23rd, 1867, to December 31st, 1867, inclusive:—No. 29, November 27, plain cylindrical, flat-ended, externally fired, 1 person killed; No. 30, December 23, single flue or Cornish, internally fired, 6 persons killed, and 4 persons injured; No. 31, December 26, particulars not yet fully ascertained, 2 persons injured; No. 32, December 28, "balloon" or "haystack," externally fired, 1 person killed, and 4 persons injured; No. 33, December 30, two flue Lancashire, internally fired, 2 persons injured; No. 34, December 31, plain cylindrical, egg-ended, externally fired, 2 persons killed, and 1 person injured Total, 10 persons killed, and 13 persons injured.

CONSTRUCTION OF THEATRES.

ONLY two days after the destruction of Her Majesty's Theatre, one of the suburban theatres of Paris, Belleville, was completely destroyed in about three hours. When we consider the great size of Her Majesty's Theatre, and the fact that in the case of Belleville the water was frozen, the shortness of the time in which the former was consumed as compared with the latter is startling, yet the construction of the Belleville Theatre was far from perfect, for the floor of the pit gave way and four firemen and a soldier injured, two of them very seriously. Few facts, observes the "Society of Arts Journal," are more remarkable than the small amount of damage done by fire in Paris, yet the number of persons in each house, and, consequently, the number of fires, is very much larger than in London; and, although the number of firemen is three or four times larger in the former than in the latter city, the engines are mere garden toys compared with those of the London brigade, to say nothing of the steam fire-engines. The comparative immunity from fire may be accounted for, in part, by the very crowding of the houses, which would seem to be a source of danger; each family only occupies one floor, and, consequently, there is little chance of a fire smouldering for hours without being discovered, but the grand difference in favour of modern French houses, as compared with those of London, arises from their superior construction.

In the first place, timber is almost entirely banished; the beams, girders, and flooring-joists are all of iron, and the spaces between them filled in with brick arches and mortar; this arrangement not only renders the floors nearly fireproof, but it excludes noise, and affords little shelter for vermin. Then, again, the floors themselves are composed of thick oak parquet, instead of inflammable deal boards; while those of the kitchens, pantries, and offices are mostly of tile. The staircases, it is true, present some danger, but nothing compared to that which surrounds the flimsy constructions in London houses. In theatres and other large buildings, the staircases and passages are of pre-eminent importance, and much attention has been given to these parts in the various recently-constructed theatres of Paris; in some of the old theatres, as, for instance, the Palais Royal, the staircases are of iron. It is only when public attention is excited by such accidents as the destruction of Her Majesty's Theatre, that attention is to be obtained for questions of this kind, and these are the moments when it is important to point to what has been done in the way of improvement elsewhere; within a very few years there have been several important theatres built in Paris, the Chatelet Theatre, Lyrique, and Gaite, amongst the number, while the New Opera House offers, at the present moment, an admirable occasion of studying the newest modes of construction and the precautions adopted by French architects and builders. When we consider what an awful calamity might have happened had Her Majesty's Theatre been crowded with spectators, the importance, nay, the moral duty, of collecting all the available results of study and experience need not be further insisted on.

THE visitors during the week ending January 25 to the South Kensington Museum were, on Monday, Tuesday, and Saturday, free from 10 a.m. to 10 p.m., 11,390; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m to 4 p.m., 1,590—total, 12,690. Average of corresponding week in former years, 9,920. Total from the opening of the Museum, 7,165,014. Patent-office Museum.—Number of visitors for the week ending January 25, 4,011; total number since the opening of the Museum free daily (May 12, 1858), 1,236,219.

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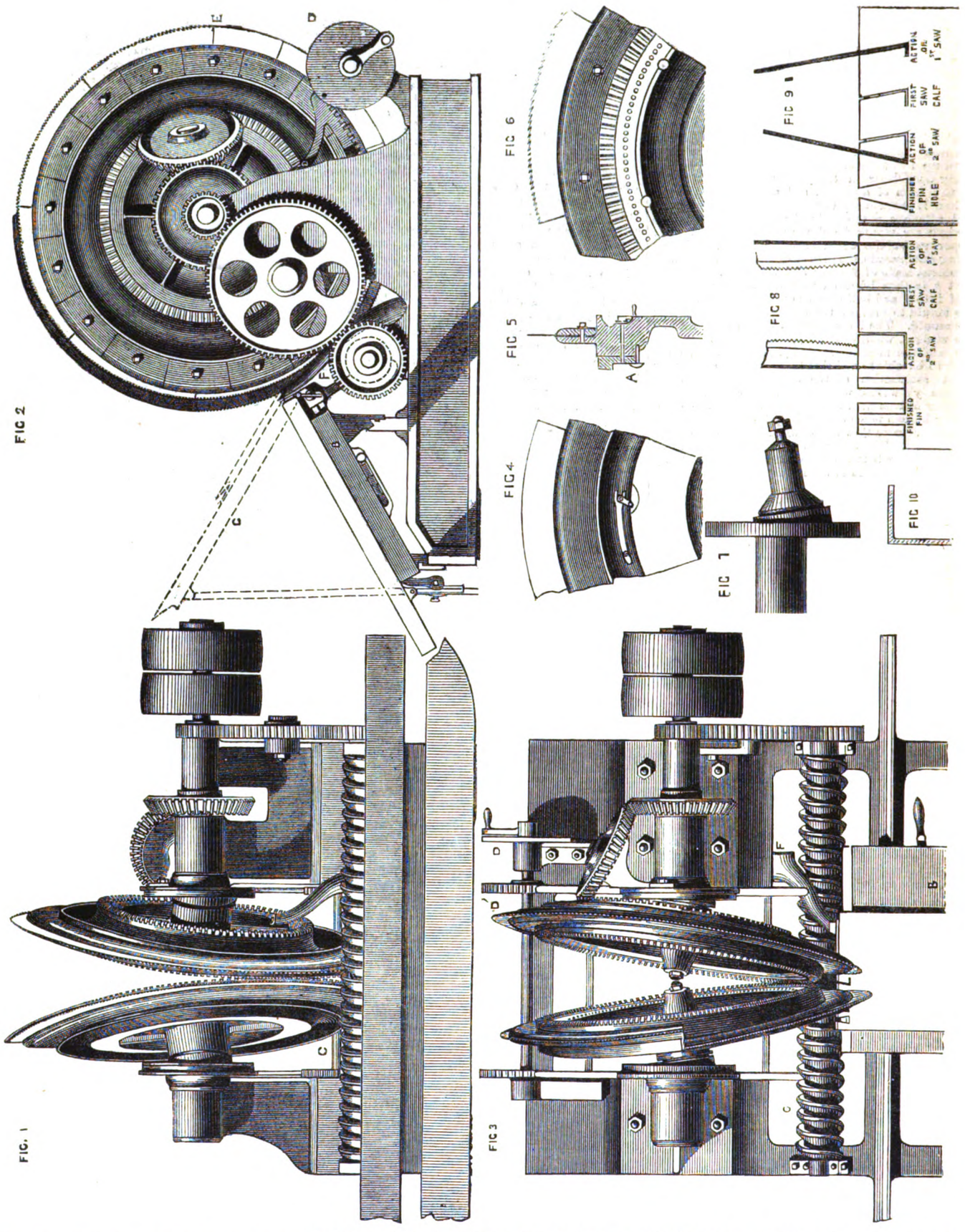
THE AMERICAN DOVETAILING MACHINE.

By MR. S. T. ARMSTRONG.



THE AMERICAN DOVETAILING MACHINE.

IN our notice of the machinery at the Smithfield Club Show in December last, we briefly referred to the American dovetailing machine which was at work there, and promised to give our readers full particulars at a future time. We now have much pleasure in placing before our readers detail engravings of this interesting machine. Manifesting as it does the exercise of the highest order of mechanical talent, and the most entire originality, it deserves to be studied not only by that class of manufacturers who are interested in it but all who can appreciate successful novelty in machinery. Though it may appear a small matter, such a tool has really been needed for a long time, and now that we have it it will enable the principle of dovetailing—without which a really strong box or case cannot be made—to be extended to a multiplicity of articles on which it would have been impossible heretofore to use it in consequence of its cost when carried out by hand. Fig. 1 is a front elevation with the table removed in order to show as much as possible of the saws; the machine is shown complete in end elevation in fig. 2, and in plan fig. 3. Figs. 4, 5, and 6, give details of the fixing of the saws. The section, fig. 5, is that of the saw disc on the driving axle, and shows the way in which the annular gearing ring working the other saw disc is capable of being moved round to any point of the circle, and there clamped with the two little pins shown at A (fig. 5); this is a very important point, as by it the relative commencements of cut

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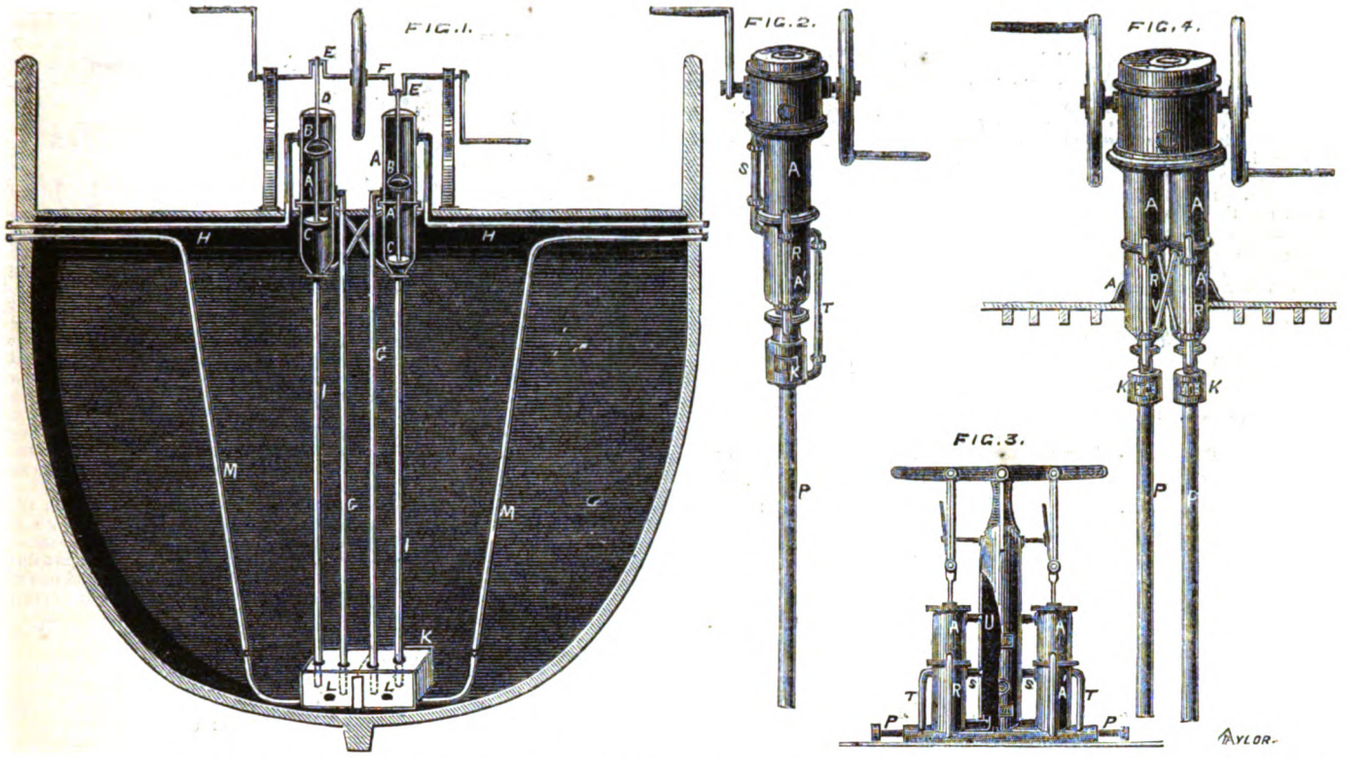
TREBLE ACTION PUMP.

By MR. F. HOLMES.



of the two saws are varied, and by that means the width of the dovetails; for as the table B, figs. 2 and 3, is moved, carrying the wood, at a uniform speed across the front of the saws, the space between each cut will of course be regulated by the number of degrees of the circle, that the entering point of one saw is behind the other.

The number of dovetails to be cut in an inch, or in any given space, is regulated by moving the half nut connecting the table with its driving screw C, figs. 1 and 3, forward or back half, a quarter, an eighth, &c., of a thread of that screw, by which one, two, or four intermediate dovetails are given between the first ones cut, corresponding with the threads of the driving screw, which, as will be observed by a glance at the gearing, is driven at the same number of revolutions a minute as the saws. The small hand wheel and segment gear, D D, figs. 2 and 3, are for moving the short spindles, fig. 7, of both wheels round together, so as to vary the angle of cut, as described in our former article, and as shown in figs. 8 and 9. When the "pins" are being cut, as in fig. 8, the spindles are turned in such a position as to bring the point of gearing of the saw disc, perhaps 45 deg., remote from the point of contact of the saws with the wood, from which results a pair of cuts diagonal to the plane of the wood but parallel to its grain. When the "holes" are being cut, as in fig. 9, the spindles are turned, so that the point of contact of the saws with the wood is in the same radius with the engaging point of the gearing, and a pair of cuts are made perpendicular to the plane of the timber, but inclined at the usual dovetail angle to its grain. The increasing diameter of the ranges of segmental saws is easily seen on fig. 2, the point where the spiral begins in the driving saw (shaded light) is just at the lower side of the disc, as there represented, and that at which the driven saw (shaded dark, the edge only being seen), begins its spiral, is at the top of the circle; one saw in this case is therefore half a revolution before the other, and the width of the pins will consequently be equal to the width of the spaces cut out between them, as the wood will have travelled over just half its motion for each revolution between the commencement of the saws.

The slight helical pitch of the saw blades is seen in fig. 3; the pitch of their screw is 1in., corresponding with that of the table moving screw, so that the cutting edges may exactly keep pace with the transverse motion of the wood. The way in which the saws are turned at an angle for the last gradient of each circle is shown in fig. 9, and with enlarged section, fig. 10; the point at which the ordinary radical toothed saw ceases, and the angle saw begins, is at E, fig. 2. It is worthy of note in regard to the durability of these saws that each segment can replace its neighbour as it becomes worn down; beginning, say, with the segment which is shallowest, and where the cut first received the last filing up of which it is capable, and must be thrown aside when blunt; it is not then replaced with a new one, but the next of a size greater in depth is moved on, and the whole range follow on, the new segment being the last one with the deepest angle edges, for this substitution is carried on in the same manner past the point where the change from ordinary to angle saws is made by just filing ordinary teeth on the last angle segment, which has by that time been worn down till it has none of the angle left projecting beyond the plane of the blade.

F, figs. 2 and 3, is a scriber, which nicks a line on the under side of the wood as it passes along, serving to define the depth of the dovetail, and to prevent the cross saws from leaving any "burr" on the lower side of the timber; the dotted lines, G fig. 2, show the position to which the table can be elevated in order to cut the kind of corner dovetail work used in small boxes and by cabinet makers, as will be easily seen by the angle at which the wood is held to the saws; in this case they cut out of it at an angle of 45 deg., leaving the corner of the work flush without the dovetail appearing through the plank. In examining this machine it must be borne in mind that the saw discs are free on the short spindles, fig. 7, and not staked on and driven by them, but by the bevel gear, shown in all the drawings, which transmits the power from the short pulley shaft driven by the belt. These short spindles are themselves free to revolve, so that they can be fixed with their inclination in either of the two directions, suitable for cutting the pins and the holes as above described. Mr. S. T. Armstrong is the inventor of this machine, which is making its way into very general use.

TREBLE-ACTION PUMP.

WE show in our engraving some very important improvements in pumps, whereby a treble action is obtained from a single-acting pump with two pistons on the same rod. The improved pump is the patented invention of Mr. Frederick Holmes, of Plumstead, and is arranged in the following manner:—From about the middle of a pump barrel having a double piston, or two pistons, the upper of which is a bucket piston, on the same rod, a pipe is carried down which terminates at its lower end in the liquid to be raised; a pipe leads from the upper part of the barrel to deliver the liquid raised by the first pipe. From the bottom of the pump barrel a pipe is carried down, which also terminates at its lower end in a closed chamber immersed in the liquid with which it is filled. The chamber is provided with inlet valves, and a pipe is carried up from its lower part to deliver the liquid. Mr. Holmes prefers to employ two pump barrels and two sets of pipes, the two pumps acting alternately.

Fig. 1 of our engraving represents two pumps worked from the same shaft, and acting alternately. A is a pump barrel divided by a flange and stuffing box at A^1 into two chambers, and having two pistons B C, the upper of which B is a bucket piston; these two pistons are on the same rod D, which is worked by a crank E of the shaft F, to which rotary motion is imparted. G is a pipe carried down from about the middle of the barrel A, above the stuffing box A^1, to the liquid to be raised. H is a pipe leading from the upper part of the barrel to deliver the liquid raised by the pipe G. I is a pipe carried down from the bottom of the barrel to the liquid to be raised. K is a chamber immersed in the liquid and closed at all points, except that it is provided with inlet valves L. In addition to the pipes G and I, which terminate in the chamber, a pipe M is carried up from its lower part to deliver the liquid.

The action is as follows:—In the down stroke of the pistons B C the liquid in the pipe I is compressed and forces liquid from the chamber K up the pipe M; the liquid thus forced from the chamber K is replaced through the inlet valves L in the up stroke. In the up stroke the liquid is sucked up the pipe G, enters the barrel A between the pistons B C and above the stuffing box A^1, and in the next down stroke passes through the valve of the piston B, so as to be discharged by the delivery pipe H at the next following up stroke. The two delivery pipes H and M may, if desired, be connected. When two pumps and two sets of pipes are used, as in our engraving, the chamber K is divided vertically as indicated by the dotted line N, and when the pumps are fitted to ships the middle of the chamber may be recessed at the bottom, as shown at O, so as to fit over the keelson. By leading a pipe, as shown in dotted lines at V, from the bottom of each barrel A to the upper part of the lower chamber of the other barrel, these pumps are made double-acting.

A modification of this pump is represented in elevation in fig. 2. Instead of the chamber K, fig. 1, fitted with valves being immersed in the liquid to be raised, a valve chamber K is fitted to the lower chamber of the barrel, and the valve chamber communicates with the liquid to be raised by a suction pipe P. R is a pipe carried down from the upper chamber of the barrel to the valve chamber. S is a pipe carried from the upper part of the lower chamber of the barrel to the pump head. T is a pipe carried from the upper part of the lower chamber of the barrel to the lower part of the valve chamber below the valve. In the up stroke the liquid is sucked up the pipe P through the valve chamber and through the pipe R into the upper chamber of the barrel, and also into the lower chamber; at the same time the liquid is forced from the lower chamber through the pipe S into the pump head. In the down stroke the valve in the chamber K is closed, and the liquid is forced from the lower chamber of the barrel through the pipe R to the upper chamber, and through the

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bucket piston into the pump head; at the same time the liquid is sucked up through the pipe T into the upper part of the lower chamber to be discharged through the pipe S at the next up stroke. Channels can be cast on the barrel instead of the connecting pipes R S T, and the valves brought together and arranged in a valve box instead of being placed in the positions we have described.

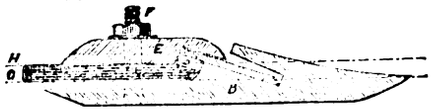
Fig. 3 represents in elevation, partly in section, two of the pumps shown in fig. 2, with an air or water vessel U applied to them to enable them to act as force pumps. By suitable arrangements of the valves, the upper chamber of one or both of the pumps may be used for forcing air into the air vessel to keep up the pressure. Fig. 4 represents two pumps constructed like that represented in fig. 2, but without the communications S and T respectively between the upper part of the lower chamber of the barrel and the pump head, and between the upper part of the lower chamber of the barrel and the lower part of the valve chamber; instead of this a pipe V is fitted between the upper part of the lower chamber of one pump and the lower part of the lower chamber of the other pump, and *vice versa*, so that in the up stroke of one pump the liquid above the piston of the lower chamber is forced out through the pipe V, and meeting the liquid discharged from the lower chamber of the other pump is discharged with it by the pipe R through the upper chamber. The lower chamber is supplied at its upper part in the down stroke by the pipe V. These pumps are being made by Messrs. Stone and Co., of Deptford.

VIOLIN AND HARP STRINGS.

THE manufacture of strings for musical instruments has been carried on from time immemorial in some of the small villages in the Abruzzi, and at the present time, the Neapolitan provinces maintain their superiority in the production of this article. They require the greatest care and dexterity on the part of the workman. The treble strings are particularly difficult to make, and are made at Naples, probably because the Neapolitan sheep, from their small size and leanness, afford the best raw material. They are made from the small intestines, which must be very carefully scraped; the intestines are then steeped in alkaline leys, clarified with a little alum, for four or five days, until the guts are well bleached and swollen. They are next drawn through an open brass thimble, and pressed against it with the nail, in order to smooth and equal their surface; after which they are washed, spun or twisted, and sulphured during two hours. They are finally polished by friction, and dried. Sometimes they are sulphured twice or thrice before being dried, and are polished between horse-hair cords. The strings manufactured in Italy are noted for their strength, transparency, brilliancy, and clearness of tone. This manufacture was introduced into France by a Neapolitan nobleman, in 1766, who established a manufactory at Lyons. This industry is carried on in various other towns in Italy, namely, Gubbio, Foligno, Bologna, Venice, Vicenza, Padua, Verona, and Bassano.

CUTTER FOR REAPING MACHINES.

THE object of the invention illustrated in the accompanying engraving, is to improve the cutting apparatus of reaping and mowing machines, to enable them to cut closer to the ground, and also to cut the crop below the horizontal bar which carries the fingers and knife of the cutting apparatus in order that the top of the uncut stubble shall not come in contact with the under side of the bar, or not to such an extent as hitherto, and thus friction is avoided. For this purpose the fingers are bolted at intervals to the under side of the horizontal bar, whilst on the upper side of this bar is carried the bar to which



the knives are attached as usual; but in place of the knives being parallel with the finger bar, as hitherto, they incline downwards at an angle, so that their points shall come below and cut the crop on the under side of this bar; the slots in the points of the fingers through which the knife works are similarly sloped downwards.

Our engraving shows a sectional view taken through the knife and one of the guard fingers. A is the guard finger bar having the guard fingers B bolted at intervals to its under side as usual; D is the knife bar resting on an inclined surface at the end of the guard finger bar; this bar has a to and fro reciprocating motion imparted to it in the ordinary manner. C is one of the knives or cutting blades attached to the knife bar and inclined downwards, the slots B¹ in the fingers being also similarly inclined downwards. E is one of the knife holders or guides which are bolted at intervals to the top of the knife bar; F is a through bolt, by which the guard finger B and guide E are fixed to the guard finger bar. By constructing the cutting apparatus of reaping and mowing machines with the cutting blades inclining downwards, the points of the knives will cut the stubble on the under side of the guard finger bar A, as shown by the dotted line G in place of cutting the stubble on the line H or parallel with the top of the cutter bar. Mr. W. M. Cranston, of 77, Upper Thames-street, London, is the patentee of this invention.

TREATING FABRICS FOR DYEING OR PRINTING.

IN the manufacture of carpets composed of jute or flax the yarns have hitherto been dyed in the several colours intended to appear on the surface of the fabric, and the designs or pattern have been confined to the production of stripes or checks or plaids, because the expense of producing an elaborate design or pattern upon such material by the aid of jacquard machinery would be too expensive, thereby rendering it impracticable to manufacture a low priced carpet from such material. It is also well known that the treatment required in producing certain colours upon jute or flax by the process of dyeing has had a tendency to make the fibre brittle, and to destroy its strength and elasticity, and to reduce it even to a dust or powder when exposed to wear. This is particularly the case with red, scarlet, dark green, orange, or other high or full colours when acids or compounds of acids and mineral substances are used at a high degree of heat in dyeing to produce a full and brilliant shade of colour. In experiments that have been made in the colouring of jute, flax, or cotton it has always been found that the strength of the fibre is weakened in proportion to the degree of heat and the strength of the dye liquor employed and the length of time required to obtain the desired colour. Hence in producing such colours as are generally known as high or full shades (requiring great heat and strength of dye liquor) the result has always been to weaken the fibre in proportion to the time required to produce the desired shade. After experimenting for several years in the manufacture of jute, flax, and cotton, and especially in colouring the same for carpets or other goods, Mr. Thomas Crossly, of Bridgeport, Conn., United States, has discovered that elaborate designs in colours may be produced upon fabrics woven of a light or heavy character, and either plain or uncoloured, by submitting the same to a process which will prepare it to receive any desired colour in any design however elaborate, and that the colours when applied will be very durable and will not cause the least injury to the fabric.

The following is the process (which has been patented in England), by which this result may be produced:—The cloth after being woven from the raw jute, flax, or cotton in the ordinary manner is immersed in a bath of water, at, say, from 90 to 120 deg. Fah. in which has been mixed a quantity of either wheat or corn bran, together with subor bi-carbonate of soda. After remaining in this bath for a sufficient length of time to thoroughly dissolve the tannin in the jute or cotton, or the gluten or gum in the flax, the cloth must be removed and washed thoroughly in clean water. It is then to be immersed in a bath of cold water mixed with a solution of crystallized tin and muriatic acid or strong muriate of tin with twenty per cent. of oil of vitriol or sulphuric acid at a strength of from 1 to 2 deg. Twaddell. When the cloth has been impregnated with this bath it is to be again washed in clean water and then submitted to a bath of a weak solution of chloride of lime, after which the cloth is to be washed clean and dried, and it will then be ready for printing or dyeing.

For preparing the fabric to receive Prussian blue or other prussiates a different proportion or strength of preparation to that above mentioned should be employed. For Turkey reds or crimsons any other alkali than that above mentioned, or another bath, may be used to dissolve and clean out the tannin or gum from the fibre, and other well known chemical combinations or mordants may be employed to prepare the fibres or fabric to receive the colour; and other suitable baths or treatment may be employed to bleach or whiten the fabric in lieu of chloride of lime. Thus, instead of chloride of lime, sulphurous acid, or the fumes produced by the combustion of sulphur and saltpetre, may be employed, and a similar or better effect may be obtained. The essential feature of the present invention is that by the process we have described, the tannin or gluten may be removed from the fibres without the least injury to them, and the fibres may be impregnated or mordanted so as to prepare them to receive the colours, and may be bleached in order to obtain a good white.

Carpets or other fabrics dyed or coloured in any colours, or pattern, or design, may thus be produced by the process of dyeing or printing without weakening or injuring the strength of the fibres, and at the same time a carpet or other fabric having all the richness and style of woollen or worsted goods, with equally durable colours, may be produced. This result has never been obtained before by dyeing or printing cloths composed of jute, flax, or cotton, and by this invention carpets may be produced from flax or jute, or cotton, or other vegetable fibre at a price very much less than when made of wool or any other animal fibre, the result of which will be a great benefit to the public.

UNAPPRECIATED GENIUS.

THE following extract from a "hitherto unpublished comedy" is given in the American "Army and Navy Journal." It will be understood by the light of the few remarks on the subject of the proposed American Naval Board of Survey, which we have made in an early portion of our paper.

[SCENE.—*A room in the Bureau of Steam Engineering. Isherwood with his hands to his head. Room in confusion.*]

Isherwood. Oh! you ungrateful country to treat me thus! I might say, with the poet, "'Twas ever thus, from childhood's hour, I've seen my fondest hopes decay." Dash pots and oil feeders! (getting excited). I'll leave the navy, and offer my services to the King of Abyssinia, he will appreciate me, or the King of the Sandwich Islands, he's used to big canoes, and will appreciate my style of vessel. To think that my genius cannot be understood! That Dickinson's at the bottom of all this.

[*Enter Member of Congress from "Scrap Heap" District.*]

Member. Ah! my dear Rear-Admiral, how are you this morning, and why so blue looking? What has occurred to disturb your machinery? Is your cut-off out of order? or don't your air pump work well? or is your expansion contracted more than you can bear? Perhaps your shaft is out of line, and propeller won't work. Or is it, old fellow, that you can't raise steam enough on your boiler to keep up with your ambition.

Isherwood. Cease this railing, "I'm not in the vein." I'm going to leave the country, and go to Timbuctoo, and see if I can't work expansively there.

Member. But, my friend, what good will that do? You can't find enough iron there to build one of your engines; they have only enough for arrow heads.

Isherwood. I'll take brass enough with me there to build all the engines I want.

Member. But tell me, Ben, is it true that you broke up Dickinson's engine that cost 400,000 dols., and threw it into a scrap heap? Mind how you answer, I'm a committee of Congress; but I notice you say so in your report.

Isherwood. Did I say that? Well, it must be so. I broke it up because Dickinson said: "Consider the lilies of the field, they toil not, neither do they spin; but I say unto you that even Solomon, in all his glory, was not arrayed like one of these." He meant me, with all my laced clothes on, and his engine went into the scrap heap for it.

Member. But could you not have sold it for something, and placed the money in the treasury; the country is much oppressed with taxes, and economy is all the fashion now.

Isherwood. Economy, taxes, oppressed country, what has that got to do with steam? "No pent-up Utica contracts our powers," we work expansively without any cut-off. I don't study economy anywhere. The only economy I think of is economy of space, that is to build ships that will hold the largest quantity of machinery, and leave room for nothing else.

Member. But tell me, Ben, why is it that your ships won't go after all this amount of engine is put in them, and they don't make over seven knots at sea?

Isherwood. That's all gammon. Dickinson pays all the navy fellows to say the ships don't go. I have nothing, in fact, to do with the ship's going. My engines all go, I can swear to that. Now you see we want more scientific men in the line, and, in their absence, we scientific engineers must take charge. Do you understand mathematics? If you don't, you can't comprehend me and my system. In any right-angled triangle the square of the hypothenuse is equal to the sum of the squares of the other two sides, and any parallelopipedon may be changed into an equivalent rectangular parallelopipedon equal to the versed sine of the square root of ten, by which you can tell to an ephography how many tenpenny nails it would take to shingle a bird's nest.

Member (in astonishment). Is that so?

Isherwood. Yes sirree! and if you will read my book you will see it all proved there.

Member. But to return to our muttons, Ben, why won't the Wamp-a-what's-her-name go after all the money that has been spent on her, and how about the twenty-four engineers looking after her

Isherwood. She will go when I choose to let her. I am just trying to see how much coal can be consumed in a given time, to find out how long our coal mines will last after I get all my vessels in motion, and I have to keep twenty-four engineers there to watch Dickenson's men, who are all around trying to put his cut-off on to my engines.

Member. Is that so? Well, people do lie! But, Ben, how is it that in this time of sore distress you slip into the estimates for yards and docks the following sums:—New York yard, 805,410 dols.; Portsmouth, New York, 150,000 dols; Boston.: 416,850 dols.; Norfolk 25,456 dols.; Pensacola 29,146 dols; besides asking for so many millions,, when you already had so much money on hand?

Isherwood. If, sir, you can't understand the square of the hypothenuse and the parallelopipedon hypothesis, you can't be made to comprehend my system of estimates. They are all based on the most abstruse mathematics. They are, sir, a tub to

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the whale. I have no idea that Congress will pass them, but the mechanics will bite at them, and overlook all I have said to their disparagement in my report.

Member. On what grounds do you claim to be made a rear-admiral?

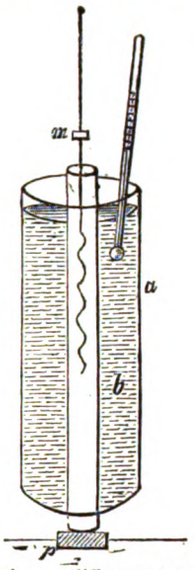
Isherwood. On the theory of expansion. I think our corps wants superheating, and to have each grade superheated to something higher. I have only ranked over three grades since my first entrance into the navy, and I want to expand till I burst.

Member. That will evidently soon occur, for you are, now, Ben, very much in the condition of the frog who wished to outswell the ox. Good morning.

[EXIT. *Curtain drops.*]

A THERMOMETER UNAFFECTED BY RADIATION.

DR. JOULE has communicated to the Literary and Philosophical Society the following method of constructing a thermometer which is unaffected by radiation. In our engraving, *a* is a copper tube about one foot long, and has a tube open at both ends in the centre. Water is poured into the space between the two tubes. In the centre tube there is a spiral of fine wire suspended by a filament of silk, and having a mirror at *m*. There is a lid at *p* which can be removed at pleasure from the lower end of the tube. When *p* is situated as in the figure, there can be no draught, and consequently the spiral with its mirror is at zero of the scale. But when *p* is removed, there is a current of air which turns the spiral, if the



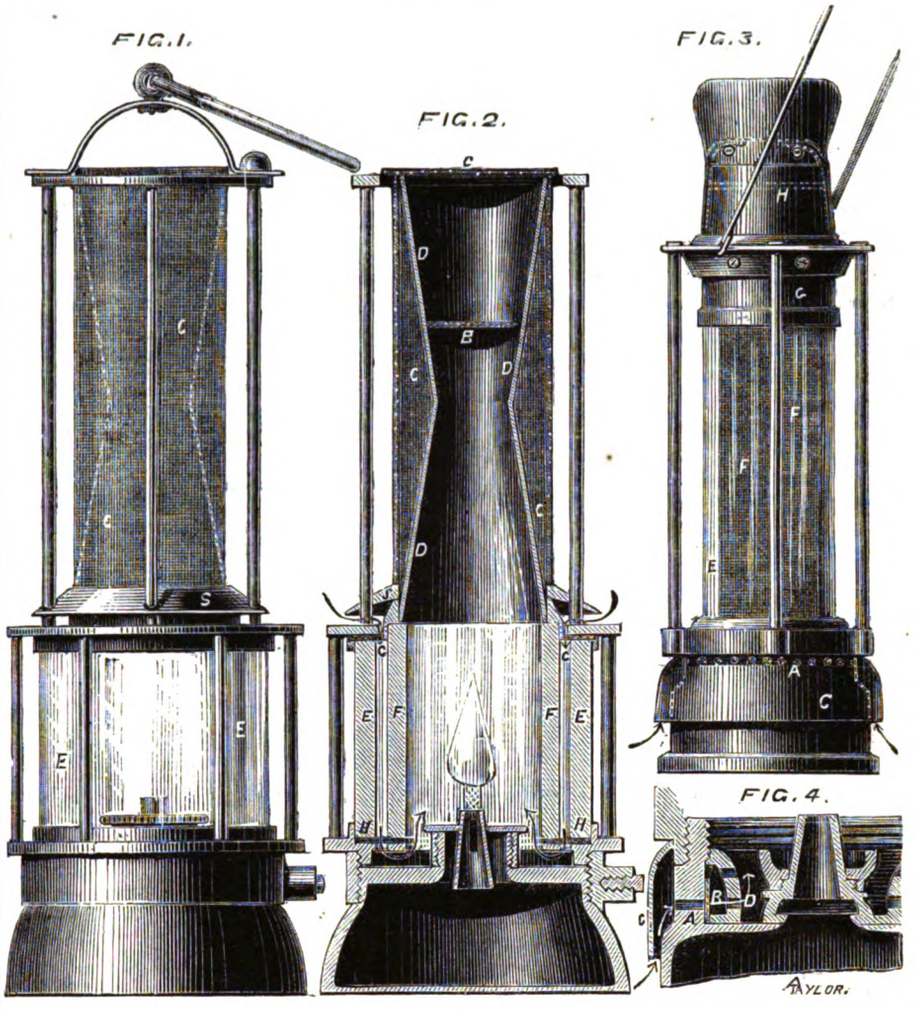
air in the tube has a different temperature from that of the outside atmosphere. In Dr. Joule's apparatus, one deg. Fahrenheit produces an entire twist of the filament. He finds that the temperature in the tube is generally warmer than in the outside atmosphere of a room, which must be owing to the conversion of light and other radiations into heat on coming into contact with the copper tube. The Doctor has tried the apparatus in the open air on a still day, with the same result. Of course when there is wind the effect is masked, but by increasing the length of the tube, making it 30ft. for instance, and using certain precautions, Dr. Joule thinks this difficulty may be overcome.

QUEKETT MICROSCOPICAL CLUB.

THE usual monthly meeting was held at University College on Friday evening, Mr. Arthur E. Durham, president, in the chair. Mr. M. C. Cooke read a paper on The Hairs of Indian Bats. He described and illustrated the microscopical characters of hair from forty-five species of cheiroptera found in India and the countries contiguous thereto. This subject possesses a special interest from the fact that a kind of bat hair from India has been used as a test object for twenty-five years, without its source having been scientifically determined. The paper was illustrated by forty-five diagrams, which, together with 100 slides of the various hairs, mounted, dry, and in balsam, were presented to the club at the close of the meeting. A discussion followed, and a vote of thanks was given to the author. Eleven new members were elected, and the meeting terminated with a *conversazione*.

MINER'S SAFETY LAMP.

By Mr. D. P. Morison.



MINER'S SAFETY LAMP.

MR D. P. MORISON, of Pelton Colliery, near Chester-le-Street, Durham, mining engineer, has just patented the miner's safety lamp shown in the accompanying engraving. His improvements relates firstly, to lamps in which the air necessary to support combustion is admitted through perforations above the cylinder or cylinders surrounding the flame; and, secondly, to lamps in which such air is supplied through perforations below the said cylinder; and are designed to prevent, in an explosive mixture, any communication between the flame of the lamp (or any ignited gas inside the lamp) and the surrounding explosive mixture, even when the explosive mixture presses against the lamp at a high velocity. In lamps where the air enters above the cylinder surrounding the flame, Mr. Morison employs for the top of the lamp, in lieu of the metallic wire gauze now generally in use, a cylinder of sheet iron or brass forming a chimney. In this chimney he places, at short intervals from each other and from the top, discs of wire gauze or perforated copper. By this means he effectually prevents any communication between the exterior surrounding explosive mixture and the interior of the lamp by the top of the lamp. The air for sustaining combustion is admitted at the top of two cylinders of glass surrounding the light through a ring of wire gauze, and is conveyed downwards between these cylinders to the wick of the lamp after again passing through one or more rings of wire gauze or perforated copper placed near the bottom of the cylinders. Over the top of these two cylinders is placed a protecting shield of wire gauze, in order to break the force of any strong current of explosive mixture. By these means a lamp is formed which has been proved by experiments to be practically safe, even in a strong current of explosive mixture.

Fig. 1 of the accompanying engraving is an elevation, and fig. 2 a vertical section, of Mr. Morison's lamp. E F are two cylinders of glass having an annular space between them, down which the air necessary for sustaining combustion passes, as indicated by the arrows; G is a ring of wire gauze at the top of the annular space, and H represents one or more rings, also of wire gauze, at the bottom of the space through which rings the air passes before entering the inside of the lamp. S is a protecting shield to break the force of a strong current of explosive mixture. D is the chimney forming the top of the lamp, and composed of two converging cones of brass or other metal. B is a disc of wire gauze inserted in the upper part of the chimney D. C is an outer cylinder of wire gauze, which, however, may be dispensed with.

In lamps in which the air is admitted through perforations placed at the bottom of the lamp, the air is made to pass under a protecting shield of brass or other metal through a series of perforations, then through a ring of wire gauze and another series of perforations before reaching the flame. In this lamp is a cylinder of glass which entirely surrounds an interior cylinder of wire gauze, and prevents any current whatever of air or explosive mixture reaching the interior of the lamp. A lamp constructed in this manner has been proved by direct experiment practically safe, not allowing the flame to pass, even at very high currents. Another benefit obtained is the obviating, by means of the shield, of any obstruction by dust or other matter to the passing of the air through the perforations. Fig. 3 is an elevation, and fig. 4 a vertical section, of the lower part of a lamp constructed in the manner just described. C is a shield to protect the perforations from strong currents of explosive mixture, and from becoming obstructed by dust or other matter. A is an outer series of perforations; B a ring of wire gauze, and D an inner series of perforations, through whtch two series of perforations and ring of gauze the air for sustaining combustion must pass before reaching the flame. E is a glass cylinder entirely surrounding an interior cylinder F of wire gauze. G is a socket into which the upper part of the glass cylinder E fits. H is a disc of wire gauze at the top of the lamp.

A NEW opera house has been erected in New York. It is built of white marble, and its architecture is Italian. One of its fronts is 120ft., and the other 112ft. wide, and the building is 325ft. long. The entrances lead into a vestibule, 40ft. wide, 80ft. long, and 30ft. high. From this ante-room a staircase leads to the dress circle of the house. From the front row of the dress circle it is 185ft. to the footlights. Above is the family circle, below the parquet, and the house will seat 2,600 people. From the floor to the ceiling is 70ft.; the stage is 70ft. deep, 80ft. wide, and 50ft. high.

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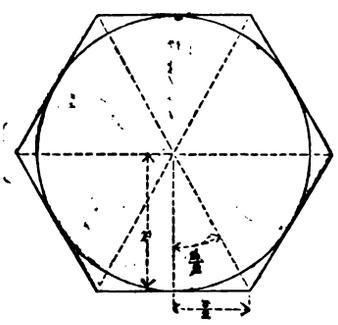
Correspondence.

SQUARING THE CIRCLE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I see from your impression of January 3, that Mr. Harvey is still writing about the squaring of the circle, in spite of his having been quite unable to demonstrate his proposition. Up to the present time your correspondents (including myself) have only shown that there is a hitch in Mr. Harvey's demonstration. I intend to show now that Mr. Harvey's proposition is an absurdity. For this purpose I shall demonstrate that Mr. Harvey's value for the area of the circle is as near as possible equal to the area of a regular polygon of thirteen sides circumscribed to his circle.

For my demonstration I must presume that Mr. Harvey allows the values of the trigonometrical functions in general, and of the tangents in particular, to be correct as given in any table of logarithms, or any other collection of mathematical tables. Mr. Harvey must allow the correctness of these tables, because all the values contained in them can be calculated without making in any way use of the ratio of the diameter of the circle to its circumference.



For any circumscribed polygon of n sides of the length s, the area, A, is $A = n \frac{s}{2} r$; r being the radius of the inscribed circle.

From the diagram it will be seen that:

$$\frac{s}{2} = r \text{ tg. } \frac{a}{2} = r \text{ tg. } \frac{360^\circ}{2n} = r \text{ tg. } \frac{180^\circ}{n}$$

If this value of $\frac{s}{2}$ is substituted in the equation for A, we find

$$A = n r^2 \text{ tg. } \frac{180^\circ}{n};$$

and for a polygon of thirteen sides we find

$$A = 13 r^2 \text{ tg. } \frac{180^\circ}{13}$$
$$= 13 r^2 \text{ tg. } 13^\circ\ 50'\ 45'',6$$
$$= 3{,}20414\ r^2$$

If the same calculation be made for a circumscribed polygon of fourteen sides, we find

$$A = 14 r^2 \text{ tg. } 12^\circ\ 51'\ 25'',2$$
$$= 3{,}19536\ r^2$$

The first calculation shows that Mr. Harvey's formula gives the area of the circle only about 0,128 per cent. smaller than the area of the circumscribed polygon of thirteen sides. This is not very remarkable, but it is most extraordinary that according to the second calculation the area of the circumscribed polygon of fourteen sides is actually 0,144 per cent. smaller than the area of the circle, calculated by Mr. Harvey's formula. Of course all the circumscribed polygons of more than fourteen sides have, according to Mr. Harvey, smaller areas than their circles, which is a clear demonstration of the incorrectness of Mr. Harvey's formula.

Perhaps many of your readers do not understand trigonometry, and are therefore not convinced by the above calculations. If they wish to be convinced that Mr. Harvey's formula is an absurdity, I advise them to strike a circle of 1 foot diameter, and to draw the circumscribed regular polygon of twenty sides. If the drawing be made with the necessary precision, they can (with a rule divided in 1-100th of an inch) measure the sides $= 1'',90 = 0{,}15833\ldots$

This side multiplied by $\frac{1}{4}$ radius $= 3'' = 0{,}25$ gives the area of one of the twenty triangles, and the sum of the twenty triangles gives the area A of the polygon.

$A = 20 \times 0{,}15833\ldots \times 0.25 = 0{,}79166\ldots$ square feet. (The exactly calculated area is $= 0{,}79191$ square feet).

Now, according to Mr. Harvey's formula, the area of a circle of 1' diameter is $= 0{,}80$ square foot; or 0,00834 square foot, or about 1,2 square inches larger than the area of the polygon, whilst everybody can see from the drawing that the polygon is larger by the twenty little triangles between the circle and the polygon, the sum of the areas of which is $= 0{,}00651$ square foot $= 1$ square inch nearly. Before Mr. Harvey goes on proclaiming his (as I have shown) absurd proposition, he would do well to explain, first, how it happens that his circle can have a larger area than the circumscribed polygon of more than fourteen sides.

The area of a circle by Mr. Harvey's rule is too large by nearly 2 per cent., whilst the area found by Mr. Hayden's rule (see his letter in the MECHANICS' MAGAZINE), is only about half per cent. too small.

If, therefore, any one wishes to square the circle by drawing, instead of using a table of areas or a good slide rule, he may use Mr. Hayden's construction, but never Mr. Harvey's rule, which has only shown that Mr. Harvey blundered, and is unwilling, or unable to see his blunder.—I am, Sir, yours, &c.,

January 13. A. W.

SIR,—Your journal is highly appreciated by your cousins on this side of the Atlantic Ocean, as giving for its price an amount of practical information greater than any other similar journal existing; but allow me, also in name of scientific, as well as practical men, to enter our protest against devoting so much valuable space to the vagaries of men who evidently are not clear about the first principles of mathematics or mechanics. It is not only your space wasted, but also the time for the thousands who read your valuable paper. Need I tell you that I refer to the long-winded letters on the quadrature of the circle by a certain Mr. William Harvey, 10, Albert-terrace, Albert-gate, London, S.W., and also the answers and criticisms on those letters, found in almost every number of the MECHANICS' MAGAZINE since October last.

Already in 1610 Ludolf van Ceuler published his book on the circle, containing the famous Ludolfian number for the circumference of 35 decimals; this book was then published to refute the theories of those who, without understanding much of geometry, already at that time pretended to have discovered a particular method of finding the relation of the diameter to the circumference, but, of course, always came to a number larger than a certain circumscribed polygon, or smaller than a certain inscribed polygon, which, of course, shows at once some error in their demonstration. Since that time, about every year, some publication appears, either in England, France, Germany, Holland, &c., of some very deficient mathematician who thinks he has made a discovery in this line. I have before me two books and three pamphlets, published here during the last decade, on this very subject; the authors all find an erroneous ratio, and some even, to save their theory, maintain that the circumference lays outside of the circumscribed polygon, as soon as this has a great many sides. Mr. Harvey goes further than any of them; the circumference of his circle, being 3 and 1-5th diameter, lays outside the circumscribed polygon of 16 sides. However, Mr. James Smith, according to the London "Athenæum" of 1861, beats him in this respect; the circumference of his circle is 3 and 1-3rd diameter, and is thus outside the circumscribed polygon of only 8 sides. Also at that time an amount of notice was taken of Mr. Smith's publication which surprised us here; the British Association even meddled with the subject, the London "Athenæum" devoted more than four columns to it, and Sir Rowan Hamilton published a demonstration against Mr. Smith's conclusions.

During the time (1859-1864) that I was connected with the Cooper Institute in this city, as many as fourteen persons applied to me, stating that they had found the quadrature of the circle, and some ten or twelve others who believed they had found perpetual motion. For the benefit of those persons I published for private distribution a pamphlet containing a condensed historical account of the most important and highly interesting results, arrived at by the researches of men, fully prepared to enter upon the investigation of such a subject. This pamphlet was always presented to any person who called on me upon the above-mentioned errand; it saved me considerable time, which otherwise would have been spent unprofitably.

Those attempts at the quadrature by ignorant persons appear to be a chronic disease of a part of society—a kind of insanity—as mostly it is found impossible to convince them of error. The traditional notion entertained by some of them, that certain governments have promised large premiums for its solution, contributes most surely to keep the contagion alive; but it is high time that all should know that the Royal Society of London, and the Academy of Sciences in Paris, already in 1775 resolved never to examine any more papers on the quadrature, trisection of angle, duplication of the cube, or perpetual motion; those learned bodies found already a century ago, that all would-be discoverers in those problems were either very ignorant or suffered from a kind of mental aberation called monomania. I have sent you here a copy of the pamphlet mentioned above.—I am, Sir, yours, &c.,

P. H. VANDER WEYDE, M.D.,
Late Professor of Higher Mathematics and Mechanics at the Cooper Institute of Chemistry, at the New York Medical College, and of Industrial Science at the Girard College, Philadelphia.

New York, December 26.

[We are obliged by Professor Van de Weyde's compliment, and accept his protest. But in keeping up the fire of the circle squaring discussion, is his practice not a little at variance with his theory? However, as we happen to know that the correspondence interests a number of our readers, we shall continue the discussion until they have had enough, which we think will be soon. We must bear in mind that our readers are not all professors, nor have they all the same turn of mind. With regard to the main question, it practically comes to what the author of "Festus" says in a later poem:—

"Disputed points stand where they always stood,
And doubtless will do till another flood."

and this is the gist of Professor Van de Weyde's letter, for which we thank him, and assure him that his name and writings are neither unknown to nor unappreciated by the readers of the MECHANICS' MAGAZINE.—ED. M. M.]

LETTER III.

SIR,—Geometricians have, I believe, a contempt for a simple measurement as a proof; yet, notwithstanding, I hold the true determination of the length of the circumference of the circle to be one of pure mechanical decision. By means of lathes and planing machines we can obtain a perfect circle and plane; and if Mr. Whitworth, for example, would undertake to do so, and roll a cylinder over the plane in conjunction with a line engraved upon its side and two lines upon the plane to correspond with a revolution, repeated back and forwards several times for correctness, and compare it with the calliper diameter by means of the delicate measuring apparatus which he possesses, I confess I should put faith in it in preference to that of any astronomer computed from the revolution of celestial bodies. For which I have a good reason:—In the first instance, we should have a perfect circle and plane to operate upon; in the second we should not. And I would ask Mr. H. Wood and "R. N.," who have laid such stress upon this mode of proof, where they will find a celestial body making a perfect circle? Take the earth and moon for examples. When the earth is between the moon and sun the joint attraction of the earth and sun upon the moon is greater than when the moon is between the earth and sun, for then their attraction upon it is opposed—so the moon's course cannot be a perfect circle.

With regard to the earth—as the influence of attraction depends upon the quantity of matter, that of the moon upon the earth is in due poroportion, and draws the earth towards herself in her revolutions round it sometimes in conjunction with the sun and sometimes in opposition (proved by the tides), and must give from this cause alone an oblate spiral motion to the earth, so the earth revolves round the sun not in a plain circular line, but in a flattened spiral one; and when, in addition to this, the action of the planets, erratic and other bodies known and unknown (for the theory is that attraction acts through all space), is taken into account, I think I have shown a good reason for my question and preference. However correct in point of time astronomical calculations may agree with the accepted formula of endless decimals, it is not an equal proof of the proportion of circumference and diameter, for the reasons which I have given, namely, that there are no bodies making perfect circles to calculate upon. So, if they agreed, it should rather be a proof that they are not correct than that they are.

But even upon the point of time I would ask astronomers the question, Whether or not they would discover if the earth were temporarily delayed or accelerated on its axis from any cause? For, as the revolution at the meridian is the data of time, what if the meridian (so to speak) were behind or before time, would they do to discover or correct it? Upon this element, nevertheless, rests the proof of those inconceivable arrays of decimals which are given as proportions of the circle, and of which Mr. Harbord is the most moderate of champions, being content in one case with only 27 odd billions as a finite proof, which is a mere drop in the ocean to some others. I am far from an unbeliever that as the course of the earth is influenced by so many and varying causes, its revolution may not also be temporarily accelerated or retarded by some of them, and, therefore, the true time as well. When such a thing happens, the best clocks and chronometers keep the worst time of course. In which case I, for one, possess a very excellent timepiece. Practically, I shall never be brought to the belief that it indicates when the earth is going too quick or too slow. And, touching those wonderful decimals again, I would observe that when we consider that an object is lost to sight that does not show up under a magnifying power of 30 millions of times, what kind of a proportion of two lines is that which is billions of trillions of times less than anything we can possibly see? I quite agree with Mr. Harvey in regarding them as monstrous absurdities, due either to the method by which they are eliminated, or to the imperfect annotation of our numerals.

As this letter has already trespassed at a considerable length, I must beg of you to allow me to complete it at a future time, and show the geometrical method by which I propose to get the circumference of the circle, subject, however, to the most absolute

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repudiation if it should not agree with the mechanical measurement under the conditions I have stated.—I am, Sir, yours, &c.,
January 21. JOSEPH A. NICHOLSON.

SIR,—May I presume to say that although Mr. J. A. Nicholson's definition of the circle being equal to a parallelogram half the length of its circumference by half its diameter is no doubt correct, yet this was well known long ago, and does not, that I can see hold us to definitely square the circle, but only (if I may coin a word) to parallelogramize it. Perhaps, however, Mr. Nicholson intends to "lead up to a square."—I am, Sir, yours, &c.,
January 24. THOMAS SCUTT.

SIR,—In your impression of January 3, Mr. Harvey, in reply to Mr. Hayden, states "that if he will persevere he can divide and put together mechanically the four spandrils E, and the squares F I G H, so as to be together equal to twice the square F I G H." Now, if Mr. Harvey can do this, why does he not do it at once and settle the controversy between him and his numerous opponents. If he can do it we (your readers) will be happy to follow him in his researches into the pyramidical angles, &c., but so long as he leaves this unexplained, his arguments therefrom must be considered totally unsatisfactory. If he supposes from the flagging of the controversy that his proofs are generally considered satisfactory, he is quite mistaken. If there be really any connection between the Pyramid and the ratio of circumference to diameter, I should be inclined to find it in the angle of the passage 26deg. 40min., the line of which approximates very remarkably to the value of the fourteenth part of the circumference, as calculated by the ratio in common use.—I am, Sir, yours, &c.,
January 27. THOMAS C. HAINES.

PETROLEUM FURNACES.

SIR,—Referring to the letter in your last issue, signed C. I. Richardson, in which the experiments made with Mr. Thomas Crow's patent are the subject of remark, and feeling that it can in no way apply to the patent obtained by our Mr. S. E. Crow, there being in the last-named patent no part of the apparatus exposed to the action of the heat, its principle being to prevent the flames from impinging upon either the boiler or the furnace; and fearing that the names being similar may cause confusion, we should feel obliged by your inserting this letter.—We are, Sir, yours, &c., S. E. CROW & Co.
Chemical Works, Stratford, January 25.

Meetings for the Week.

MON.—Society of Arts.—"Preservation, Preparation, and Culinary Treatment of Foods," at 8 p.m.
Royal United Service Institution.—Captain J. H. Selwyn, R.N., on "Further Information on the Employment of Mineral Oils as Fuel for Steam Ships," at 8.30 p.m.
Society of Engineers.—Dr. Cullen on "The Surveys of Proposed Lines for a Ship Canal between the Pacific and Atlantic Oceans," at 7.30 p.m.
Royal Institution.—General Monthly Meeting, at 2 p.m.
TUES.—The Institution of Civil Engineers.—Mr. A. C. Howden, A.I.C.E., on "Floods in the Nerbudda Valley; with Remarks on Monsoon Floods in India Generally." Discussion upon "Fresh Water Floods of Rivers," at 8 p.m.
Royal Institution.—Professor Tyndall on "The Discoveries of Faraday," at 3 p.m.
THURS.—Royal Institution.—Professor Tyndall on "The Discoveries of Faraday," at 3 p.m.
FRI.—Royal Institution.—Professor Huxley on "The Animals most Intermediate between Birds and Reptiles," at 8 p.m.
SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—G. H.—G. E. P.—H. S. C. and Co.—J. G. N. A.—T. S.—Messrs. D. and M.—J. H.—R. J.—R. B. P.—J. W.—B. F. F.—S. L. L.—J. H.—W. P. M.—Dr. D.—Messrs. C. M. and Co.—J. H.—R. T. B.—W. H.—W. J. M.—R. S.—J. S. and Co.—J. B. T.—M. B. W.—J. F.—S. E. C and Co.—W. S.—Messrs. S. Bros.—T. C. H.—W. H.—E. M.—R. S.—J. W.—S. E.—J. C.—J. W.—D. C.

Naval, Military, and Gunnery Items.

THE "Hercules" has the whole of her armour-plating fixed, the date named for her being floated out of dock being the 8th of February.

A MEMORIAL has been presented to Congress asking for a Government subsidy to support an American line of steamships between New York and one or more European ports.

THE new class of twin-screw composite unarmoured steamers of the "Beacon" class, a complete squadron of which is either completed or building, are to be officially designated as gun-vessels of the second class.

IT is stated that early on Friday morning one of the guns at the fort of Duncannon, Passage West, near Waterford, was spiked. No information is procurable on the subject, and no clue has been found, nor have the police any suspicion of the "spiker."

ON Saturday last, Mr. E. J. Reed, who has recovered from the effects of the late railway accident, paid an official visit to Chatham dockyard, and was engaged for some time in inspecting the iron-clad turret ship "Monarch," and the "Hercules," building from his designs. Mr. Reed also inspected the "Blanche," fitting for a term of service in Australia.

MARSHAL NEIL has lately made experiments in France with the wood gunpowder invented by Capt. Schulze. It is found to be extremely advantageous for rifles, as it leaves no fouling. The English Government should not overlook it, when determining the rifle of the future. The chamber ought to be a trifle larger than for the common powder, as Schulze's powder, though strong, is much lighter.

THE Board of Trade intend to present Captain Antonio M. Budinich, master of the Austrian barque "Ebe," with a binocular telescope, in recognition of his services to the crew (12 in number) of the "Eudora," of Sunderland, who were rescued by him from their sinking vessel on the 30th November last, and landed at Constantinople on the 5th December. Captain Budinich generously refused to accept any compensation for the subsistence of the shipwrecked crew whilst aboard the "Ebe."

THE "Toronto Globe," gives the following account of the Volunteers and Militia of Canada:—There are in Ontario and Quebec 31,194 Volunteers (officers and men); in Nova Scotia 1,002, and in New Brunswick 1,791. The service Militia of Ontario consists of 48,496, that of Quebec numbers 40,545; in New Brunswick there are 35,412 Militiamen, and in Nova Scotia 58,031. The Militia of Nova Scotia and New Brunswick are partially drilled and organized; in the last named province turned out for five days' training during the past year.

MESSRS. HENDERSON, Coulburn, and Co., of Renfrew, have just launched a composite screw of 850 tons, built for the East India trade. This vessel has been named the "Sakura," and she is being now fitted by the builders with a pair of compound engines of 110 horse power, nominal. Messrs. R. Duncan and Co., of Port Glasgow, have contracted to build a paddle for Messrs. J. Brymner and Co., of Greenock. Messrs. Robertson and Co. have contracted with Mr. J. Kincaid, of Glasgow, to build and engine a saloon steamer for the South American river trade.

ON Saturday last an experiment was made at the Lyons Railway Station as regards the transporting of cavalry and infantry per train in fewer carriages than have hitherto been used for the purpose. A company of sappers, another of gendarmes, the band of an infantary regiment, two squadrons of Curiassiers and of the Carbineers of the Guard, were ordered down under the command of M. de Langalerie—horses and men in marching order. The object was first to try whether twelve men with their horses could travel in the space hitherto occupied by eight. Whether this was accomplished is not stated.

WRITING from Malta on the 22nd, the "Times" correspondent says:—Lieut-Col. Clarke, Royal Engineers, Director of Admiralty Works, returns to England by the present mail, without any settlement having been come to regarding the long-pending harbour question between the Admiralty and the Malta Government, which, as the Chief Secretary to Government stated at the last sitting of council, has weighed for the last eight years like an incubus on the island. The offer which Colonel Clarke has been authorized to make respecting the valuation of the property in the French creek is said to be substantially the same as that which had been previously rejected. The question will now have to be settled by correspondence.

Miscellanea.

WE read that a man at Detroit has skated 60 consecutive hours for 500 dols. Towards the last, blankets had to be held about him to keep the wind from blowing him over.

IN Berlin there is some fear of a temporary failure of coal, as the merchants had not laid in a sufficient supply, and it is just possible that some of the manufactories may have to stop work for want of steam power.

THE total production of anthracite coals in the United States during 1867 is estimated at 12,750,000 tons, an increase of 250 tons over the yield of 1866. 214,000 tons of coal, mainly cannel, were imported from Great Britain during 1867.

THE council of the Aeronautical Society have decided upon holding an exhibition in London of objects connected with aeronautical science, in the month of June. Arrangements have been made for the exhibition to be held at the Crystal Palace.

LAST week two young men were buried under a mass of earth while at work in a chalk pit, at Farningham, Kent. They were soon extricated, and conveyed by train to St. George's Hospital, Hyde Park, where it was found that both had sustained compound fracture of the legs, besides other serious internal injuries.

EXPERIMENTS were recently made with the electric light in the gardens of the Royal Horticultural Society by the Royal Engineers stationed at the South Kensington Museum. Many of the Fellows feel interested in the question of illuminating these gardens, and we understand that further experiments are contemplated during the coming season.

THE Havre journals speak of a dreadful tempest which burst over that place a few days back. The sea rose and carried away not only the whole of the palisade at the Gosset baths, but destroyed several of the bathing machines, damage being caused on that point alone to the extent of 4,000f. The works in course of execution for the Maritime Exhibition were much injured, and two blocks of masonwork for the gallery blown down.

A TABLE published in the "Moniteur" shows that the highest price of land in Paris is generally for places in the neighbourhood of the theatres. Thus, the various sites near the Theatre Francais, either in the Rue Richelieu, the Avenue Napoleon, or the Place in front, have fetched per square metre 1,056f., 1,200f., and even 1,300f. Near the new opera the figures have varied from 600f. to 1,040f., the new Vaudeville from 1,000f. to 1,250f., the Gaite from 450f and upwards.

ANOTHER very interesting discovery has been made near Malton. Last week workmen commenced getting up clay in a brickyard at Norton, and at the depth of nearly 4ft., found a very fine and quite perfect rubbed flint axe. The implement is 6¼in. long by 2in. wide at the cutting edge, and has the other end tapering to a point. The axe is of the chisel shape. The discovery was made about 150 yards from the river Derwent, and but a short way from the ancient intrenchments at Malton.

WE hear that a new line of telegraph is likely to be laid from the Tyne to Denmark, which promises to give not only much cheaper messages to Denmark, Norway, Sweden, and the north of Russia, but much greater speed and accuracy. One-fifth of the whole capital for this line, it is said, has been subscribed by the Danish Government; altogether, £85,000 has been already subscribed; and the specification for the cable is to be settled by the Danish Government. The United Kingdom Telegraph Company are to work the line direct from London to Copenhagen—a distance of about 1,000 miles.

ONE of Vivian's tunnelling engines was in operation at Mr. Greaves's slate quarry, Festiniog, last week, but with what amount of success it is difficult to say, as the engine, it would appear, has not been satisfactorily put to work, only two instead of three boilers generating the air by which the revolving apparatus, to which about forty-eight drills are fixed by means of screws, is worked. When the three boilers are at work, the men attending the engine entertain the most sanguine expectations of its successful operation. The level is driven through the slate rock, in close proximity to the hard rock which separates the main vein from the new vein, as it is called.

RECENT letters from America state that the track of the Union Pacific Railway, to which line we made special reference in our last, has been laid to a point 540 miles west of Omaha, and is now said to be "down" within ten miles of the rocky mountain range known as the "Black hills." It is said that the track is laid loosely, and with no view to permanence, the object of the contractors being to secure the Government subsidy as soon as possible. The road has been built with Government funds, in fact; before it can be made secure or profitable, it must be re-laid over at least half its length. This accounts for the wonderful rapidity with which the line has been made.

A LETTER from St. Petersburg, in the "Nord," states that a chemist of Simbirsk has established in that town a laboratory for analysing the various soils of the province which require manuring. Simbirsk s a Russian Government district situated on the Wolga, and is of considerable extent. It has been proverbial for the richness of its black soil, or humus, which is of more than usual depth, but which for many years past has become less and less productive. During the last seventy years the yield of the crops has diminished by fully one-half, and, besides, the quality of the wheat has deteriorated. The land is evidently becoming exhausted, and the Agricultural Society of Simbirsk has very favourably received the proposal of constituting a laboratory for experimentalising.

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IN Captain Shaw's analytical list, the fires of the past year are assigned to some 125 different causes, including "unknown." Candles, gas, and flues seem to be the most prolific source of this kind of danger, having led in the course of the past 12 months, the candles to 205, the gas to 130, and the flues to 116 fires. To children playing with lights and lucifers 39 cases are attributed; smoking tobacco, 32; stoves, 24; hot ashes, 22; lucifers, 22; naphtha and paraffin lamps, 21; turpentine, fat, pitch, resin, and similar substances boiling over, 19. Six houses were set on fire by the inhabitants waging a war of fumigation against bugs and beetles with reckless ardour. A cat managed to burn its master's dwelling by upsetting a box of lucifers, and another disaster was due to a parrot playing with vesuvians.

SINCE the abandonment of the gigantic undertaking contemplated by the late directors of the North British Railway in the formation of a bridge over the Firth of Forth from Blackness to Charleston, where the water is about two miles broad, a project has been started for the erection of a swing bridge across the river a little above Alloa. The proposed bridge would shorten the distance between Fifeshire and Glasgow by about ten miles, and the towns of Dundee, Cupar, Dunfermline, and Alloa would be benefited in their communication with the west of Scotland to that extent. The line would leave the Stirling and Dunfermline section of the North British Railway a little to the west of Alloa, and cross the river on an iron bridge with a central span of 200ft. wide, opening at certain states of the tide to admit the passage of vessels.

RUSSIAN railways are rapidly on the increase. The Ryasan-Morschansk line, a portion of the Moscow-Volga line has just been opened. It is 150 miles long, and has taken only a year and three months to construct. The Koslow-Woronesh Railway, a link in the long line to be laid down between Moscow and the Sea of Azof, will be completed in a few weeks; the Moscow-Odessa Railway is progressing so fast that it will, perhaps, be finished this year; and the works between Poti and Tiflis, a line which, after its extension to the Caspian harbour of Baku, will monopolize a considerable portion of the Persian trade, have just begun. The man to whom Russia is indebted for the rapid development of her railway system, and whose name will not be forgotten in the annals of her might and culture, is Herr Von Delvig, a Courland baron, Government director of railway matters.

THE gentlemen intrusted with the responsible duty of procuring salmon ova from the rivers of this country for transmission to New Zealand have now procured their required stock of impregnated spawn. The operations in the river Severn were completed at Worcester, and about 40,000 ova obtained from that river, under the sanction and personal superintendence of the Board of Conservators of the Severn Fishery District and its officers. Among the fish captured with nets for this purpose were some remarkably fine ones, 28 salmon taken in one draught averaging 20lb. apiece, and some being of from 30lb. to 35lb. Not a single clean fish was captured. Mr. Ramsbottom, of Clitherhoe, in Lancashire, was the operator, assisted by Mr. Vowben, who will have the charge of the ova on the voyage to New Zealand. All the fish when operated upon were returned to the river, and the fishermen believe that some of them would not recover their rough treatment.

A MAGNIFICENT upright steam rolling-engine has just been constructed at the South Brooklyn Engine and Boiler Works, United States, for the Trenton Iron Company. An immense cast-iron open pedestal sustains the cylinder, steam-chest, and connections, the connecting-rod and crank work inside the column near the bottom. The fly-wheel and spur-wheel are secured to the shaft by three massive feathers forged on the shaft, the intervals between which and lugs cast in the interior of the hubs are fitted with hard wood wedges, intended to receive and diminish the jar and concussion to which an engine employed for driving rolls must be subjected. The fly-wheel is 22ft. diameter, and weighs nearly 25 tons. The cylinder is 46in. diameter, and the stroke 40in. The total weight of the machine is 67 tons 13 cwts. The engine is calculated to make 75 revolutions per minute, at a steam pressure of 80lb., and is, although extremely compact, of 1,200 estimated horse-power.

IT is about six years since gold was first discovered in any appreciable quantity in Nova Scotia, and for a good while after the discovery was made, very little comparatively was done in developing this source of national wealth. Gradually, however, the matter has been making progress. And it is now believed that, considering the extent of the gold producing area, the quantity of quartz mined, and the number of men employed, Nova Scotian goldfields are the most productive in the world. Since 1862 about 120,000oz. of gold, or nearly 3½ tons, have been secured, amounting in value to nearly 2,500,000 dollars. The yield in 1867 has not been less than 30,000oz., or about 600,000 dollars, almost half the value of the yearly yield of coal in Nova Scotia. In the Sherbrook district the average yield per miner engaged has risen from 562 dollars in 1862 to 1,669 dollars in 1867. There has been as much as 117oz. of gold got from a ton of quartz, and the average yield over all has been 1oz. and 3gr.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—1735, 1742, 1749, 1814
BUILDINGS AND BUILDING MATERIALS—None
CHEMISTRY AND PHOTOGRAPHY—1808
CULTIVATION OF THE SOIL, including agricultural implements and machines—None
ELECTRICAL APPARATUS—1750, 1755, 1770, 1771, 1772
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—1733, 1734, 1743, 1744, 1752, 1758, 1774, 1795, 1807, 1825
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1751
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1792, 1796, 1805, 1811, 1812
GENERAL MACHINERY—1753, 1756, 1760, 1761, 1768, 1769, 1777, 1779, 1781, 1783, 1799, 1801, 1802, 1809, 1813, 1816, 1818, 1820, 1821, 1823
LIGHTING, HEATING, AND VENTILATING—1668, 1673, 1748
METALS, including apparatus for their manufacture—1739, 1747, 1767, 1784, 1803
MISCELLANEOUS—1738, 1745, 1746, 1754, 1759, 1763, 1765, 1766, 1775, 1776, 1780, 1782, 1786, 1788, 1789, 1790, 1797, 1800, 1804, 1815, 1817
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1736, 1737, 1740, 1762, 1773, 1793, 1798
SHIPS AND BOATS, including their fittings—1697, 1778
STEAM ENGINES—1787, 1791, 1822
WARFARE—1757, 1785, 1806

1717 S. W. WOOD. *Improvements in apparatus for elevating and moving grain, and for weighing and moving grain.* Dated June 11, 1867.

This invention is not described apart from the drawings. —Patent completed.

1718 J. FLETCHER. *Improvements in the construction of retorts for manufacturing and reburning animal charcoal.* Dated June 11, 1867.

This invention is not described apart from the drawings. —Patent completed.

1719 W. ROWAN. *Improvements in machinery for heckling or cleaning flax, hemp, and other fibrous material, and for preparing the same for spinning.* Dated June 11, 1867.

The patentee claims the combination with holders for the fibrous material of ribbed rollers which act upon the fibrous material, such rollers having some of the ribs formed with serrated teeth, or with heckle pins, all being constructed and arranged substantially as described with reference to the drawings.—Patent completed.

1720 J. C. FULLER. *An improvement in telegraphic insulators, and in caps or shields for the same.* Dated June 11, 1867.

This invention consists in making porcelain or other insulators, and the iron or other caps or shields for the same, with perforations or apertures. The invention cannot be described in detail without reference to the drawings.—Patent completed.

1721 J. MILLWARD. *A combined step cover and wheel fender for carriages and other vehicles.* (A communication.) Dated June 12, 1867.

This invention relates to a device for preventing the accumulation of mud and dust on the steps of carriages and other vehicles, and also for guarding the clothes of the rider from coming in contact with the wheels on entering or leaving the vehicle, and consists in attaching to, or hinging upon, the door of the carriage a flexible plate of sheet steel, or other suitable material, the lower part of which is fitted with a bar having one end hinged or coupled to a loop formed in a flange upon that side of the step which corresponds to the hinging of the door.—Patent completed.

1722 J. F. BOETIUS and J. EICHHORN. *Improvements in the manufacture of types for printing.* (A communication.) Dated June 12, 1867.

In carrying this invention into effect the inventors first prepare by the electrotype process a plate of copper, or any alloy or suitable metal harder and more durable than the well-known type metal, with type heads ranged in proper rows. They then moisten the plate with hydrochloric acid, saturated with zinc, which plate is afterwards rubbed with an alloy of tin and zinc. The plate is next placed in a corresponding mould, and is then strongly heated on a glowing or very hot plate. In this state the type metal (which can either be of common type, or any other cheaper metal, metallic compound, or alloy), is cast thereon to the required height.—Patent abandoned.

1723 J. COCHRANE. *An improved pontoon bridge, also applicable as a life raft and lighter.* (A communication.) Dated June 12, 1867.

This invention consists in arranging a series of two or more pontoons, or long buoyant bodies, by preference hollow metal vessels, of comparatively small transverse dimensions, connected together by a trellis framework arranged similar in principle to a "lazy tongs"—namely, so as to turn upon the connecting pins and to open out or fold together in such manner that the parts of the framing then lie closely side by side. Upon this framework is placed a deck or flooring, the separate boards of which are all hinged together, so as when not in use to fold together backwards and forwards.—Patent completed.

1724 C. D. ABEL. *Improved appliances for horse shoes as a substitute for roughing.* (A communication.) Dated June 12, 1867.

In performing this invention a strong belt is provided at one end with a jaw, which fits over the inner edge of the front part of the horse shoe; the lower part of the jaw is furnished with a spike or "brob," serving as the "roughing" to the front part of the shoe. The other end of the bolt has a screw thread formed upon it, and passes through a tapped bush in a bridge piece extending across the heel of the shoe and taking purchase against the two inner edges thereof.—Patent abandoned.

1725 D. and D. CRIGHTON, and W. DONBAVAND. *Improvements in looms for weaving.* Dated June 12, 1867.

This invention relates to the swells in the shuttle boxes of looms, and consists in improvements for enabling the shuttle to have an easy motion in the shuttle boxes:—First, instead of the ordinary swells, the patentees employ at each end of the lathe a combination of an ordinary inclined swell with a curvilinear pressure apparatus oscillating on an axis as the shuttle travels in and out of the shuttle boxes. Second, they combine the ordinary inclined swell with a curvilinear pressure apparatus revolving intermittently on an axis as the shuttle travels. Third, they apply to the ordinary inclined or curved swell, at either side of the fulcrum, a supplementary spring action, or its equivalent, for the purpose of regulating the pressure of the swells, so as to enable the shuttle to have an easy entrance and delivery in and out of the boxes, and give at the same time the required pressure on the stop rod and swells when the shuttle arrives at the ends of the boxes.—Patent completed

1726 F. D. FROST. *An improvement in rollers used in frames for drawing and spinning or preparing fibrous materials.* Dated June 12, 1867.

This invention consists in forming the front rollers used in frames for drawing and spinning or preparing fibrous materials with a groove in its periphery, and in placing in the bottom of this groove leather, or other suitable yielding material. The ordinary lower roller or boss works in the groove and draws the fibrous material through.—Patent abandoned.

1727 J. H SNELSON. *Improvements in axles and boxes, and in securing wheels thereto.* Dated June 12, 1867.

This invention consists in forming a flange or flanges at the outer end of the axle to receive and hold a metal collar thereon. According to one arrangement, the wheel box fits over the axle, and is secured thereon by placing the metal collar between the flanges, the outer end of the wheel box abutting against the collar. The collar cannot leave the axle under all ordinary circumstances; however, to afford greater security, the inventor unites the ends of the collar by a wire or other piece of metal secured by a screw or pin passing into the end of the axle, and the ends inserted in apertures formed in the collar. An ordinary cap is screwed on to the wheel box.—Patent abandoned.

1728 A. M. CLARK. *Improvements in the manufacture and treatment of white lead, and in apparatus connected therewith.* (A communication.) Dated June 12, 1867.

The apparatus for performing this invention cannot be described without reference to the drawings.—Patent completed.

1729 T. S. PRIDEAUX. *Improving wine on draught, and of apparatus that may be used for that and other purposes.* Dated June 13, 1867.

This invention consists, chiefly, in preventing the access of free oxygen to the wine by supplying it with an atmosphere of carbonic acid gas as the wine is drawn off, whereby the wine will be preserved from becoming sour up to the last, even if it has not been brandied.—Patent completed.

1730 E. T. HUGHES. *Improvements in the manufacture of brushes, and in the machinery or apparatus employed therein.* (A communication.) Dated June 13, 1867.

This invention relates to brushes made from bristles and other similar materials, the object being to secure the bristles in the back or stock of the brush, without the application of a false back to the brush, or without the means employed for securing the bristles being visible upon the back of the brush. The bristles are secured in a solid back or stock by first drilling holes partly through the back or stock, and then inserting a bunch of doubled bristles into each of the said holes with a wire staple, the ends of which, on being pressed down to the bottom of the hole, turn longitudinally or laterally into the wood or material of which the back or stock of the brush is formed, and thus draw the wire tightly around the bristles so as to secure them firmly in the back or stock.—Patent completed.

1731 A. C. LION. *Improvements in the manufacture of chains, bracelets, necklaces, and other similar articles of jewellery.* Dated June 13, 1867.

These new articles of jewelry are formed of two distinct parts, each of which is prepared separately, and which are afterwards connected in such manner as to cause them to form one body, the meshes, loops or mails of which are connected in an invariable manner, but so as to impart to the jewel the required suppleness and pliability, no other soldering being made use of than that required for finishing the terminal ends of the jewel.—Patent completed.

1732 J. HOLMES. *An improved combination of materials to be used in the manufacture of drain bottoms, flue slabs, bricks, and other like purposes.* Dated June 13, 1867.

This invention consists in the admixture of the scale or shale found in clay beds underneath the clay with the clay itself, or the admixture of the scale or shale with the "seat" found underneath coal in its bed as well as with the clay, by preference in the proportion of five-sixths of the former to one-sixth of the latter, the scale or shale having previously been pulverized and mixed with water to render it of a pasty consistency, and then blended or mixed with the clay, moulded to the required shape, and burnt in the customary manner.—Patent completed.

1733 F. B. BAKER and L. LINDLEY. *Improvements in stretching or tentering, and in dressing or finishing lace or other fabrics, and in machinery or apparatus employed therein.* Dated June 13, 1867.

This invention relates, first, to improved means of stretching or tentering lace or other fabrics in dressing frames. For this purpose the patentees mount one or more of the pins or hooks upon which the fabric is fixed upon separate bars working upon rods or bars running the length and breadth of the frame at the sides and ends thereof. Second, the invention relates to improved means of distributing the dressing or stiffening material upon the fabrics to be dressed or stiffened, and for this purpose they employ a box in which the dressing or stiffening material is placed; this box is provided with a roller working in the dressing or stiffening material, and other rollers

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fixed one underneath the box and one at each side thereof. Around these rollers an endless sheet or cloth is passed, and on the ends of the two outside rollers are fixed flanged or grooved pulleys, which run upon and are supported by a suitable tramway formed by preference of wire stretched between suitable framing formed on or fixed to the dressing frame, such flanged or grooved pulleys serving to support the distributing apparatus, and at the same time to give motion to the endless sheet or cloth carried thereby.—Patent completed.

1734 R. H. BARTON. *Certain improvements in apparatus to be employed in the preparation of cotton and other fibrous materials.* Dated June 13, 1867.

This invention relates to drawing frames, &c., and the improvements consist in the use of apparatus for bringing the ordinary stop motion into action when the can is full, and this apparatus consists of a pawl fixed on the ordinary rocking shaft, which pawl gives an intermittent motion to a ratchet wheel mounted on a shaft, at the end of which is a worm gearing into a worm wheel, and on this worm wheel shaft a finger is fixed, having a projection on one part of its periphery; between this finger and the usual "spoon levers" a lever extends, so that as the finger is caused to rotate by the rocking shaft, pawl and worm and worm wheel once in each revolution, the finger raises the lever which lifts the ordinary spoon lever over which the "sliver" passes, and which brings the ordinary stop motion into action, as though the sliver had broken, and so stops the delivery of more sliver to the cam, whereby waste of sliver is prevented, and a regular weight of sliver is delivered to the cam.—Patent completed.

1735 J. GLOVER. *Improvements in furnaces for steam boilers and other uses.* Dated June 13, 1867.

The patentee claims arranging or combining bars or surfaces for supporting the fuel in steam boiler and other furnaces so that such bars or surfaces may be formed alternately broad and narrow to admit the air in passing up to the fuel supported thereby in limited quantities and varying distances, substantially as described.—Patent completed.

1736 S. HANCOCK. *Improvements in apparatus to be used in signalling in and from railway trains.* Dated June 13, 1867.

In order to enable the guard or other person on a railway train to communicate with the engine driver, the patentee mounts in the guard's van, or in other convenient part of the train, an apparatus consisting of bellows and an air vessel, and the bellows are worked when required by power taken from one of the axles of the running wheels of the train; they force air into the air vessel, from which it passes to a large bell whistle, which it causes to sound, and within the bell is a piston which can be raised or lowered by means of a handle, so as to vary the note of the whistle and so convey any pre-arranged signals. In order to enable the passengers to give an alarm in case of danger, one of the axles of each of the carriages has a cam fixed upon it outwards away from the axle; as soon as the cam has passed, a spring causes the sudden return of the arm, and in this motion the other end of the arm, which is furnished with a hammer head, strikes a bell, and as these motions are rapidly repeated, the bell is loudly sounded, more especially as he uses, by preference, two such hammer arms striking on opposite sides of the bell. In order to lay fog signals on the rails from a train in motion, he employs a holder which receives the fog signal, and which when the fog signal is to be laid, brings it down so rapidly on to the rail that the forward motion of the train during the time required for the operation may not affect the laying.—Patent completed.

1737 W. KING. *Improvements in apparatus for communicating between the guard and driver and passengers and guard of a railway train.* Dated June 14, 1867.

For this purpose the inventor carries a cord or chain through tubes or eyes along the tops of the carriages on one or both sides (so as to work in either direction without turning the carriages), or it may be in the centre of the roof, the said cords being connected by links between each carriage.—Patent abandoned.

1738 C. ASKEW. *Improvements in refrigerators for cooling worts and other liquids.* Dated June 14, 1867.

This invention relates to the employment of a double series of tubes through which water is caused to circulate, and over or around which the wort or other liquid is caused to flow, and consists, essentially, in a novel arrangement whereby the water is caused to flow in two streams through alternate sets of tubes, one set of tubes being fixed, and the other set movable, so as to afford facility for cleansing the refrigerator.—Patent abandoned.

1739 S. TUDDENHAM. *Improvements in the construction and manufacture of iron or metal rail rods or bars for balconies, gates, railings, and pillars, and also in the machinery employed therein.* Dated June 14, 1867.

The patentee claims, first, producing ornamental bars or rods of the kind mentioned in the title by twisting prepared bars or rods having their surfaces so prepared or ornamented as to produce a twisted bar or rod of a given ornamental section or surface, as described. Second, the use of machinery constructed and arranged as described for the purpose of twisting metal bars.—Patent completed.

1740 D. E. MCMAHON. *Improvements in saddles.* Dated June 14, 1867.

In constructing pack saddles the inventor forms the saddle trees in such manner as to admit of their being adjusted to the animal which is to carry the saddle. For this purpose he connects the saddle trees together at the top over the back of the animal by two screws, the one over the other, which, when turned, draw the parts in which they are fitted together.—Patent abandoned.

1742 S. E. CROW. *Improvements in apparatus to be used in connection with steam boiler and other furnaces to adapt them for burning creosote and other combustible liquids.* Dated June 14, 1867.

In carrying out this invention the patentee allows a small stream of creosote or other oil to fall from a pipe in front of the furnace, and blows it in by a jet of high pressure, or superheated steam, as it falls.—Patent completed

1743 G. KER. *Improvements in apparatus for drying or finishing garments and fabrics after cleaning or dyeing.* Dated June 14, 1867.

In place of holding the garments or fabrics in fixed frames, the inventor employs movable frames that can be run upon rails into and out of a drying chamber. Each frame is for this purpose provided with rollers to run upon rails into and out of a drying chamber heated (by preference with steam) by a coil or coils of pipes.—Patent abandoned.

1744 J. FLETCHER and W. CARR. *Improvements in or applicable to machines for sizing yarns or threads preparatory to weaving, and also to slubbing and roving frames, and to other machines.* Dated June 15, 1867.

First, these improvements consist in causing the yarn or thread to pass through the size, while subject to as little strain as possible, by driving each beam from which the yarn is drawn by friction or by frictional contact with a roller. Second, the invention relates to the mechanism for measuring and marking the yarn, which may be applied to other measuring purposes.—Patent abandoned.

1745 J. QUIN. *A new or improved fire-escape.* Dated June 15, 1867.

This apparatus consists of a support and ladder. The support is constructed of a rectangular horizontal frame, similar in principle to the boards used by painters, which rests on the window sill or frame, and is formed of strong iron bars strengthened by cross pieces. To the two side bars of this frame are fixed two longitudinal pieces or bars to form guides or slides for receiving in a suitable position two vertical iron bars, adjustable at any parts of the guides by means of pins attached to chains, and passing through holes in the guides and vertical bars or uprights.—Patent abandoned.

1746 T. WALKER. *Improvements in the manufacture of a spring hook, catch, or fastening, known as Nicholls and Walker's patent.* Dated June 15, 1867.

This invention consists, in the first place, in cutting out of metal a solid blank with lugs on each side hollowed out, and so arranged that the long ends act as a spring hook when doubled or bent about the middle; one end is so formed as to lap slightly over the other ends. Second, the inventor cuts out of metal a blank somewhat similar with arms on either side. The one to be pierced, so as to allow a pin to be inserted, and when the end is closed round the said pin, to hold it firm; the other end is to be pierced and turned in such a shape as to receive the point of the said pin, thereby making a kind of brooch fastening, the long ends to be so arranged and shaped into the spring hook as aforesaid.—Patent abandoned.

1747 J. ONIONS. *Improvements in the manufacture of iron and steel.* Dated June 15, 1867.

This invention consists in the mixture of crude pig or scrap cast iron with a certain quantity of wrought scrap iron, and with a certain portion of charcoal, ammonia, potash, salt, or other chemical ingredients containing one or more of the last-named materials.—Patent completed.

1748 G. MCKENZIE. *Improvements in the manufacture of illuminating gas.* Dated June 15, 1867.

The patentee claims, first, the manufacturing of illuminating gas by using for that purpose a compound, or compounds, of coal and oleaginous or fatty matter, such compound, or compounds, being made substantially in the improved manner described. Second, the manufacturing of illuminating gas by mixing gas made in the manner referred to in the preceding claim with gas obtained from common coal, or from cannel, or similar coals. Third, the obtaining of a slight increase in the illuminating power of gas obtained from common bituminous coal, or from such coal mixed with more or less cannel, or similar coal, by adding to such coal or coals oleaginous or fatty matter in the proportion of not more than fifteen gallons of oil to every ton of coal. Fourth, the adding of about sixty pounds of resin to the ton of any of the gas-producing compounds described, in order to increase the illuminating power.—Patent completed.

1749 C. SADDLER. *Improvements in furnaces for consuming smoke.* Dated June 15, 1867.

According to this invention, in place of injecting steam into the chamber of the furnace containing the fuel, as practised in some arrangements, the inventor causes numerous jets of steam to be injected from the outer surface or ashpit between the fire bars, so as to pass through the burning fuel into the furnace.—Patent abandoned.

1750 R. BEARD. *Improvements in flexible galvanic batteries, applicable to medico-electric purposes.* Dated June 15, 1867.

This invention is not described apart from the drawings, —Patent completed.

1751 A. M. CLARK. *Improvements in the means of cooling beverages, also applicable for preserving substances from the action of heat.* (A communication.) Dated June 15, 1867.

The inventor uses a glass with double sides and fills the annular space with water, which is then converted into ice, in a similar manner to icing a "carafe." A thickness of ice is thus formed, and the drink being served in the vessel will be kept cool until the ice is melted.—Patent abandoned.

1752 W. E. NEWTON. *Improvements in the preparation of pulp for the manufacture of paper.* (A communication.) Dated June 15, 1867.

This invention consists in submitting wood reduced to fragments to the action of steam in a close vessel, the temperature of the steam being greater or less, according to circumstances, and causing the disintegration of the wood by the simultaneous action of the pressure of the temperature and the dissolving properties contained in the steam, which disintegration is finally effected by ordinary mechanical means; also rendering the bleaching operation cheaper and easier by the previous immersion of the wood in any suitable solution.—Patent completed.

1753 G. ALLIX. *Improvements in drilling machines and hoisting machines.* Dated June 15, 1867.

This invention cannot be described apart from the drawings except at great length.—Patent abandoned.

1754 C. ERBA. *Improvements on depilation and leather tanning.* Dated June 15, 1867.

This invention has for its object the shortening of the tanning process. The operation consists in soaking the skins in a bath composed of the following ingredients:—Ninety-six parts of water, two parts of carbonate of soda, and two parts of hydrated oxide of lime, and reduced to a milky state. The skins, being well stripped of hair and washed in running water, are afterwards immersed from four to ten hours in a bath composed of a hundred parts water and a half of ammoniacal liquid. Instead of this, a bath of ammoniacal carbonate may be substituted, containing one per cent. of the said salt. After being washed and scraped again the skins are immersed in a first bath of tannin marking two to four degrees of density, Beaume. In this bath the skins remain from ten to fifteen days, after which they are placed in a second bath of six to seven degrees for four to ten weeks.—Patent completed.

1755 C. and S. A. VARLEY. *Improvements in electric telegraphs.* Dated June 15, 1867.

We cannot here give space to the details of this invention.—Patent completed.

1756 W. R. LAKE. *Improvements in saws and saw teeth.* (A communication.) Dated June 15, 1867.

This invention is not described apart from the drawings. —Patent completed.

1757 G. CLARK. *Improvements in guns, projectiles, and cartridges, and in the construction of the same.* Dated June 15, 1867.

We cannot here give space to the details of this invention.—Patent abandoned.

1758 L. J. CROSSLEY and J. SUNDERLAND. *Improvements in machinery for oiling wool or fibre to prepare it for carding, combing, or other treatment.* Dated June 15, 1867.

This invention is carried out in the following manner:—Over the endless apron or gill combs, or other instrument, which carries the wool or fibre forward continuously, and in a thin layer, there is mounted a trough containing oil; along this trough from end to end an axis passes, and near each end extremity of the trough there is a disc fixed upon the axis, and wires or rods are strained between these discs, and as the axis revolves the wires or rods dip into the oil in the trough, and emerge with oil adhering to them. There is also extending from end to end of the trough a stationary brush, so placed that the strained wires or rods as they come up out of the oil strike the bristles of the brush in passing them, and by these means the oil which the wires or rods take up is thrown off in a fine spray on to the surface of the wool or fibre.—Patent completed.

1759 R. W. BARNES. *Improvements in metallic pens and pen-holders conjointly.* Dated June 17, 1867.

This invention consists in forming one or more holes, notches, indentations, or projections in suitable positions upon the length or periphery or edges of the pens as conveniently to allow corresponding projecting tongues or nibs, projections, or indentations formed on the holder, or upon any suitable form of spring disposed in the holder, or upon a spring disposed upon or forming part of the surface or periphery of the holder, to engage or lock at right angles to the length of the pens, into one or more of such notches, holes, indentations, or projections, when, by so locking in, together with the action of the spring pressing at right angles or obliquely upon the longitudinal edges, or against the surface or periphery of the pens, such pen will be kept perfectly steady in position, and will be prevented slipping into or dripping out of the holder whilst being used or coming out of the holder whilst being wiped.—Patent completed.

1760 J. MEIKLEJON. *Improvements in machinery or apparatus for lifting, lowering, and transporting heavy bodies.* Dated June 17, 1867.

This invention consists in mounting a gantry on or under an overhead turn-table.—Patent abandoned.

1761 J. FLETCHER and W. CARR. *Improvements in sewing machines.* Dated June 17, 1867.

This invention relates to the mechanism or arrangements for feeding the fabric to be sewn, and consists in arranging the two surfaces between which the cloth is fed so that both will move with the cloth when fed, and before they move back again for the next stitch one of the surfaces is lifted or removed from the fabric, so that both surfaces can move back without dragging or pressing upon the fabric, and at the same time leave the fabric at liberty to be freely turned.—Patent abandoned.

1762 C. D. ABEL. *An improved apparatus for utilizing the power spent in stopping the motion of carriages and machinery, as also the power produced by carriages and other vehicles when moving down inclines.* (A communication.) Dated June 17, 1867.

This invention consists, namely, in utilizing the power spent in stopping or retarding the motion of carriages or other vehicles when moving down inclines by causing such motion or excess of power to compress air in strong receptacles, which compressed air is afterwards usefully employed in starting or accelerating the motion of vehicles or machinery.—Patent completed.

1763 J. H. JOHNSON. *Improvements in wood screws, and in the means employed in their manufacture.* (A communication.) Dated June 17, 1867.

This invention relates, first, to wood screws, and particularly to those known as gimlet-pointed screws, and consists in forming in the shank of the screw one or more longitudinal grooves, flat sides, or indentations, which extend upwards from the point of the screw, and are transverse to the thread of the same. The second part of this invention has reference to the tools for cutting the threads on the improved or other wood screws, and consists in the employment for that purpose of a cylindrical or other suitable curvilinear form of tool, whether a complete cylinder or only a segment of the same.—Patent completed.

1765 J. WELCH. *Improvements in swivels for fishing tackle, and for other purposes.* Dated June 17, 1867.

The patentee makes the box or case of the swivel of a piece of metal tubing of the required length, the tube being open at both ends. To one end of this tube he attaches, by soldering, a bow or loop made from a piece of wire. He makes the shank or stem of the swivel of a piece of wire, the head or knob being situated within the bow or loop, and he twists and fashions the opposite end of the said wire into an eye or loop.—Patent completed.

1766 J. E. BOYCE and R. HARRINGTON. *Improvements in umbrellas and parasols.* Dated June 17, 1867.

The patentees claim applying to the runner of an umbrella or parasol a lever, one arm of which is made to engage with one or other of two studs or projections on the stick of the umbrella or parasol, so as to fix the said umbrella or parasol in its open or closed position, the said lever being used in conjunction with a longitudinal channel in the runner for enabling it to slide over the studs or projections on the stick without obstruction, substantially as described and illustrated in the drawings.—Patent completed.

1767 F. B. MILLER. *An improved method of toughening brittle gold bullion, of refining alloyed gold, and of separating therefrom any silver they may contain.* Dated June 17, 1867.

This invention has for its object the toughening of brittle gold bullion, and the refining of alloyed gold (whether naturally or artificially alloyed) whilst in a melted state, with the separation therefrom of any silver they may contain. This the patentee effects by means of chlorine gas, or hydrochloric acid gas, which latter

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should be mixed with atmospheric air or oxygen, brought in contact with the alloyed gold when the metal is in a molten state; in this manner the silver present, and any baser metals which render the gold brittle, are converted into chlorides, whilst the gold remains in a purified and tough condition.—Patent completed.

1768 I. G. LLOYD. *Improvements in machinery for compressing air.* Dated June 17, 1867.

This invention consists in so arranging the gearing for transmitting motion from the driving shaft of a steam engine to the reciprocating piston of an air pump that, whilst the driving shaft of the engine revolves at an even speed, the piston of the air pump may, at the commencement of each stroke, move with a quicker motion than towards the end of the stroke. In order to effect this the patentee employs differential toothed wheels.—Patent completed.

1769 G. T. BOUSFIELD. *Improvements in indicating time by time-keepers.* (A communication.) Dated June 17, 1867.

This invention consists in causing time-keepers constantly to emit automatically a succession of varying sounds, by counting which, and observing intervals of variation, the time, or approximation to the time, indicated upon the dial may be at any time ascertained, and which may be made to indicate the last hour only, or the last hour and quarters, or still more minute subdivision of time.—Patent completed.

1770 M. GRAY. *Improvements in the manufacture of electrical telegraphic conductors.* Dated June 17, 1867.

The patentee claims the manufacture of electric telegraph conductors by enclosing the insulated wire with strands or threads of manilla, hemp, silk, or other suitable yarn, coated with gutta-percha and bituminous substances, or gutta-percha, tar, and bituminous substances, or with other compounds of gutta-percha.—Patent completed.

1771 M. GRAY and L. GIBSON. *Improvements in means or apparatus employed in examining the coating of electrical telegraphic communicators.* Dated June 17, 1867.

The patentee claims the adoption or combination of means whereby the motion of the creel or bobbin employed in winding coated telegraph conductors during the examination of such coating is dependent on the will of the examiner, in manner substantially as described with reference to the drawings.—Patent completed.

1772 M. GRAY. *Improvements in the manufacture of electrical telegraphic conductors, and in the means or apparatus employed therein.* Dated June 17, 1867.

The improvements relate to, first, coating the several wires which are to surround a central or core wire, or with a substance adapted in the subsequent twisting of these outer wires on the internal or core wire to fill up any space between them. The second part of the improvement relates to drawing the coated wire at separate parts of its progress through the cooling media before winding it on to the reels or creels, in order as much as possible to avoid injury to such coating while it is cooling.—Patent completed.

1773 W. COOKE. *Improvements in means or apparatus for registering the number of passengers carried in omnibuses and other vehicles.* Dated June 17, 1867.

For this purpose the patentee makes use of three chief operating means or agents; first, the motion of the vehicle itself; second, the weight of each passenger when seated; and, third, the weight of each passenger whilst passing on to or off from the vehicle.—Patent completed.

1774 D. SOWDEN and R. C. STEPHENSON. *Improvements in looms for weaving.* Dated June 17, 1867.

This invention relates, first, to means of governing the order of picking, and to operate the picking apparatus in looms wherewith change shuttle boxes are employed at both ends of the lay or batten, and when two or more shuttles are required to be picked from either end in succession; and the improvements consist in having the picking shafts supported at their upper ends in swivel brackets and their lower ends on oscillatory footstep pedestals. These pedestals are connected by a rod which is movable endwise in either direction by the action of a cam operated by the ordinary Jacquard, or other indicating apparatus employed for working the change shuttle boxes, by which the bottom ends of the picking shafts can be moved laterally. The second part of this invention relates to the weft motion, or apparatus for detecting when the weft breaks or becomes used up, and consists, by one arrangement, in dispensing with the ordinary weft fork attached to the knocking-off lever, and instead of which in applying a weft grate at each end of the loom, which is hinged to the front of the batten and embedded in the shuttle race thereof, each having an arm projecting towards the breast beam, which takes into the notch of the weft hammer, or the lever which acts on the knocking-off apparatus when in position for that purpose.—Patent completed.

1775 SIR T. TANCRED. *Improvements in the construction of beehives.* (Partly a communication.) Dated June 17, 1867.

The patentee claims the means described of enabling the combs to be extracted by sliding laterally to and fro, whether the combs are suspended to only a single bar sliding along the guide bars, or are formed within a complete frame, and also by whatever contrivance the bar beneath which the combs are suspended is enabled to slide to and fro, whether by resting by its two ends on guide bars, or in notches or rebates cut into the sides of the box.—Patent completed.

1776 P. WELCH. *An improvement in machinery for rubbing or dressing printers' types.* Dated June 17, 1867.

This invention is not described apart from the drawings.—Patent completed.

1777 W. FAIRLEY. *An improved mechanical arrangement for preventing over-winding in shafts of coal and other mines.* Dated June 18, 1867.

This invention is not described apart from the drawings.—Patent completed.

1778 J. M. FROST. *Improved means and apparatus for raising sunken vessels, which invention is also applicable for preventing vessels from foundering.* Dated June 18, 1867.

This invention consists principally in the use of air-tight bags, buoys, or vessels made of canvas or other suitable material, provided with a nozzle and stop cock, so that they can be inflated or exhausted at pleasure.—Patent abandoned.

1779 C. D. ABEL. *An improved repeating striking movement for watches, clocks, and timepieces.* (A communication.) Dated June 18, 1867.

These movements are worked by one and the same barrel that gives motion to the clockwork. The patent is too voluminous for abstraction.—Patent abandoned.

1780 R. BODMER. *An improved method of securing the nuts of bolts.* Dated June 18, 1867.

This invention has special reference to jointing the rails of railways by means of fish-plates, and consists in splitting longitudinally the whole or a portion of the screwed part of the bolt, and after the same has been put in its place, and the nut drawn up as tightly as may be desirable, introducing and driving into the slit—either in the direction of the axis of the bolt or transversely—a wedge representing a very slightly inclined plane, so as in a trifling measure to expand the two halves or parts of the bolt, and thereby to prevent the nut from becoming loose through the vibrations caused by the passing of trains over the rails, or from other causes.—Patent abandoned.

1781 J. EDWARDS. *Improvements in lifts or cages and tubs for raising minerals from pits or mines.* Dated June 18, 1867.

The patentee forms the frames of his cages of pipes jointed by angles and T's, as gas pipes are.—Patent completed.

1782 T. BROWN. *An improved apparatus for holding and lifting plates and dishes.* (A communication.) Dated June 18, 1867.

This apparatus is designed for the purpose of lifting heated plates and dishes, and consists of two parallel arms formed of wire, &c., which extend radially from a rod or handle, the extremities being formed to lie under the rim of a plate or dish and support the same. One of the arms is fixed rigidly upon the handle, while the other swings loosely thereon, and is arranged to open and allow the apparatus to be adjusted to articles of various sizes.—Patent abandoned.

1783 J. G. JONES. *Improvements in apparatus to be used for getting coal, stone, and other minerals.* Dated June 18, 1867.

This invention relates, first, to an arrangement of apparatus to be employed when driving headings in coal mines, and is applicable when machines are employed for cutting grooves into the coal to facilitate its removal. The special merit claimed is the laying in order of, first, longitudinal; second, transversed; third, longitudinal rails to carry any coal-cutting machine and facilitate its being moved out of the way. The second part of the invention relates to certain improvements in the hydraulic wedging-down apparatus.—Patent completed.

1784 W. S. THOMPSON. *Improvements in the construction of heating and annealing furnaces.* (A communication.) Dated June 18, 1867.

This invention cannot be satisfactorily described without drawings.—Patent abandoned.

1785 J. LANG. *Improvements in breech-loading firearms.* Dated June 18, 1867.

The first improvement relates to a new arrangement or construction of locking bolt for securing the barrel or barrels in place, and consists in the use of a horizontal spring bolt which is mounted on a vertical centre pin fixed in the body of the gun. When the barrels are brought down on their seat, a notched lump fixed on the under side of the barrels comes against and forces back the horizontal locking bolt, which turns on its centre pin to yield to the pressure of the notched lump, and then springs back into the notch.—Patent abandoned.

1786 D. JONES. *Improvements in the manufacture of coal vases, buckets, casks, and other similar articles of hollow ware.* Dated June 19, 1867.

This invention is not described apart from the drawings.—Patent completed.

1787 F. W. WAIDE. *An improved mode of obtaining motive power.* Dated June 19, 1867.

The inventor makes use of a closed fire-box, in which the coal or other fuel is burnt, the compressed air for supporting combustion being supplied from a blast engine or otherwise through a pipe furnished with a stop valve. The products of combustion from the fire-grate or stove are conveyed into a coil or series of pipes or flues placed within the boiler or chamber containing water, which is thereby heated and converted into steam. The upper end of the coil of pipes or flues is open into the steam space at the top of the boiler, consequently the products of combustion (or heated air under pressure) are discharged into, and become mixed with, the steam, and the mixed air and steam are taken from the top of the boiler and utilized for obtaining motive power.—Patent abandoned.

1788 L. SIMON. *A new or improved machine for bronzing.* Dated June 19, 1867.

This invention is not described apart from the drawings.—Patent completed.

1789 M. LYONS. *Improvements in making frames for looking glasses, pictures, and mouldings.* Dated June 19, 1867.

In performing this invention the inventor gilds moulded, blown, or cut glass inside with leaf gold, or any of the well-known processes, so as to resemble a gilt frame; or he silvers them or coats them inside with Dutch leaf metal, and fills them, if hollow, with any well-known composition, and then fits them on wooden frames, or unites them in any way to make frames or mouldings.—Patent abandoned.

1790 J. COPPARD. *Closing of doors, windows, and other such apertures with a spring, when necessary to close them by such means.* Dated June 19, 1867.

This invention consists in adapting a ring made of india-rubber or other elastic substance as a substitute for the ordinary spring used for the purposes mentioned in the title, which said springs may be either round, square, or flat; but the patentee prefers them flat.—Patent completed.

1791 E. W. HUGHES and T. H. HEAD. *Improvements in rotary engines and pumps.* Dated June 19, 1867.

The object of this invention is to produce a complete rotary engine which maintains the action and reaction always the same, and all the pressure that is employed therefore effective, the pressure of the power always acting continuously, according to the area of the piston, and the pressure employed. The inventors employ an annular cylinder in which rotates a piston (or pistons), and concentric with which also rotates a centrepiece. At any one part of the internal periphery of the cylinder a piece is either cast on or fitted in, touching the internal centrepiece, and forming a joint therewith. The piston (or pistons) on the turning of the machine retires into the centrepiece on coming to the cam on the internal periphery (in which are also the eduction and induction ports), and on passing such cam is forced out again, either by spring, or by the water, steam, or other pressure.—Patent abandoned.

1792 A. L. PANTER. *An improved seat for babies or young children.* Dated June 19, 1867.

In constructing this seat a circular base board is mounted on castors, the said base board supporting a cushion having a raised rim stuffed or padded, and passing about half round it and forming a low back. There is also a stuffed or padded projection which comes between the legs of the child, thereby preventing its slipping off at the front of the seat. Various straps are employed for securing the child in the seat, and a board may be fitted in the front of the seat for holding toys, &c.—Patent abandoned.

1793 H. C. HURRY. *Improvements in stop-blocks and buffer stops to be used upon railways, part of which improvements is also applicable to the working of points on railways.* Dated June 19, 1867.

According to this invention the stop block or buffer stop is made to turn round a horizontal axis situated in the centre of the web of the rail, or some other point in the vertical line of the section thereof, and this block or buffer may be connected to a disc or other signal in such a manner that the movement of the stop block around the axis in one direction shall cause the said disc to turn so as to show the flat side.—Patent completed.

1794 W. M'LELLAN. *Improvements in railway buffers.* Dated June 19, 1867.

This invention consists in so constructing the buffers as, with a given quantity of the vulcanized rubber used as the elastic medium, to obtain an increased range and improved action; and the features of novelty are, first, the making concave those sides or surfaces of the rubber rings or pieces which ordinarily become convex under compression; and, second, the making either concave or convex the sides or surfaces of the rubber rings or pieces on which the compression acts.—Patent abandoned.

1795 J. H. JOHNSON. *Improvements in the treatment of yarns intended to be printed.* (A communication.) Dated June 19, 1867.

This invention relates to a mode of treating yarns of silk, wool, cotton, and other fibrous materials intended to be printed, and consists in weaving such yarns into a temporary loose fabric by combining therewith warp threads of cotton or other suitable material, such warp threads being disposed, by preference, in pairs at wide intervals, the yarns to be printed forming the weft of the temporary fabric. Yarns so treated or woven into a temporary fabric may then be printed or otherwise treated with colouring matter while still forming the weft of such fabric. After having been printed or otherwise treated with colouring matter the weft of the temporary fabric is separated or divided into hanks or skeins, to facilitate which operation the warp threads are cut and drawn out. Each length or portion of the said temporary fabric forming a hank or skein may be pushed on to a pair of wooden or metal rods or pins, such rods or pins being passed into the bends or loops of the yarn formed over the selvage cord, which may be either single or double, and the next inner cord or thread of the warp, which thread, for the sake of distinction, is termed the loop thread.—Patent completed.

1796 J. E. WHITING. *Improvements in the construction of castors.* Dated June 19, 1867.

The object of this invention is to arrange the castor so that the weight of the article of furniture may be placed centrally over the roller. The supporting roller turns on a pin placed immediately beneath the centre of the castor, and a guide wheel or fixed guiding point, stud, or spring is adapted to the extremity of the horn, so as to guide and turn the castor round on its vertical spindle when required.—Patent abandoned.

1797 D. JONES. *Improvements in the manufacture of bails or handles for articles or vessels of hollow ware.* Dated June 20, 1867.

This invention consists in forming the bails or handles of articles of hollow ware in such a manner that a substantial bulk or swell is produced for the grasp of the hand. This may be effected in one way by cutting out a pair of blanks to an outline which when stamped in a suitable die or press will form the two halves of a curved swell or handle; a piece of rod iron or wire of suitable length and thickness to form the bail is then placed between or passed through the two stamped halves of the handle or swell, the ends of which are of such size and stamped so as to fit the circumference of the rod or wire. A small washer passing over each of these ends is held in position by turning up the edges of the swell or handle, or by soldering the parts.—Patent completed.

1798 A. M. CLARK. *Improvements in apparatus for sewing saddlery and other leather or strong materials.* (A communication.) Dated June 20, 1867.

In this improved apparatus two needles are employed, the one serving as an awl, the other carrying the thread; the two needles have at the same time a vertical movement, and also an adjustable horizontal movement, the needles are operated alternately. Second, the invention relates to improvements in the arrangement of the shuttle whereby it is caused to pass through the hoops formed by the waxed thread without touching it.—Patent completed.

1799 T. WILSON. *Improvements in movable spanners or screw wrenches.* Dated June 20, 1867.

This invention consists, first, actuating and adjusting the slide bar or movable jaw by means of a conical worm or screw attached to the end of the handle of the spanner or screw wrench, engaging with a rack or screw teeth formed upon the edge of the slide bar or movable jaw of the said spanner or wrench. By giving a rotary motion to the handle, the slide bar or movable jaw may be made to approach to or to recede from the fixed jaw. The invention consists, further, in actuating and adjusting the slide bar or movable jaw of spanners or screw wrenches by means of a small pinion engaging in the teeth of a rack upon the edge of the slide bar.—Patent abandoned.

1800 F. G. N. PERRETT. *The self-regulating balance blind pulley.* Dated June 20, 1867.

In performing this invention the patentee passes a cord over the wheel or sheave of the curtains or roller blinds in the ordinary way, and then passes the same under a wheel, roller, or sheave fixed at the upper end of a balance weight of any required shape or size enclosed in an outer case of metal, this outer casing being made open at both ends, so that the weight can work up or down through the same, and by its weight alone retain the curtain or roller blind cords at one uniform tension.—Patent completed.

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1801 L. STERNE. *Improvements in chucks or apparatus for holding drills or boring tools.* (A communication.) Dated June 20, 1867.

This invention consists in the employment of a pair of spring jaws, each half of which is preferably composed of a spring plate seemed at one end, while its other end carries a block of metal or other material forming the jaw proper. The acting face of each block is recessed, the two recesses forming a tapered hole, the narrow parts of which is at the exterior. The invention further consists in combining with the spring jaws a shank held between the spring places, and having at the end adjoining the blocks a tapered socket or recess. The drill or tool is placed with its back end in this socket, and nuts acting on screws passed through the blocks are then screwed up, so that the tool is not only central, and held at its back end, but is also held about midway of its length by the jaws. The tapered socket will adapt itself to different sized drills.—Patent abandoned.

1802 C. STUART. *An improved arrangement or construction of adjustable wrenches.* Dated June 20, 1867.

The object of the first part of this invention is the arrangement and construction of an adjustable wrench in which the retaining power consists of a liquid, either water, oil, or other suitable substance. The second part of the invention relates to a different arrangement of adjustable wrench.—Patent abandoned.

1803 H. K. YORK. *Improvements in the manufacture of steel.* Dated June 20, 1867.

This invention consists in manufacturing steel from cast iron by fusing a mixture composed of iron purified and decarbonized according to the process described in the specification of a previous patent granted to the present patentee dated 5th May, 1866 (No. 1,291), and a certain proportion of cast iron containing carbon, or carbon and manganese, which is commonly known as spiegeleisen.—Patent completed.

1804 H. G. B. ROBER. *Improvements in the construction of safety-box slides.* Dated June 20, 1867.

Into the top or other part of the box there is filled a trunk or passage. On two opposite sides of the passage centres or studs are fixed on which two arms are able to turn. At their upper ends these arms carry a cover for the top of the passage, and the cover has a knob upon it by which it can be moved about its centres, so as to uncover the passage when required, but, when the knob is released, a counterbalance weight brings the cover back over the passage. Formed with these parts, and turning the same centres, are other arms carrying a cover for the lower end of the passage, and this is so placed as to close the bottom of the passage when its upper end is uncovered.—Patent completed.

1805 J. WARD and F. DRESSLER. *Improvements in easy or invalid chairs.* Dated June 20, 1867.

The patentee claims combining the back and seat of a chair, and both, with the frame in the manner described. Also locking the back and seat in position by a toothed or notched arc jointed at the back to the frame, and catching on to a bar forming the joints between the arms on the back and the links which support the back of the seat. Also combining with chairs having adjustable seats and backs a jointed foot-rest connected to the seat with tangs or stems and sockets capable of being worked by set screws at any desired inclination to the seat.—Patent completed.

1806 J. W. COCHRAN. *Improvements in projectiles and cartridges for ordnance and firearms.* Dated June 20, 1867.

This invention consists, first, in forming the exterior of a hollow projectile or shell of a metal tube of equal thickness on all sides; second, in the employment of rings formed with lateral teeth or corrugations, and fitted or packed closely together within the outer case or tube, which rings break and scatter when the shell explodes. Third, in the employment of a central fixed tube to keep the wings in place. Fourth, in the arrangement of an inner tube or case containing the charge, which tube slides forward and explodes the percussion fuze when the projectile strikes an object. Fifth, in the combination with the said sliding tube of a percussion fuze consisting of a nipple attached to the said tube. Sixth, in the novel construction of a time fuze.—Patent abandoned.

1807 W. CLARKE. *Improvements in the production of ornamental fabrics.* Dated June 20, 1867.

This invention is not described apart from the drawings.—Patent completed.

1808 J. W. PERKINS. *Improvements in stills for petroleum paraffine oil, tar, turpentine, and like bodies.* Dated June 21 1867.

This still consists of a series of chambers or compartments in communication with each other, each of which chambers contains a coil of pipes, through which the heating medium is caused to flow.—Patent abandoned.

1809 W. ROBERTSON and C. J. WADDELL. *Improvements in the apparatus by which the oscillations of the comb in the carding engine, the knife in the cotton gin, and the saw in the reaping machine, or reciprocating saw, may be readily multiplied.* Dated June 21, 1867.

According to this invention the inventors employ as the instrument of multiplication a knee joint having three axes, two external and one central. Of the external, one is a fixed stud; the other is a stud fastened in the part the oscillations of which are to be multiplied. The central axis is moved equally on each side of the line joining the three axes when the joint is unbent, and the external axes are thereby made to approach and recede from each other twice for each oscillation. In employing more than one multiplication the second external axis is a stud in one of the legs of the second multiplying joint.—Patent abandoned.

1811 B. BROWNE. *Improvements in the construction of camp or folding bedsteads.* (A communication.) Dated June 21, 1867.

The sides of this bedstead are formed of round pieces of wood in three parts, hinged together by metal hinges so as to fold up; around these side pieces the sacking is fixed. The hinges are each formed of two pieces of cast iron, and into one piece a flat piece of metal is fixed, and has a slot therein through which passes a pin, the pin being fixed across one end of a short tube of metal, the other end of the tube having a round piece of wood fixed thereunto; and in this manner each hinged piece is provided, these pieces of wood being used as the legs of the bedstead, and also to keep the sacking distended. To effect this the inventor crosses the legs like the letter X, and around each of the crossing parts is fixed a short tube of metal, in one of which, and midway of its length, is fixed a T-shaped piece of metal, which takes and locks into a corresponding shaped recess formed in the tube which is upon the other leg, and the legs are thus held together. The legs at the head part of the bedstead are longer than the other legs, for making the sacking higher at this part of the bedstead, so as to serve as a pillow.—Patent abandoned.

1812 J. GARDNER. *Improvements in the construction of folding bedsteads and couches.* Dated June 21, 1867.

The side supports of this bedstead each consist of two ribs jointed to each other at one end, the joint being at or near the middle of the bedstead, and of such form that the ribs will fold upon one another, or nearly so, but will not open out to a greater extent than to form an angle of about 120deg. more or less, with each other. Transverse strengthening pieces connect the side supports. To the outer ends of the ribs at each side are jointed the head and foot rails, the joints allowing these rails to fold upon the transverse strengthening pieces. Near the inner ends of the ribs, at each side, the inventor hinges two stretchers, one for each half of the bedstead, and the hoop iron bands forming the support for the bed are riveted to the sides and ends of the stretchers. The outer ends of the stretchers carry hooks, &c., to take hold of the transverse bars, so that the two stretchers and the head and foot rails may mutually support each other when in position, and at any desired angle. To strengthen the side supports, a hinge is fitted a little below the hinge before described, which hinge, when the bedstead is folded, falls down and allows the ribs to fall nearly upon each other.—Patent abandoned.

1813 J. POWIS and J. S. JAMES. *Improvements in tenon cutting machines.* Dated June 21, 1867.

This invention consists in using three horizontal spindles with blocks and cutters for cutting double tenons, the wood being fed to the cutters in the ordinary manner. The spindles are preferred to be in the same vertical line. An arrangement of table with three slides is also described to be used with the machine.—Patent abandoned.

1814 W. BELLHOUSE. *Improvements in furnaces for consuming smoke, applicable to steam boilers and other furnaces.* Dated June 21, 1867.

Here the inventor forms an additional bridge behind the furnace bars, so as to form an air chamber, which is covered with a grid, the level of the grid being higher than that of the furnace bars. At the rear of the additional bridge a hole is made to receive a pipe which is carried to the rear of the boiler, and extended vertically to a funnel-shaped inlet. The products of combustion in passing through the flue are thus carried over the grid, where they are met by a supply of air which is heated in its passage through the pipe by the heat of the furnace, the smoke and gases being mingled with the air and consumed.—Patent abandoned.

1815 A. M. CLARK. *Improvements in apparatus for measuring horses' feet, and for adapting and fitting shoes thereto.* (A communication.) Dated June 21, 1867.

This invention is not described apart from the drawings.—Patent completed.

1816 F. C. HENNET and D. SPINK. *Improvements applicable to apparatus for raising and lowering weights, for indicating and registering the amount lifted, or for indicating only the said weight.* Dated June 21, 1867.

The crane or other chain for lifting is passed through a block which is connected by rods to a weighted lever, the deflection of which shows the amount of weight being lifted, the lever having an index or dial, and a needle or hand, to indicate the deflection on the divisions of such dial which show the weight. For registering as well as indicating the weight, a second hand is applied on the dial, actuated by the one first mentioned, which remains stationary on being moved to any point in order to register the weight.—Patent abandoned.

1817 B. and T. FORD. *Improvements in water tuyeres.* Dated June 21, 1867.

This invention consists in providing a tank in connection with the tuyere, the tuyere being so attached to the tank that both its ends are inserted through the sides of the tank, which, being kept supplied with water, and the tuyere being so attached that the water may flow freely therein, the tubes of the tuyere are kept full of the liquid. Ordinarily, when the nose of the tuyere gets so hot as to cause the water therein to boil, steam is generated, and there is danger of the tuyere exploding; or if this does not happen, it becomes so damaged from the fire as to be afterwards useless. By these improvements, although the water may be caused temporarily to boil at the nose of the tuyere, the flow of water coming from the tank will be sufficient to force a fresh supply of cold fluid to the nose, and to all the other parts of the tuyere exposed to great heat, and so all danger of explosion is avoided.—Patent abandoned.

1818 W. PRICE. *Improvements in the manufacture of dies for stamping.* Dated June 21, 1867.

This invention consists in casting the whole of the die in cast steel from a mould.—Patent abandoned.

1819 G. DICKIE. *Improvements in the manufacture of illuminating gas.* Dated June 21, 1867.

In obtaining illuminating gas from oils of the mineral hydrocarbon class, the oil or oils is or are admitted into a highly heated retort, &c., the temperature of which at once causes the conversion of the oil into a permanent gas of high illuminating power.—Patent completed.

1820 G. SIMPSON. *Improvements in charging and emptying retorts, and in the machinery or apparatus employed therefor.* Dated June 21, 1867.

Here the range of retorts is built in the ordinary manner, and a frame is made for each retort that fits into and rests upon its bottom. Each frame has a set of trays, which trays are hinged to the frame at one side, the trays being used for containing the material with which the retort is to be charged. In front of this retort one or more travelling frames is or are situated, any one of which may, at any time, be moved to any one retort of the series; its upper side is level with the bottom of the retorts, so that the frame and trays may be drawn out from the retort; as the trays pass over a plate at its back end, they fall over on the hinge joints and discharge their contents, and on being again put into the retort, the trays, as they pass over the plate before referred to, are thereby again lifted to their horizontal position, in which position, as they pass into the retort, they are discharged by means of a belt of elevators, which discharge a certain quantity of the substance to be distilled into each tray; when the frames and trays are passed into the retort, its mouth is closed, and the distilling process is carried on in the ordinary manner. The frame and trays are drawn in and out by chain gearing, and this and the elevator are actuated by a steam engine or other prime mover.—Patent abandoned.

1821 F. REDDICLIFFE. *Improvements in buckets for pumps, especially suitable for pumps for mines, and in pistons for steam and other engines.* Dated June 21, 1867.

This invention consists of certain mechanical arrangements whereby the patentee adjusts the packing of the pistons of steam or motive power engines or pump buckets as the same wears away. He places two plates or rings of metal one above the other, and connects them together by distance pieces. Upon the faces of these plates, which stand toward each other, are protuberances, so disposed that they do not stand opposite each other, but in directions between one another, and each extends for half the space between the two plates. The packing pieces or gearing are introduced into the apertures between the protuberances; they are made to fit water-tight, and to overlap each other at the ends. Each packing piece carries an arm projecting inwards, and furnished with a ruck. These rucks are so disposed as to receive a pinion between them, whereby the packing may be adjusted as it wears. The pinion carries a fork, and when the packing is to be adjusted, the rods are disengaged from the engine at the top of the pump, and the bucket lowered on a bar near the bottom of the working barrel. The fork crossing the bar will keep the pinion in position, and the bucket being turned by the rods will be equivalent to turning the pinion, and the packing or gearing will thus be adjusted. The bucket can then be drawn up clear of the bar and set to work.—Patent completed.

1822 E. M'CLINTOCK. *Improvements in the construction of motive power engines and pumps.* Dated June 21, 1867.

Here the patentee employs a double-acting cylinder and piston, serving also respectively as valve box and valve, in combination with one other similar cylinder with its piston. The two cylinders and their pistons are so arranged that the piston of each cylinder shall act as a valve to govern the distribution of steam, or other fluid or liquid, for the other cylinder.—Patent completed.

1823 J. ONSLOW and F. NORTHALL. *Certain improvements in the construction of water tuyeres.* Dated June 22, 1867.

This water tuyere is so formed that the water way is divided into two parts of equal proportions. The division is effected by placing inside the water way two metal partitions opposite to each other, and which fit up to the back part of the tuyere, reaching to within about three inches of the nose or front part of the tuyere. This arrangement compels the water contained in the tuyere to pass freely round its nose, the partitions serving as channels for the water. The outlet pipe of the tuyere is of slightly smaller diameter than its inlet pipe.—Patent abandoned.

1824 O. R. CHASE. *An improved combined feed water regulator and water gauge for steam boilers.* (A communication.) Dated June 22, 1867.

This invention relates to an apparatus for preventing injurious variations in the level of the water in steam boilers, and consists, chiefly, in the use of devices operated by a float to open and close the stop valve of the feed pump, or otherwise control the supply of water to the boiler. Two sliding blocks are connected to levers which operate the stop valve, and the float in rising or falling elevates or depresses a cam and guide, whereby a vibrating link is caused to take hold of one or other of the said blocks, and thereby operate the corresponding regulating lever to admit or cut off the supply of water to the boiler. The invention also consists in the combination of a scale and pointer with the regulating mechanism, which pointer follows the movements of the float, and is caused (by the devices which operate the vibrating link) to oscillate over the face of the scale, and indicate thereon the height and variation of the level of the water.—Patent completed.

1825 R. W. MORRELL. *Improvements in dyeing black upon certain mixed textile fabrics made of worsted, alpaca, or mohair, woven in combination with cotton.* Dated June 22, 1867.

The patentee claims, firstly, the dyeing of the materials above named, either in the warp or weft, or both, with the wood and indigo process (separately, or in combination) in addition to the ordinary process of dyeing to ensure a faster and more intense colour as a black than the ordinary methods of dyeing will effect, as described. Second, the dyeing of "pieces," as described, having white or undyed cotton warp or weft, with woad or indigo (separately, or in combination) in addition to the ordinary process, in order to obtain a more intense black on the cotton portion of the fabric, and for dispensing with the use of oil or glycerine for bringing up the colour upon the cotton portion of the fabric.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated September 19, 1867.

2630 T. C. Clarkson, Stamford-street, Blackfriars-road, manufacturer. Improvements in the method of and materials for manufacturing ammunition boxes, pontoons, baggage, and other waggons and carriages and various equipments for military, naval, and civil purposes.

Dated November 28, 1867.

3381 E. H. Bentall, Heybridge, near Maldon, agricultural implement manufacturer. Improvements in the manufacture of nuts and bolts.

Dated December 11, 1867.

3520 F. Vita, Rue Feydeau, Paris, merchant. A new or improved material to be employed in the manufacture of cord, rope, lace, paper, cardboard, pasteboard, and other articles.

Dated December 18, 1867.

3600 J. Cockshoot, jun., Manchester. Certain improvements in the construction of carriages, landaus, and other similar vehicles.

Dated December 24, 1867.

3658 P. Demeure, Rue Croix Nivers (Grenelle), Paris, mechanician. An improved railway carriage break.

Dated December 27, 1867.

3682 J. W. Lewis, Newcastle-upon-Tyne, engineer. Improvements in warming, ventilating, and heating apartments or buildings, and in the arrangement of apparatus connected therewith.

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Dated December 30, 1867.

3704 A. M. Clark, Chancery-lane. Improvements in the permanent way of railways. (A communication.)

3705 A. Grainger, Lower Kennington-lane, Surrey, surveyor. Improvements in the construction of roads or carriage-ways and footpaths.

Dated December 31, 1867.

3721 R. Tooth, Fenchurch-street, City. An improved mode of and apparatus for evaporating liquids, with a view to obtaining the saccharine, saline, or other substances contained therein, in a dry or crystalline state.

Dated January 1, 1868.

4 G. A. D. Goodyar, Osborne Villas, Windsor. Improvements in the method of and machinery for propelling boats or vessels.

12 C. W. May, Rue Gaillon, Paris, manufacturer. Improvements in the manufacture of metallic cartridges.

Dated January 3, 1868.

22 J. S. Cockings, civil engineer, and F. Potts, manager of works, Birmingham. Certain improvements in welded iron tubes for gas, and other purposes where strength and lightness are required.

Dated January 6, 1868.

38 G. Platts, Stockport, W. Tate, agents, and W. H. Bailey, Salford, brass founder. An improved mode or method of and apparatus for laying fog signals on railways.

40 E. Gourdin, Boulevard of Sebastopol, Paris, merchant. Improvements in the modes or methods of combining a lamp or lighting appliance with a cane or walking stick.

43 J. Combe, Belfast. Improvements in machinery for winding or balling yarn or other twisted material.

45 J. Gardner, South Bridge, Edinburgh, surgical instrument maker. Projecting liquids in the form of spray by a draft or current of air forced through part of the liquid, and an instrument or apparatus for such purpose.

Dated January 7, 1868.

46 F. W. Hartley, Millbank-street, Westminster, gas engineer. Improvements in optical illusions used in conjunction with the magic lantern.

47 E. Myers, Craven-street, Strand, and G. A. Cannot, Pudding-lane, City. Improvements in the permanent way of railways.

48 C. D. Abel, Southampton-buildings, Chancery-lane. An improved method or process for removing sulphur, phosphorus, and other impurities, from iron, steel, and other metals. (A communication.)

52 J. Maury, Liverpool. Improvements in connecting the ends of metallic straps applied to bales of cotton and other merchandize.

54 J. Granville, Liverpool. Improvements applicable to lowering boats from ships' sides in a seaway.

56 J. B. Dunn, Castle-street, Liverpool. An improved buckle or tie for connecting the ends of metallic straps applied to bales of cotton and other merchandize.

58 W. Avery, Redditch, needle manufacturer. Improvements in the manufacture of needle cases.

60 G. Warsop, Mount-street, Nottingham. Improvements in mangles.

62 G. Warsop, Mount-street, Nottingham. Improvements in washing machines.

64 P. Spence, Newton Heath, Manchester, chemist. Improvements applicable to roasting or calcining copper and other ores containing sulphur and also regulus, and in apparatus connected therewith.

Dated January 8, 1868.

66 M. Grant, St. Paul's-road, Camden-road. Improved playing cards for the use of short-sighted and aged persons, as well as for persons of good vision.

67 J. Tomlinson, Rochdale, machine maker. Improvements in machinery for twisting and untwisting flax, hemp, and other fibrous substances.

69 S. Goldstein, Manchester, merchant. Improvements in that portion of gentleman's attire called the vest or waistcoat.

70 M. Walker, Essex-street, Strand, engineer, and G. H. Money, Jermyn-street, Middlesex, Lieut.-Colonel. Improvements in breech-loading small arms, including pistols, and in the cartridges to be used therewith.

72 C. Pontifex, Northampton-grove, Ball's Pond, vat maker. Improvements in presses or apparatus for expressing wort from spent hops, the same being applicable for expressing fluids from other matters.

74 G. W. Bacon, Strand, publisher. Improvements in apparatus for gymnastic purposes.

75 R. Girdwood, Edinburgh. Improvements in bags for transmitting samples or materials by post or otherwise.

76 J. Dawson and J. Howorth, Bacup, Lancashire. Certain improvements in looms for weaving.

77 S. Benjamin, Lancaster-road, Bayswater, merchant. Improvements in receptacles for coin or other valuable articles. (A communication.)

78 W. E. Kenworthy, Crown Point-road, Leeds, agricultural chemist and oil merchant. An improved method of purifying drains and sewers.

79 W. E. Newton, Chancery-lane, civil engineer. An improved mode of propelling vessels. (A communication.)

80 T. Greenwood, Leeds, machine maker. Improvements in machinery for preparing to be spun silk, china grass, and other similar fibrous substances. (A communication.)

81 J. Petrie, jun., Rochdale, machine maker. Improvements in brats or travelling surfaces for conveying wool and other fibrous materials out of or into washing machines, which improvements are also applicable to other machines in which similar travelling surfaces are required.

83 J. Tucker, Old Lenton, Nottingham, starch manufacturer. Improvements in the manufacture of paper.

84 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. Improvements in cutters for forming wood mouldings, and for other like purposes. (A communication.)

Dated January 9, 1868.

85 C. J. B. King, Great Portland-street. An improved process to be employed in the tanning of skins or hides.

86 C. H. Newman, Temperance Brewery, Brentford End. Improvements in the manufacture of unfermented and unintoxicating malt liquors.

88 G. A. Heath, Greenwich, carpenter. Improvements in sash fastenings.

Dated January 10, 1868.

91 J. Vivez, Quai Jemmapes, Paris, lamp manufacturer. Improvements in the construction of lamps for burning volatile hydrocarbons and other mineral essences or compounds.

92 J. Lewtas, Manchester, window blind manufacturer. Improved apparatus for holding and releasing the cords of venetian and other blinds.

94 S. Mortimer, Bradford, machine and tool maker. Improvements in machinery for combing wool or other fibrous substances.

95 J. Fawcett, Kirton, Lindsey, cake manufacturer. An improved manufacture of cattle food.

96 J. M. Rowan, Glasgow, engineer. Improvements in the manufacture of artificial fuel. (A communication.)

97 G. Davies, Serle-street, Lincoln's Inn. An improved self-supplying pen. (A communication.)

98 J. G. Tongue, Southampton-buildings, Chancery-lane. Improvements in apparatus for sewing the backs of books for the purpose of binding the series of numbers or separate sections of a book or volume together. (A communication.)

Dated January 11, 1868.

99 H. Cochrane, The Longlands, Middlesborough-on-Tees. Improvements in machinery or apparatus for making moulds for hollow and other castings, and for testing or proving hollow castings.

100 W. Champness, Manchester. Improvements in the method of ornamenting wearing apparel, turned stays, and corsets, or riding belts.

101 C. S. Lemon, Liverpool, ship owner. Improvements in shirt fronts and other similar garments.

102 A. Budenberg, Manchester. Improvements in steam hammers. (A communication.)

103 J. Pilling, machinist, and R. Scaife, overlooker, Colne, Lancashire. Certain improvements in machinery or apparatus to be employed in spinning, twisting, or doubling cotton, silk, or other fibrous substances.

104 J. Hirst, machinist, and W. Hirst, clog and patten maker, Halifax. Improved machinery to be employed in the manufacture of clog soles and patten boards.

105 J. Somervell, Kendal. An improved method of obtaining and preserving alimentary substances in a highly concentrated form.

106 W. W. Hooper, Bow, optician. Improvements in apparatus for giving signals on board ship or other places.

107 J. C. Ellison, Rawfolds, Yorkshire, dyer. Improvements in machinery for folding fabrics, and also for inserting papers, metallic plates, or other suitable substances, between the folds of fabrics for pressing.

108 N. Hodgson, New Barnet, machinist. Improvements in engines to be worked by water pressure, compressed air, or other elastic fluid.

109 J. G. Tongue, Southampton-buildings, Chancery-lane. Improvements in machinery or apparatus for sizing the backs of carpets or other pile fabrics. (A communication.)

111 J. H. Johnson, Lincoln's Inn-fields. Improvements in pipes for smoking. (A communication.)

112 T. Whitwell, Stockton-on-Tees, iron master. Improvements in furnaces.

113 G. Ireland, Handsworth, Staffordshire, manager of works. Improvements in cruet frames, liquor frames, and other frames for holding bottles and vessels and other articles.

114 T. S. Ellin, Sheffield. An improved self-securing skate. (A communication.)

Dated January 13, 1868.

115 M. A. Hamilton, Southampton-buildings, Chancery-lane. An improved device for holding pens, pencils, papers, and other articles.

116 P. Pittar, Gresham-street, City. Improvements in mineral and rock drilling apparatus.

117 J. M. Kirby, Northampton. Improvements in the means of and apparatus for generating steam and warming buildings.

Dated January 14, 1868.

121 W. E. Gedge, Wellington-street, Strand. Improvements in the construction of breech-loading firearms. (A communication.)

123 C. W. Lewis, Langham-place, merchant. An improved spirit level. (A communication.)

125 J. C. Ramsden, Bradford, reed maker. Improvements in the mechanism or apparatus of looms for producing a certain class of fancy fabrics.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated January 18, 1868.

174 H. H. Lloyd, Fort William, Douglas, Isle of Man, Colonel. Improvements in coffins.

179 H. A. Bonneville, Sackville-street, Piccadilly. A new and improved fly cover for protecting stitched books. (A communication.)

Dated January 20, 1868.

197 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. Improvements in wood rings or washers, and in machinery for manufacturing the same. (A communication.)

198 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. Improvements in machinery for nailing or pegging the soles of boots and shoes to their vamps or uppers. (A communication.)

Dated January 21, 1868.

211 T. V. Lee, Macclesfield, civil engineer. Improvements in producing charcoal fuel and fire-lights from peat, and for kilns and machinery to be employed therein.

LIST OF SEALED PATENTS.

Sealed January 24, 1868.

2095 J. Schofield and J. C. Dawson
2157 W. Howes and W. Burley
2170 C. Silvy
2173 E. Smith
2175 E. A. Rippingille
2178 E. T. Hughes
2193 P. G. B. Westmacott
2324 B. F. Sturtevant
2402 T. Sault
2551 D. C. Brown
2913 C. S. Lynch
2915 O. C. White
3016 R. M. Letchford

Sealed January 28, 1868.

2063 T. Berney
2198 A. Watt
2200 J. Jones
2201 W. Gadd and J. Moore
2204 A. Murray
2205 C. Mayo
2211 M. J. Fearnley and C. Smith
2213 G. Gordon
2215 J. C. C. Azemar
2216 C. E. Brooman
2218 W. Snell
2219 F. A. Calvert
2223 R. B. Boyman
2239 E. A. Kirby
2261 C. de Negri
2263 G. Schneider
2275 E. Corneley
2277 A. J. Paterson
2335 A. M. Clark
2439 W. Muir
3211 T. Wilson
3248 I. Swindells
3278 R. A. E. Scott
3465 J. Adams

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," January 28, 1868.

2609 G. F. Bradbury and T. Chadwick. Sewing machines.
2610 W. J. Cunningham. Sewing machines.
2620 T. Stevenson. Faggots.
2621 A. M. Clark. Valve closets. (A communication.)
2627 T. B. Wilkinson. Apparatus for crushing beans.
2630 T. C. Clarkson. Ammunition boxes.
2632 J. Rust. Material for decorative purposes.
2637 J. G. Willans. Iron.
2639 J. H. Sams. Drill sowing machines.
2652 W. Hall. Separating yeast from liquid matters.
2653 W. E. Newton. Whips. (A communication.)
2654 C. E. and J. Green. Cartridges.
2656 G. E. Marchisio. Treatment of the residuum of cotton seed.
2657 J. Hargreaves. Iron.
2665 A. Mackenzie and S. Robinson. Cisterns.
2667 T. Muir. Washing rollers.
2669 J. Rives. Metallic pens.
2673 G. W. M'George. Pipes for smoking.
2677 W. Cooke. Regulation of currents of air in shafts.
2693 R. Wilson and J. Nuttall. Cranked axles.
2699 A. Tod and J. Heatley. Manufacture of tobacco.
2708 G. H. J. Simmons. Lamps.
2756 E. P. Alexander. Cast steel. (A communication.)
2761 J. L. Field. Candles and moulds.
2788 G. Mellor. Nails.
2811 N. F. Taylor. Impregnating air with hydrocarbons.
2865 W. E. Newton. Preparing iron. (A communication.)
2992 J. Mitchell. Buffers.
3013 R. Carter. Looms for weaving.
3042 E. B. Wilson. Furnaces.
3284 H. H. Lloyd. Signals.
3291 L. B. Joseph. Tramways.
3441 R. Hornsby and J. E. Phillips. Reaping machines.
3530 N. Paxman. Steam cylinders.
3600 J. Cockshoot, jun. Carriages and landaus.
3712 J. Novikow. Drawing and spinning hemp.
76 J. Dawson and J. Howorth. Looms for weaving.
80 T. Greenwood. Preparing silk. (A communication.)
103 J. Pilling and R. Scaife. Spinning cotton.
179 H. A. Bonneville. Fly cover for protecting books. (A communication.)
197 W. R. Lake. Wood rings or washers. (A communication.)
198 W. R. Lake. Nailing the soles of boots to their vamps. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

186 J. H. Wilson
188 J. Snider
191 C. Brakell, W. Hoehl, and W. Gunther
209 W., R., J., and A. Woodward
226 A. A. Croll
230 C. Falck
232 G. Dibley
234 W. Clark
243 J. Twibill
250 W. E. Newton
257 W. Foster
298 W. Vale

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

198 J. Vero
206 C. Lungley
289 J. Abraham

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending January 18, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
613	0 4	1648	0 6	1699	0 8	1755	1 0	1787	0 4	1809	0 4
1213	1 2	1652	0 4	1707	2 4	1758	0 10	1789	0 4	1811	0 4
1369	0 8	1653	0 8	1708	0 8	1760	0 4	1791	0 4	1812	0 4
1373	0 10	1654	0 10	1709	1 2	1761	0 4	1792	0 4	1813	0 4
1393	0 8	1658	0 8	1710	0 6	1767	0 4	1794	0 4	1814	0 4
1555	0 8	1660	0 8	1714	0 10	1775	0 8	1795	0 6	1816	0 4
1573	1 0	1663	0 8	1715	0 6	1777	0 10	1796	0 4	1817	0 4
1596	1 8	1665	0 8	1716	0 8	1778	0 4	1798	0 4	1818	0 4
1599	0 8	1669	0 8	1717	0 10	1779	0 4	1801	0 4	1820	0 4
1606	0 8	1676	0 10	1721	0 6	1780	0 4	1802	0 4	1823	0 4
1616	0 6	1677	1 4	1725	0 8	1782	0 4	1803	0 4	1827	0 4
1620	0 6	1680	0 8	1734	0 8	1784	0 4	1804	0 4	1828	0 4
1641	0 8	1684	0 8	1735	0 10	1785	0 4	1805	0 4	1831	0 4
1645	0 6	1697	0 6	1739	1 4						

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, FEBRUARY 7, 1868.

TECHNICAL EDUCATION.

IT may safely be predicted that the present time is pre-eminently one of educational manifestoes. How far the speeches and debates at Manchester and in London will really forward a movement of vital importance to the nation remains to be proved; but when a subject of real importance is openly discussed by capable men it never loses by its publicity, though not a few of the views put forward may be erroneous, and the selection of the speakers altogether arbitrary, as in the case of the Society of Arts meeting. We confess ourselves disappointed with the scope of the resolutions proposed and carried—by no means unanimously—at that conference. Framed prior to a discussion which time rendered altogether inadequate, they cannot be taken as a deliberate digest of the majority of opinion of a concourse of minds really competent to take cognizance of such a subject if free discussion had been allowed. The pre-determined idea was that nothing but general, *i.e.*, loose resolutions, should be passed, and the result arrived at was the enunciation of the fact that extended education in England was desirable, which everybody knew beforehand. It is the great lesson which thinking men have tried to teach us for more than a century, and which intercourse—and, above all, competition with more generally educated nations—has brought practically and tangibly before us in the last twenty years. The question propounded for the Society of Arts discussion was that of "Technical Education." That really discussed there, was education at large, descending, if at all, into the distinction between a classical and scientific, or, as some would have it, artistic basis of instruction. Now, in the phase of the subject with which we have to deal, such a question is easily dismissed on two manifest grounds, first, because with the main body of the working classes in this or any other country there is not time to spare for anything but rudimetary teaching, properly so called. Education—that is, the training of the mind after rudimentary instruction for the reception of really elevated ideas—is impossible from economic considerations to the great mass of those who must earn their bread from day to day, though it may succeed well if conducted by a course of either classical or scientific study, treated as study in the abstract, for the purpose of training only. Secondly, because whatever may be the merits of that tendency of thought induced by classical study for some sections of the world's workers and thinkers, there is no merit, but an actual demerit, in such a groundwork for those who are to deal with matter not with man, who investigate and apply the latent forces of nature instead of either combating the follies or developing the resources of human intellect.

What is wanting for the elevation of that large and important class of Englishmen with whom in this discussion we are principally concerned, is, first, rudimentary instruction for the very young, not only free and universal, but, within certain limits and restrictions, to bring it within our English ideas of liberty. Compulsory, and, secondly, such a system of scientific education freely open as shall hold out to all that have the capacity a fair opportunity of obtaining that higher cultivation of which so many of the artizan class are worthy and so few of them can now practically obtain. Thus far we shall only be fitting two classes of the community for their appropriate work, the lower for a fairly intelligent prosecution of handicraft, the higher for a more extended appreciation of first principles, from the study and development of which, by a vastly increased number of individuals, the nation will incalculably benefit. Beyond and above these we require an endowed foundation for the few whose talent, industry, and ambition may raise them above mere training and education, and fit them for the real advancement of science as individual thinking beings.

Such are the requirements of the nation considered both internally and individually for its own positive development, and as compared with the advances made by other nations and the facilities afforded in their actual educational status, by comparison with which we now find ourselves, after thirty years' discussion and some Government action, very much behindhand. It is not our province to discuss the means by which politically it may be possible to obtain such results as are absolutely necessary to place Englishmen on a fair footing in this respect with the people of other States. The end may be accomplished, as a *pis-aller*, by Mr. Ayrton's confiscation of existing endowments, though why we should rob one class for the intellectual benefit of another it is difficult to see; or it may be brought about by a special organization, paid for by the nation at large, for the benefit of classes unable or unwilling to benefit themselves; but one way or other it must be brought about if we would even hold our own in the keen competition of modern intelligence. One thing, however, is certain, that the funds, from whatever source they come, must not be left at the mercy of the parochial boards, whose inefficiency in the discharge of their present duties is one of our most crying evils, or put up to be wrangled for by sectarian demagogues, nor, above all things, must they be in any way under the direction of that worthily-artistic, but utterly unscientific, department which occupies so prominent a position in the West End. Let us have no half measures after the long probation of years, in which successive Governments have talked much of education and effected little teaching, but let us have such a comprehensive scheme as shall at least embody the advantages obtainable by the citizens of many minor European states, though to this day unknown in England. Amongst the speakers in the short debate at the Society of Arts was one who put forward, as one of themselves, the views of the working classes, urging strenuously the institution of museums of art, or, as he called them, "South Kensingtons" in the midst of the centres of manufacturing industry. He spoke feelingly of the advantage to be derived both by the present and the rising generations from the possibility of studying at leisure the works of art, now visible only to a favoured few of his class. Perhaps no more effectual instrument for the development of a real taste for knowledge could be found than such exhibitions, if multiplied to such an extent, and in such positions as would render them commonly accessible to the class who would most benefit by them, and, if made, really of use in the great fields of science, instead of being confined to the subordinate subjects of art. However unfitted the South Kensington officials may be to take charge of an organized national education, there can be no doubt of the ameliorating influence of the art display, for which we are indebted to that national institution. No practical action in the matter of education can be hoped for till late in the coming Session, and we fear that any real settlement of the subject will be still further postponed, but we cannot avoid strenuously urging on those in whose power it is to do or not to do that every month, not to say year, frittered away in paltry discussion over the details of a great question, is a tangible intrinsic loss to the country and a cumulative loss also, for the more the gap widens between the bare possibility of improvement to our own youth, and the State obligation to improvement in most other civilized nations, the more will increase the difficulty of regaining the lost vantage ground which natural resources and national aptitude have hitherto given us in most industrial pursuits.

IMPERFECTIONS IN PHOTOGRAPHIC APPARATUS.

IN many respects photographic apparatus has not been brought to the highest attainable level of perfection, and our intention is now to point out to those manufacturers of apparatus who are on the alert to meet commercial demands before their competitors, some points where improvement is necessary. One of the most useful instruments, both to professional and amateur photographers, is the binocular box camera, enabling two cartes de visite to be taken on one plate, because it may also be used for stereoscopic pictures, or for landscapes when the central diaphragm is removed. Moreover, being a box camera, furnished with several dark slides, the whole packing up like a little portmanteau, it is very useful in travelling, or for taking outdoor views. Hence, cameras of this description are made and sold in large quantities, and competition and experience enable English manufacturers to turn them out beautifully made, the workmanship being unequalled on the Continent, and the admiration of photographers in the United States. Yet most of these cameras, and we believe all those at present in the market, have one great fault when they are required for outdoor work. Their several parts waste so much time in the operation of screwing together to take a view. Scarcely any of them have room in the box to carry the lenses attached to the front of the camera, so that valuable lenses have to be carried in the pocket at the risk of breakage in walking, and in the operations of screwing and unscrewing before and after taking each picture. These screwing operations involve waste of time; moreover, the camera usually has to be screwed upon the top of the box, then the back of the camera has to be pulled out and fixed down by two screws, and three or four screws are called into operation in fixing the legs. When the view is taken, the unscrewing work and packing away of the different parts begin. Supposing these operations to waste five or eight minutes over each view, the loss of time over the exposure of six or twelve plates is very great, and to this the annoyance of the unnecessary trouble must be added.

A very little forethought and ingenuity on the part of the manufacturer would enable him to do away with these real practical evils. The upper portion of the inside of the box, for instance, might be made to form the top and two sides of the camera, so that on opening a door at one end of the box, the lenses always in their right position would be pointing at the view, and on opening the other end the focussing screen would be exposed to the view of the operator. A side arrangement for the admission of the dark slides would also be necessary. Here, then, there is really no practical reason why most of the screwing and unscrewing, and the risk of breakage of lenses, should not be abolished at one fell swoop. How to abolish the trouble and waste of time of fixing the three screws of the legs seems at first sight a greater difficulty, but Mr. W. H. Harrison, who has had considerable experience in tourist's work with preserved plates, long ago published a simple remedy. The top of the stand should be made of a little circle of wood, only three inches in diameter, with three one-inch projections from this circular piece, each projection only one and a-half inch wide. The tops of each of the legs will thus open only one and a-half inch to bite the outside of the projections, where they may be held as usual by three screws. But, as this wooden

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top is very small, the legs may be carried without inconvenience, without removing the top, when several views in the same neighbourhood have to be taken, so that in fixing the box camera to the stand, it is only necessary to fix *one* screw through the centre of the stand, and everything is ready for use. Of course, when the views are many miles apart, it is best to take the legs asunder, so that they will lie together more in walking-stick fashion. He has tried legs made as here described for many years; they were quickly made by a common carpenter, and have been found more practically useful than those supplied by regular manufacturers. Though the top is small, it is found to give firm and solid support to the camera, even in a rough wind. There is, therefore, no reason, whatever but the want of knowledge of manufacturers of the requirements of practical photographers why the latter should be forced by beautifully made apparatus to waste five or eight minutes over each view, and run the risk of breaking their lenses.

Now for the lenses. Every good landscape photographer knows the value of taking out two or three sets of lenses, because when he has chosen a picturesque point of view to the eye, the lens in camera may exhibit minor objects in the foreground on a large and imposing scale, and dwarf the principal object in the distance to an insignificant little speck. The substitution of a long focus lens, including less angle, is the remedy. But as makers of lenses do not adhere to similar screw threads in the flanges, the unfortunate photographer is usually reduced to the necessity of carrying an extra front to his camera, with other flanges, to fit the second pair of stereo lenses. Should he carry three pairs of lenses, a third front would be necessary. Here, again, if photographic opticians would only agree among themselves to adopt one particular screw thread in flanges for all lenses, from quarter-plate size downwards, it would greatly benefit their patrons. Not only so, but the fact that the purchase of extra lenses involves the carrying of extra wooden fronts to the camera, at present actually causes practical men to buy and use fewer lenses than they otherwise would employ.

Suppose, however, that one screw thread were now in use for all small lenses, the trouble of screwing and unscrewing for each view would not be entirely abolished, so we would recommend, if action be taken to meet these photographic wants, that a standard tube, rather than a standard flange, be chosen. The lenses should be mounted so that they would slide right in and pull out of the standard tube, so that they might be changed in an instant. Thus would a real hindrance to the purchase of lenses be abolished, because buyers would not have the present inconvenience of specially adapting their camera fronts to the change. There is another fault in double combination lenses, as sold by makers of the highest reputation. These lenses are sold with Waterhouse diaphragms for insertion between the glasses, but are not now furnished with front stops, yet with front stops a portrait combination is a more efficient instrument than without them. For instance, front stops will flatten the field of a lens which otherwise would not give sharp definition over a flat surface, so that when flatness of field is required, the photographer has to push pieces of blackened card with a hole in the middle into the hood of a lens, which ought to have been provided with good front stops by the optician.

ELECTRICITY AND TELEGRAPHY.

IT is with great pleasure that we announce that the Queen has been pleased to confer the honour of knighthood upon Charles Wheatstone, Esq., F.R.S.

Our transatlantic friends are certainly well up in telegraph news, informing us of the rapid progress of work doing in England, of which we have not heard the commencement. The immersion of the cable for the Franco-American route, now making in London, is to begin next May, and we are informed that the "Great Eastern" will be employed to lay it. Great endeavours are being made in favour of this scheme, but at present we can safely say that the cable is not yet commenced, although we hope ere long to see some active steps taken in the matter.

Some despatches were spoken of in our papers lately, when Mr. Gladstone spoke in Lancashire, as being the longest messages sent by telegraph in England. They are not behind us in America, where, we are told, that the President's message, consisting of nearly thirteen thousand words, was sent in the space of 7 hours and 40 minutes, without error.

Telegraphy appears to be progressing in Peru. Two companies have lately been established there under very favourable circumstances, with the object of extending the telegraph to some of the principal points in the country. At present, arrangements have been made for extensions from Lima to the port of Callao, Huacho, and Lambayeque, a distance of one hundred and fifty leagues in length; and further extensions from Callao to Pisco and the Chincha Islands (renowned for their guano), about one hundred and ninety miles. The lines, when completed, will be worked by the Morse instrument, on the American system.

A curious experiment has lately been tried by M. Balsamo. Two small magnetized bars of iron, of equal surfaces and weight, were plunged into ozalic acid at the same moment, their opposite poles being inserted—the north of one, and the south of the other. The bar whose north pole was in the acid was found to act as a zinc or a positive element, while the other, whose south pole was dipped in, acted as a copper or negative element, and a current was consequently obtained from the pair.

A new battery was lately presented by M. Balsamo to the French Academy of Sciences. Both elements consisting of iron, the one being immersed in a solution of chloride of calcium, the other in diluted sulphuric acid, the two solutions being separated by a porous cell. The iron in the sulphuric acid acted as the positive element, and the other as negative. The current obtained from this novel arrangement is constant and of considerable intensity.

On the 22nd, the Turkish lines in Asia Minor were temporarily interrupted, and have not yet been announced as being again in order. It fortunately happened that on the same day communication was restored via the Russian route. Since the above date, Indian messages have been forwarded and received over the Prusso-Russian and Persian route to the Indo-European cable, and the lines have been in such thorough good working order that messages from India are now being received in London of the previous day's date.

It is reported that a movement will be made in the Canadian Parliament at Ottawa, in favour of the Government purchasing and working the telegraph lines.

A new thermo-electric pile, the invention of Mr. Farmer, of Boston, U.S., appears to give great results in the deposition of metals, and to give a constant and uniform current; it consists of antimony and copper, the strips or arms of copper protrude outward from the bars of antimony, so as to secure the cooling influence of an air-current, whilst a jet of gas is heating the other extremity. There is some similarity between this and the large pile constructed many years ago by Wheatstone on Marcus' principle, the positive metal of which was an alloy composed of copper 10, zinc 6, and nickel 6 parts, and the negative an alloy composed of antimony 12 parts, zinc 5, and bismuth 1 part. The metals were screwed together, so that their lower junctions could be heated by a jet of gas, and the upper cooled by a current of water.

A novel battery, termed an "electric buoy," is now being experimented upon at Cherbourg. It consists of a zinc plate and a cylinder of carbon attached to a cross piece of wood, having as an exciting liquid the sea water. The inventor, M. Duchemin, claims for it a great variety of applications.

Another variation of a battery has been tried by M. Miergue, of Boufarik, consisting of a cylindrical cell of porous carbon, containing nitric acid, and an exterior cylinder of amalgamated zinc in a cell full of water.

By a telegram from Malta we learn that the Malta and Alexandria Telegraph is interrupted between Tripoli and Benghazi. The repairing steamer "Hawk," left on the first of this month to carry out the necessary repairs.

The Electric and International Telegraph Company have just had their half-yearly meeting, declaring a dividend of 5 per cent. on the half year. We are glad to see that they are about to present a bonus to their staff out of the surplus. The increase in their system during the past year has been 267 miles of line, 2,047 miles of wire, and 754 instruments.

One of the most extraordinary natural phenomena we have ever heard of, is mentioned as having taken place in Rochester, U.S., on the Atlantic and Pacific Telegraph line. One of the wires of this line was down between Rochester and Syracuse; it was discovered that neither section would work. A continuous current of electricity was then observed to be passing over the wire through the several instruments, and this while the batteries were disconnected. The current seemed to be of the volume of a medium sized pipe-stem (sic), and it gave the several colours of the rainbow. With the key open the current flowed in waves or undulations, and from the surcharged wire it would leap over the insulated portion of the key and flow along the wires beyond. The same phenomenon was observed at Buffalo and Cleveland. The gas in the office at Rochester was lighted without difficulty by holding the end of a wire within an inch or two of the burner. The current was intense enough to shock one holding the wires or instruments, and it is stated that one of the employés had his fingers scorched by the current. We should be glad to have some further details of this extraordinary phenomenon.

Some interesting experiments have been performed by M. Poggendorff on the heat developed in the passage of an electric discharge. From these experiments it appears that by the discharge by sparks, or with the addition of conductors, the total heating is less than in the "brush" discharge or without conductors, and from them he concludes that the difference of temperature at the two poles has no relation to the source of the electricity, but only depends upon the manner in which the discharge is made.

The following experiment has been tried by M. Louis d'Henry, as an illustration of the power of magnetism to generate heat, and as one more example of the correlation of physical forces. If a glass flask be placed on a small copper plate, and a magnet with its poles pointed upwards be made to revolve rapidly in a vertical axis below this plate, an increased temperature in the air of the flask will be observed, which may be made sensible by any particular arrangement. It is supposed that by substituting for the plate and flask a copper vessel containing water, sufficient heat may be generated by the rapid action of the magnet to cause the water to boil.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

POROSITY OF CAST IRON—CONVERSION OF METHYLIC INTO ETHYLIC ALCOHOL—THE LIGHT OF THE

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MAGNETO-ELECTRIC MACHINE—THE MANUFACTURE OF BRONZING POWDERS — GAS FROM WASTE MATERIALS.

THE porosity of cast iron is a well-known fact. Many years ago, Mr. Perkins forced water through thick plates of it: hence it is not astonishing that gases pass with ease. A few years ago, a physician at Chambery was struck with the circumstance that an epidemic of fever occurred in Savoy every winter; and he fancied that he had traced the cause to the use in the cottages of cast-iron stoves, which allowed the gases of combustion to pass into the atmosphere of the rooms. The subject has been investigated by MM. Deville and Troost, and they find, by a very carefully conducted experiment, that hydrogen, carbonic acid, and carbonic oxide do actually pass through the walls of a cast-iron stove, at a dull as well as at a bright red heat. The fact is worth knowing here, for such stoves are often used in this country, and most frequently in ill-ventilated apartments. The amount of gases which pass is certainly not large, but carbonic oxide is an exceedingly poisonous agent, and most of the discomfort experienced in rooms heated by these stoves is no doubt attributable to that gas. The subject deserves the attention of manufacturers, who might possibly devise a tile or clay-lined stove that would diminish the inconvenience we mention, and at the same time economize fuel.

Among the most recent and striking novelties in chemistry we notice the conversion of methylic into ethylic alcohol, which has been observed by Siersch, a chemist at Lemberg. The circumstances under which this change was noticed to take place we shall refer to on another occasion.

In Holmes's magneto-electric machine each revolution developes sixteen currents in opposite directions: hence the light it produces must be discontinuous, being extinguished and relighted sixteen times in the course of each revolution. As the machine makes 500 revolutions in a minute, the interval of time during which the current is cut off is excessively small; nevertheless, M. Jamin thought he could demonstrate the intermittence of the light. He failed to do this, but was able to recognize that the light of the luminous arc was less intense than that given off by the charcoal points, which he attributes to the interruption of the current. Properly speaking, he says we have in this lamp not the discontinuous electric light, but that of the carbon poles heated to intense whiteness, and giving a light nearly uniform. The light of the magneto-electric machine is, therefore, less blue and poorer in chemical rays than that from a lamp excited by a battery, and consequently better adapted for light-houses.

The composition and modes of manufacture of bronze powders are but little known, and some information on the subject may not be without value to many of our readers. Dr. Wagner has made the preparation of these metallic colours a special study, and gives, in Dingler's "Polytechnic Journal," an interesting account of the rise and progress of the industry, and some analyses of recent products. He shows, first, that these colours are really metallic, and are not, as many besides the writer he quotes believe, mixtures coloured with organic pigment, like carmine and indigo. The metals employed are, for the most part, copper and zinc, an alloy of the two being reduced to an impalpable powder by means to be presently described. The proportions of the metals are stated to be as follows:—For a bright yellow shade, 83 parts of copper and 17 of zinc; for an orange shade, from 90 to 94 of copper, and from 6 to 10 of zinc. A red bronze was composed entirely of copper. We append the amount of copper in several specimens, some of them from the French Exhibition.

			per cent.
French bronzes,		copper red	97·32
,,	,,	orange	94·44
,,	,,	pale yellow	81·29
English	,,	orange	90·82
,,	,,	deep yellow	82·37
,,	,,	pale yellow	86·42
Bavarian	,,	copper red	98·92
,,	,,	violet	98·82
,,	,,	orange	95·30
,,	,,	deep yellow	81·55

In no instance was tin, silver, or nickel found, but one English specimen contained a little iron. The original mode (and, indeed, that still followed to a great extent) of reducing the alloy to a fine powder is, first to beat it into thin leaves, then to rub the leaves with a scratch brush through a fine iron sieve, and afterwards to grind with oil the powder so produced, the shade of colour required being obtained subsequently by careful heating. Sometimes, however, the alloy is reduced to powder by filing. The particles obtained by filing are necessarily angular and devoid of lustre; they therefore require to be flattened by rolling, after which the powder covers well and reflects light. Rostaing obtains a powder by submitting the melted alloy to the action of a centrifugal machine. Another mode now followed is one we mentioned some time time ago for obtaining metals in powder. An amalgam of the alloy with mercury is made, which latter metal is afterwards driven off by heat. A spongy mass remains behind, which is reduced to a brilliant lamellar powder by rubbing in a mortar. When copper is obtained in powder by a chemical process, such as the reduction of the chloride by heating it with soda and sal-ammoniac, or by precipitating a solution of the acetate of copper with sulphurous acid, or a solution of the sulphate with iron, the powder is always hard and crystalline, and useless for bronzing. Dr. Wagner, however, has produced a very good bronze by the reduction of oxide of copper, as effected in an organic analysis. The special means he employs is passing the vapour of a petroleum oil over the strongly-heated oxide. Taking the composition of a light petroleum oil (known in Germany as Rhigolene) as expressed by the formula $C_{12} H_{14}$, he shows that 16lb. of this oil will reduce 200lb. of oxide of copper. The reduced metal must be allowed to cool in an atmosphere of the petroleum vapour, and the powder is then brought into the scaly lamellar condition necessary for bronze by rubbing it in a mortar. Various and bright shades of colour may be given to this powder by exposing it to zinc or cadmium vapour, and so effecting a sort of cementation of the metals. Lastly, Dr. Wagner states that if an oil containing a small amount of sulphur is used to effect the reduction, a beautiful variegated coloration is produced, which resembles the coloration of peacock copper ore. These last described processes are novel, and may deserve the attention of manufacturers. We need not follow the author into his account of the tungsten, mosaic gold, and chromium bronzes, which offer nothing new.

The experiments now in progress at Woolwich Arsenal on the manufacture of gas from a mixture of Trinidad bitumen and coal remind us of the recent use of various waste materials for the purpose in Germany. Among these are the residues of the manufacture of paraffin, and the refining of petroleum oils. With each of these materials a large quantity of permanent gas of a high illuminating power was procured. Another substance experimented with was the waste grease from the woollen manufacture, which yielded a smaller amount of gas. From a review of all the experiments, however, it is concluded that the use of bituminous oils, in combination with coal or peat for the production of gas, offers no advantages, as regards price, over ordinary coal gas. In small works it may be profitable when manufacturers use up their own waste products.

NOTICES OF BOOKS.

THE student who would read history aright, and who desires to acquire an enlarged and accurate conception of the manners, spirit, circumstances, and condition of our forefathers, and of the influences affecting habits of thought and action in operation in bygone times, which either promoted or retarded national and social, material and mental progress, must extend his reading beyond the historical works which record the rise and fall of dynasties, the contests of political parties, or the "battles, sieges, fortunes," incidental to national and political struggles and revolutions. Some of the bypaths of history offer knowledge as interesting and as practically valuable and important as are presented by what is usually regarded as the main line. In the volume* before us, Mr. Walford invites to an exploration of one of these bypaths, and the book is full of internal evidence that he is completely trustworthy and competent to be a "guide, philosopher, and friend," in the journey. The book is a thoroughly honest piece of hard work well and solidly framed, and perfectly finished. The author's industry and perseverance in fishing in all waters for materials to complete and enrich his work are conspicuous in almost every page, and his industry has only been surpassed by his digestive and manipulative powers, his judgment and skill, as displayed in his embodiment of the ample and fit materials he has collected. In dedicating his work to insurance agents, the author pays a high compliment to their intelligence. To the agent who depends upon mere importunity for obtaining proposals, this book—or any other, indeed—will be of little value, but to an intelligent man representing a sound and prosperous office it will be as a quiver full of arrows which he will not fail to use with a good result. The work is a treasure which agents should highly prize, but it is fitted to prove useful and interesting in a far wider range; the most accomplished actuaries will respect it, we are persuaded, and statesmen need not be ashamed to learn from it. There is probably no single work on the subject treated better arranged and more complete and exhaustive than this, which will enable any man of average intelligence to understand fairly and satisfactorily the principal points in the theory and practice of assurance. It is well fitted to awaken the reader to an appreciation of the duty of assurance, to instigate to the performance of the duty, and to guide him in its discharge in such a way as shall secure most surely the largest possible amount of advantage. The man who masters the contents of this book will feel perfectly competent, acting upon the knowledge it will impart, to select his own office, and will not be a prey to the most importunate of the touting canvassers who may pester him.

The history of life and other assurances is given fully, but far from tediously, in the first division of the work, and is followed by a section containing much curious and interesting matter touching the laws of mortality, population, and longevity. The theory and practice of life assurance are very fully discussed in the last three divisions of the work. It concludes with a quantity of matter specially designed for agents to whom, if it has their attention, it cannot fail to prove of great value. A copious carefully-prepared index adds greatly to the value of the volume. It ought to be stated that Mr. Walford is, to all appearance, a thoroughly independent writer. This book has not been written to order to puff one office or set of offices and to decry another. He so instructs his readers on the cardinal and minor points of the whole subject that he needs not give names of good or of shaky offices; their accounts and balance sheets, if they can be got at, and are honest, will serve the turn, and will either attract or

* "The Insurance Guide and Handbook." By CORNELIUS WALFORD, Barrister. Second edition. London: C. A. E. Layton, Fleet-street.

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repel the intending assurers who have mastered the handbook and retained the "guide" Mr. Walford has provided for them. The ruck of insurance office advertisements, which one might have expected to see at the end of such a book as this, and which could have been obtained doubtless, are conspicuous by their absence; their absence is creditable to both author and publishers. Mr. Walford's book has much in it that cannot fail to interest the general reader as much as professional men. Unless he has printed very largely indeed, it may be safely predicted that it will not rest at the second edition.

Another work of the same class as the foregoing is the Journal of the Institute of Actuaries.* The current number of this valuable periodical fully sustains its high reputation and that of its eminent contributors. The *piece de resistance* of the number is the first article, by Mr. J. Hill Williams, being on Brigg's method of interpolation, and an admirable translation of the 13th chapter, and part of the 12th, of the preface to the "Arithmetica Logarithmica." Brigg's work is very scarce, and some of the editions published in his lifetime do not contain the matter here translated, which will doubtless prove very acceptable to the readers, or rather students, of the journal. Mr. A. de Morgan furnishes some interesting notes on the valuable statistical works of M. Fourier, the eminent French statist, and gives a specimen table relating to Paris in 1817, which is deeply interesting, as showing the results of the long wars of Napoleon I., and the rapacious conscriptions resorted to for the human *materiel* necessary for their prosecution. The table gives the ages of the males and females by quinquennial steps from 0·5 to 30, and above that by decennial steps to 100 years of age, with the numbers at the several ages, married, single, widowers, and widows. There is painful interest in the remarkable disproportion between the numbers of widows and widowers at the more advanced ages. Between 10 and 15 there were 65 married females but no married males; between 15 and 20, 380 married males and 2,796 married females, 44 widows, and 12 widowers; between 20 and 25, 4,784 married males and 12,099 married females, 362 widows, and 58 widowers. The effects of the conscriptions and of the war, as a producing cause of widowhood, are not fully apparent for several decades. Between the ages of 40 and 50 there were 9,754 widows out of 47,422 women, and 2,180 widowers out of 38,572 men; between 50 and 60 there were 11,476 widows out of 34,578 women—about one woman in every three: the widowers were 3,686 of 34,852 men; between 60 and 70 the widows were 11,446 of 23,087, or about every other woman (!), and the widowers 4,001 of 23,043. There were 45,565 of both sexes of 5 years of age and under, 106,153 from 30 to 40, 2,662 from 80 to 90, and 135 above 90. The numbers of the intermediate ages are in ascending and descending gradations. The Journal contains able papers by Mr. Peter Gray and other writers, including Professor de Morgan, whose "Budget of Paradoxes" is continued.

The subject of the earth's varying presentation towards the sun is both important and interesting, but it is one which nevertheless has hitherto only been illustrated by meagre and incorrect drawings. To supply the place of these is the design of Mr. Proctor's "Sun Views of the Earth,"† which include forty-eight views of the earth, as supposed to be seen from the sun at different hours and seasons. We have also five enlarged sun views of England, and a diagram representing the earth's daily motion in her orbit. The figures are drawn with all the accuracy that could be secured by careful calculation and construction. Sufficient descriptive matter accompanies the drawings, to enable an intelligent use to be made of them by the student. Such a series of views as those before us are of greater value than they appear to be at a first glance. They are not educational only, they are something more. Many important geographical, geological, and meteorological facts are far more aptly illustrated by those views than they could be by any set of ordinary maps. Hence their extensive usefulness and great value, which is enhanced by the clearness with which the whole matter is placed before the reader.

The unfortunate condition of our railway system has led to many suggestions for its improvement. Amongst others, Mr. Samuel Haughton has ventured a pamphlet upon the subject,* in which he summarizes the history of the French railway system, and suggests a thorough railway reform at home. From this pamphlet we gather some very interesting facts connected with French railways. It appears that the first railway constructed in France was in 1823, from St. Etienne to Andrezieux, eleven and a-half miles long, for goods and coals, at a cost of £7,400 per mile of single line; and it was worked by bullocks and horses at a profit of 12 per cent. The first trial of locomotives was by MM. Seguin Frères, on the line from St. Etienne to Lyons. This was a double line, and cost £16,200 per mile. It is curious to note that the first railways were made far from Paris, and by a southern population, whose enterprize is generally considered to be languid. These were followed by lines in the district between Nismes and Montpellier; then from Paris to St. Germain; and in 1837, the two railways to Versailles. In 1838, the Cabinet proposed that the State should construct the great trunk lines, which the Chamber did not approve, but granted several concessions to private companies towards the west, north, and south-west.

In 1841, there were only 323 miles of railway at work in France, which had cost £22,000 per mile, or a total expenditure of £7,016,000 by the companies, and of £130,000 by the State, the net profit being only 3·11 per cent. In 1842 power was given to the State to undertake the main trunk lines, which now connect Paris with the frontiers of France. Notwithstanding monetary crises and other difficulties at the end of 1851, there were 2,213 miles of railway at work in France. Another ten years saw a great increase, which has continued up to the present time, when France counts 9,065 miles of railway at work. This is about one mile for 26 square miles of, country, or for 4,607 inhabitants. This, of course, contrasts very badly with the United Kingdom, where there are 13,289 miles of railway at work, being one mile of railway for nine square miles, or for 2,238 inhabitants. In Ireland we have 1,838 miles open, being at the rate of one mile for 17·1 square miles, or for 3,260 inhabitants. The slow progress in France is variously attributed to want of capital, of enterprise, and of political security, or to greater commercial prudence. In the face of the grumbling and discontent at home, with regard to railway arrangements, it may be consoling to know that our continental neighbours are not much better off than ourselves in this respect. Complaints are constant against high fares, low speeds, delays, charges for luggage, &c., and these emanate chiefly from that important body, commercial men. The remedy recommended by Mr. Haughton for the present unhappy condition of our railway system, is in effect that railways should become public property. The three chief reasons for the public ownership of railways may be shortly stated to be, the more rapid extension of new lines; the reduction of fares and rates; and the almost certainty that lines not earning a profit cannot be maintained in safe working order by private enterprise. The railway public cannot fail to be interested in Mr. Haughton's little book.

Mr. Thomas Gray, who is well known as having taken an active interest in steering and sailing rules recently delivered a lecture on the subject.* The author examines into the probable meaning of the words, "two ships under steam meeting end on, or nearly end on, so as to involve risk of collision," as used in the steering and sailing rules. The author asks whether the quoted words (which are contained in Article 13 of the regulations) mean overtaking ships, or ships at night showing red and green to the stern of another which is ahead. Do they mean two passing ships, or ships showing at night red to red or green to green, &c.? Or do they mean two ships crossing at any angle, or ships at night showing a red light to a green light or a green light to a red light? If not, do the words quoted refer to the only other position, namely, to two ships meeting each other end on, or nearly end on, that is, two ships at night showing each other both the red and the green lights? Mr. Gray observes that if the reader is satisfied that the express direction to port applies to Class 4 only, he has found an answer. Without doubt, the regulations do not expressly direct the use of the port helm unless two ships are meeting end on, or nearly end on; and two ships cannot be approaching each other thus at night without showing to each other both the red and green lights. As the profits of the sale of Mr. Gray's lecture are to be invested in prizes for boys in training ships, who pass good examinations in the rule of the road at sea, we wish the publication every success. Every seaman should read it.

"Aerial Locomotion" (Tinling, Liverpool) forms the subject of a small pamphlet by Mr. George Murray, who describes what he terms a practical method of traversing the atmosphere. Well, it may be practical, but we doubt whether it is practicable We commend Mr. Murray and his pamphlet to the notice of the Aeronautical Society.

The "Management of Health" (Virtue) forms the subject of one of Weale's rudimentary series. It is a manual of home and personal hygiene, and contains some useful practical hints on air, light, and ventilation, exercise, diet, rest, mental discipline, &c. It is by Mr. James Baird, B.A., and interests all who are careful to preserve a sound mind and a healthy body. The author lays down simple rules for the management of health, moderation being inculcated in all things. Those who never lose sight of this golden rule may expect a full measure of that earthly blessing, "mens sana in corpore sano."

"Metals and their Uses" are well discussed by Mr. F. H. Joynson in one of Nimmo's handy books of useful knowledge (Nimmo, Edinburgh). The information is brought down to the latest time, and special prominence is given to iron, steel, and Bessemer steel, &c. Although written somewhat in the popular style, this little book will be found to contain some useful hints to workers in metals. Another of Nimmo's handy books treats of "Free-hand Drawing." It is by an art student, and will be found a very useful guide to those who wish to learn the art of ornamental, figure, and landscape drawing. The book, which is profusely illustrated, commences with the first principles of drawing, and gradually leads the student on to the highly finished works of the pencil.

"Hardwicke's Science Gossip" (Hardwicke), appears very regularly every month, and is always full of interest to the student or amateur in science. The last number contains an interesting article, by Mr. M. C. Cooke, on the hair of Indian bats microscopically considered In the same number, and in the previous one, also, are articles on that domestic nuisance the bug, which are highly amusing and instructive. An article on the highest mountains, too, may be perused by all with benefit. The signification of the names by which they are known is worthy of attention, as they are singularly well chosen for mountains of such exceptional height as those under notice.

THE INDUSTRIAL ENTERPRISE OF HUNGARY.

IT was expected that the reorganization of Hungary would have driven all energies in a political direction, and that attention would have been turned to anything rather than the development of the material interests of the country. Such, however, has not been the case, but, on the contrary, confidence has everywhere prevailed, and an activity which no one ever anticipated has been produced in every direction. A plentiful harvest, after several years of failure, has led to an unparalelled export trade, and the money thus realized has stimulated industrial and commercial enterprise. The result is that new enterprises are everywhere springing up. New branches of industry are being opened out, and old ones greatly enlarged. The Hungarian Minister for Agriculture and Commerce is therefore able to report favourably of the progress made in Hungary during the past year. The report first enters upon the details of the post-office and telegraphs. Notwithstanding the difficulties which beset the working of the departmental system in Hungary, the post-office produced 5 per cent. more than the anticipated revenue. The

* "Journal of the Institute of Actuaries and Assurance Magazine." No. LXX. London: C. and E. LAYTON, Fleet street.

† "Sun Views of the Earth; or, The Seasons Illustrated." By RICHARD A. PROCTOR, B.A., F.R.A.S. London: Longmans, Green, and Company. 1867.

* "A Sketch of the History of French Railways, with Suggestions for a Reform at Home." By SAMUEL HAUGHTON. Dublin: Webb and Son. 1867.

† "On the Value of Coloured Side Lights as a Means for Preventing Collisions at Sea." BY THOMAS GRAY. London: Potter, 31, Poultry.

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number of post-offices in Hungary and Transylvania, which had been 938, has been increased within the last eight months by 136 new offices, while more rapid intercourse between the different offices has been provided for. The telegraphs yielded 45 per cent. more than in the corresponding period of the year 1866. Whereas formerly there were 136 telegraph stations, there are now 152; the length of lines was 814 German miles (4½ to the English mile), now it is 895 miles. 158 new post-offices and 186 more miles of telegraph lines, with 57 stations, have been opened. In order to form telegraph officials, a course of instruction has been established in Pesth, which has already given 69 competent persons. Commercial progress is not very clearly defined by figures, for certain local reasons. An approximate statement, however, of the chief exports is given, and from this we learn that 16,500,000cwt. of grain have been exported, 1,890,000cwt. of flour, 600,000cwt. of rape seed, 331,000cwt. of tobacco, 304,000cwt. of wool, 638,000 of wine, and 1,423,000 of cattle, sheep, horses, and pigs.

With regard to the industrial enterprises, we find the report gives the first place to steam flour mills, two of which with large capital are at work, whilst ten more are in progress. These mills have become the chief industry of Hungary, the tendency to export flour instead of grain being greatly on the increase. The other manufactures are represented by a mechanical engineering establishment, a chemical factory, a flax-spinning mill, several spirit refineries, a factory for railway waggons and agricultural machinery, a brewery company, a leatherware factory, and a woollen manufactory. There are also steam navigation and steam tug companies in a flourishing condition. According to the report, the iron industry has likewise taken a new start after the long depression, so that a yield of 600,000 tons of raw iron is anticipated for the present year. The Minister mentions the Exposition of last year as having contributed to stimulate energy. Of 300 exhibitors, 161 received distinctions; among them 17 gold medals and 42 silver ones. If we look at agricultural machinery we still find cause for congratulation, for had it not been for the general introduction of steam thrashing machines, the grain could never have been exported in time. Altogether, the energy displayed and the progress made in a comparatively short time augur well for the future of Hungary. Although she may not at present be able to compete with more advanced countries, she is going the right way to overtake some of us. In fact, she has already done so to some extent, inasmuch as in the Universal Exhibition of 1867 Hungarian flour beat all competitors.

TRIAL OF A TEN-INCH ARMOUR PLATE

IN these days, when it must be evident to all that it is time we stirred ourselves in the matter of iron ships and defences, if we mean to retain anything like our old position afloat and ashore, it is gratifying to find that the great iron armour-plate makers are equal to the emergency. It has been a question whether armour-plates could be made as thick as 10in., and at the same time of similar quality for resistance to thinner plates. This question has now been decided by the results of some experiments which were made last week on board the "Thunderer" target ship. A plate from the rolling mills of Messrs. John Brown and Company Atlas Steel Works, Sheffield; 10in. in thickness, by 15ft. in length, and 3ft. 9in. in broadth, was fairly tested before artillery. It was selected as a "test" plate from a score of plates manufactured by Messrs. Brown for the central broadside armour of the "Monarch." The plate was bolted on to a wooden backing of upwards of 4ft. in thickness, supported by iron and oaken beam struts of immense strength. The gun was the ordinary test gun—95 cwt. 68 smooth-bore, but on this occasion fired with 16lb. in lieu of the ordinary 13lb. of powder. The distance between the muzzle of the gun and the face of the armour-plate was 25ft. Nine shots were fired, and all struck the plate within a square space of 34in. The greatest indentation made was only 1·7in., and the least 1·5in.; no cracks, surface or otherwise. The trial, indeed, gave the plate an extraordinary degree of credit. It was the first 10-inch plate tried on board the "Thunderer"; but, in comparison with a series of 8-inch and 9-inch plates previously tested on board, its resisting powers to the impact of shot was very much in excess of what was simply due to its exceptional thickness. The plate will be sent to Shoeburyness, where it will be further experimentally tested with the 10-inch rifled gun and maximum charges of powder. This plate has thoroughly settled the question above referred to, and has shown that thick plates can be had of the same quality for resistance as thinner ones. This is proved by the circumstance that on the plate being taken from the backing after the severe test it had undergone, it was found to be very little bulged, and to have only two small cracks on it, and no separation of the lamina could be detected in the bolt holes. There is no doubt that thick plates of this kind are what are required for fortifications; and, as they can be made at a moderate cost, as wide as 5ft. or 6ft, and 20ft. long, we cannot see why they should not be at once adopted in our defences.

INSTITUTION OF CIVIL ENGINEERS.

AT a meeting of the Institution of Civil Engineers, held January 28th, Charles Hutton Gregory, Esq., president, in the chair, the paper read was on the relation of the fresh-water floods of rivers and streams to the areas and physical features of their basins; and on a method of classifying rivers and streams, with reference to the magnitude of their floods—proposed as a means of facilitating the investigation of the laws of drainage, by Lieut.-Col. P. P. L. O'Connell, R.E., Assoc. Inst. C.E.

After referring to what might be termed the first stage of natural surface drainage, subsequently carried on and completed by rills, streams and rivers, the author observed that streams draining large areas were not subject to sudden floods caused by short smart showers, and that a lake, like the extension of the area of a drainage basin, was a moderator of the flood discharge, resulting from a given rate of rainfall. There were other natural moderators which were more or less effective, as, for instance, a porous, absorbent soil, and the foliage of dense forests, but the latter had apparently the property, in some situations, of increasing the actual amount of rainfall, which counterbalanced its effect as a moderator of river floods. Snow might, according as it thawed slowly or rapidly, be a moderator or the reverse. Again, when a tributary in flood flowed into a large main river, the channel of the latter also acted as a moderator. If a series of natural basins could be found, increasing regularly in area, having physical features as to slope, soil, &c., all tending in the same degree to discharge the rain falling on them, and if the distribution of the rain were the same in all these basins, then, doubtless, the rate of discharge in floods might be described graphically by some regular curve, the abscissæ of which would denote the area drained, and the ordinates the flood discharge per second. This curve would be concave to its base, and the tangent at its origin would have a value representing exactly the maximum rate of rainfall. Such, however, were the diversities of physical features in river basins, and in the distribution of rainfall in the world, that the search after the desired series of natural basins possessing exactly similar characteristics would probably be a vain one. This was to be regretted, for rivers small and great might alike be referred to some such curve, and classified as flood dischargers, according as they took up positions near to or distant from the curve.

To supply the place, as a classifier, of this unknown curve, the author suggested the use of the common parabola, as follows:—Let x, the abscissa of a point in the curve, represent the area in square miles drained by a river, and y the ordinate of the same point, represent the number of cubic yards discharged per second by that river. Then, in the common parabola, $y = M. \sqrt{x}$, where M might be termed the modulus of the river, or of its drainage basin, as a flood producer. When M was large, it would indicate that the physical features were such as to slope, soil, total amount and distribution of rainfall, as to give the river and its drainage basin a high place in the classification. When M was small, it would, on the contrary, show either that but little rain fell on the basin, or that it possessed some of those physical features which tended to moderate floods. With the view of illustrating how far this method of classifying rivers as flood producers was likely to prove useful, reference was made to some facts respecting the Mississippi and its tributaries, as recorded in the report on that river, by Captain Humphreys and Lieutenant Abbot, which tended to show, in the author's opinion, that the method might be usefully, if cautiously, applied.

Certain exceptional cases of river floods were next alluded to, and regret was expressed that data sufficiently extensive and accurate for the purpose of testing very rigidly any method of classification had not yet been collected. The author had, however, prepared a table, exhibiting a few of the physical features of some of the principal rivers of North America, Europe, and India. This table gave the area of the drainage basin of each river in English square miles, the flood discharge of the river in cubic yards per second, with the name of the authority for this statement, the flood discharge of the river in cubic yards per second per square mile drained, and the values of M in each case. The facts so collected were also exhibited in diagrams. After commenting upon the range in the values of M thus recorded, it was observed, that whereas, in the case of large rivers, the parabola expressive of the relation between the area drained and the discharge per second might, without sensible error, be supposed to have its apex situated at the origin of the co-ordinates, in the case of small districts this supposition would lead to error. In the latter instance it became necessary to ascertain, at least approximately, what was the maximum rate at which rain fell in the district, and to place the origin of the co-ordinates at a point in the curve where the inclination of the tangent to the axis of x should correctly represent that maximum rate.

For the sake of illustration, it was assumed, that a district existed in which the maximum rate of rainfall was five inches an hour, and the maximum value of the modulus M was 20. This required that the origin of the co-ordinates should be situated at a point in the parabola where its geometrical tangent was inclined to the axis of x, at an angle whose trigonometrical tangent was 120. If x^1 and y^1 were the rectangular co-ordinates of the curve, measured from this point, its equation was—

$$y^1 = 20 \sqrt{x^1} - \frac{y^1}{120},$$

the areas being measured in square miles, and the discharges in cubic yards per second. But as, for small districts, it would be more convenient to measure the areas in acres, and the discharge in cubic feet per second, the formula became, when adapted to these new measurements—

$$21.4 \sqrt{x^1} - \frac{y^1}{5}$$

very nearly, or after the solution of this quadratic equation,

$$y^1 = -45.796 + \sqrt{2097.28 + 457.96\, x^1}.$$

A table, computed by this formula, was then given, showing the discharge in cubic feet per second from districts increasing in size from ten acres to five square miles; and it was stated, while the discharge from an area of ten acres represented a rainfall of 3·56 inches an hour, that from a district having an area of five square miles represented a rainfall of only ·36 of an inch. It was stated, that in rivers whose basins were by no means small, very extraordinary floods might occur in years not remarkable for large totals of rainfall; and in conclusion a few statements and quotations were given, as affording examples of flood moderators.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

THE council of the Aeronautical Society have decided upon holding an exhibition in London of objects connected with aeronautical science in the month of June. Arrangements have been made for the exhibition to be held at the Crystal Palace, where ample opportunity will be afforded for experiments. The importance and interest of some of these experiments are indicated by the fact that the Shipwrecked Mariners' Society have allotted £50 as a prize in connexion with one of the objects of exhibition—viz., "the best form of kite, or other aerial arrangement or modification thereof, for establishing a communication from a wreck on shore or between two vessels at sea." The late very successful experiments in Paris, conducted by M. Giffard with a captive balloon, have suggested their repetition upon the forthcoming occasion, when Mr. Glaisher will probably prosecute further experiments, and an opportunity will be afforded to inventors to propose means for controlling ascent and descent without loss of gas or ballast. The objects for exhibition, and for which prizes will be offered out of the funds now raising, are light engines and machinery, complete working aerial apparatus, models (working and stationary), plans and drawings, articles of interest commemorating previous experiments, kites or other similar apparatus proposed to be used in cases of shipwreck, traction, or in the attainment of other useful ends; paintings of landscape and cloud scenery as observed from a balloon. A number of

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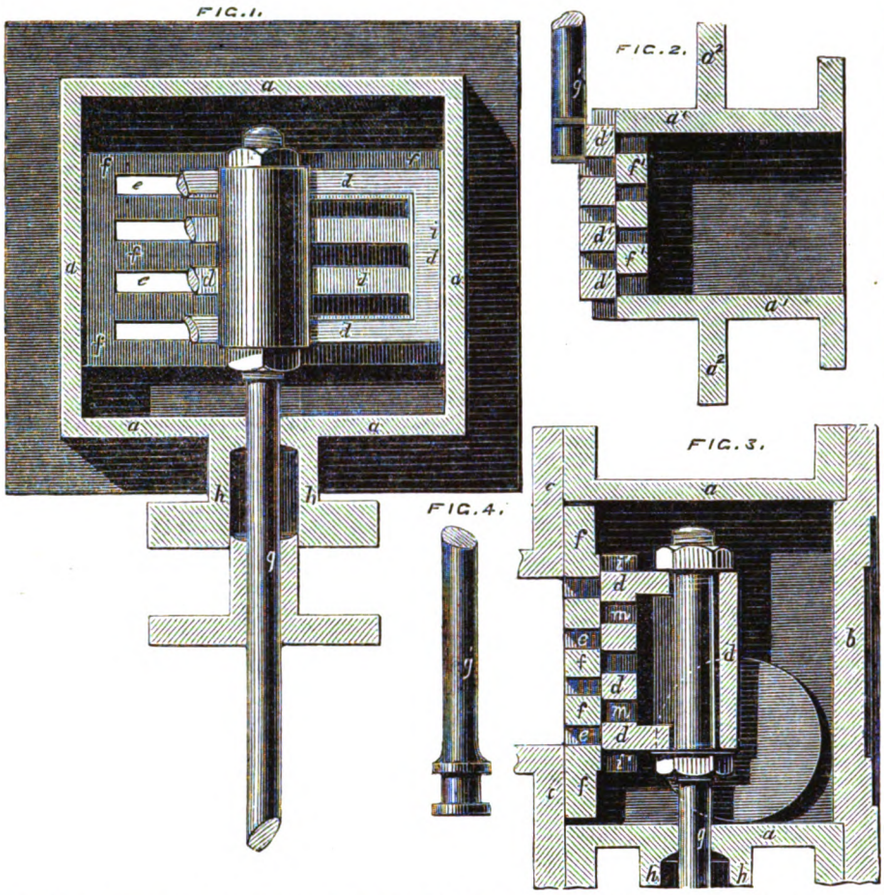
IMPROVED GRIDIRON VALVE.

BY MR. E. BLAND.



scientific gentlemen in America have associated themselves, and have appointed a secretary to correspond with the Aeronautical Society and to aid in this exhibition. The interest excited among inventors in this and other countries has been manifested so strongly that, although the idea has only been made known through the members of the society, already many new inventions have been promised for exhibition. The display of light engines particularly is likely to be large, and further applications for space are being made to Mr. F. W. Brearey, the honorary secretary, at the Crystal Palace.

IMPROVED GRIDIRON VALVE.

MR. EDWARD BLAND, of Bury, Lancaster, has patented some improvements in the use and application of the common gridiron valve. In his arrangement the steam and exhaust valves are placed in separate compartments, and as near to the inner side of the cylinder as the thickness of metal of the cylinder side will allow. The admission valves are placed near the ends of the cylinder, and at any convenient part of the cylinder's circumference, and the exhaust valves are also similarly placed on any other part of the cylinder's circumference not occupied by the inlet valves. The object of using these valves and placing them in the positions mentioned is to prevent undue waste of steam by having as little space as possible between the valves and the interior of the cylinder.

Figs. 1 and 3 of the accompanying engraving show the compartment and its valve for the admission of steam, *a* being the outer part of the compartment or chest; *b* the cover, *c* the cylinder flange, or that part of the cylinder to which the compartment or chest *a* is fixed. The parts marked *d* show the gridiron valve, and in fig. 1 a portion of the valve is broken off to show the openings *e* passing to the cylinder. The seating on which the valve *d* works, and through which the openings *e* pass, is marked by the letter *f*, and the rod for moving the valve is shown at *g* passing through the stuffing box *h*, and guides to keep the valve in its place are shown at *i i*. Fig. 3 is a section through the middle of fig. 1, the valve being shown closed or covering the openings *e*, and when the valve is wide open the openings *m* in the valve correspond with the openings *e* in the seating, and the steam passes through the openings *m* and *e* at one and the same time.

Fig. 2 shows the way in which each exhaust valve is placed near the interior of the cylinder. The valve is shown at d^1, and the seating at f^1; the compartment carrying the seating is marked a^1, and the flange a^2 is used to secure the said compartments a^1 and the valve seating f^1 to the cylinder. The rod g^1 for working the valve passes through a stuffing box placed near the cylinder end so as to allow the valve d^1 to work as near the cylinder's circumference as may be convenient.

Fig. 4 shows another view of a portion of the rod g^1 attached to the valve d^1. These valves are placed in any convenient way so that their reciprocating motion is in a direction parallel to the axis of the cylinder of the engine, or at any angle to the axis. Motion is given to the valves by tappets, cams or eccentrics. The openings in the valves and seatings are shown of a rectangular form, there being three such openings *m* in the valve and four in the seating *e*. The number of these openings may be varied according to the traverse wished to be given to the valve. Four valves and seatings are used to each cylinder, two for the admission of steam and two for the exhaust, one for admission and one for exhaust being attached to each end of the cylinder.

INSTITUTION OF MECHANICAL ENGINEERS.

THE twenty-first anniversary meeting of the members of this Institution was held on Thursday, January 30, in the Lecture Theatre of the Midland Institute, Birmingham, Sampson Lloyd, Esq., Vice-president, in the chair.

The Secretary (Mr. W. P. Marshall) having read the minutes of the previous meeting, the annual report of the council was then presented, which showed the very satisfactory progress of the Institution during the past year, and its highly prosperous condition, with a large increase in the number of members; and reference was made to the large and important meeting of the Institution held in Paris last summer, during the period of the International Exhibition. The annual election of officers then took place, John Penn, Esq., being elected President of the Institution for the ensuing year. Several new members were also elected.

The first paper read was "On the Transmission of Power by Water Pressure, with the Application to Railway Goods Stations, Forge and Foundry Cranes, and Blast-furnace Hoists," by Sir William G. Armstrong. In the employment of water pressure for the transmission of power, the high pressure required is obtained by means of the "accumulator," consisting of a large vertical cylinder, fitted with a plunger, from which is suspended a loaded weight-case, to give pressure to the water pumped in by the engine. The accumulator is thus a reservoir giving pressure by load instead of by elevation, the load generally used upon the plunger being such as to produce a pressure of 700lb. per square inch; and from the cylinder of the accumulator the water is conveyed by a pipe to the various places where motive power is required. The water therefore acts as a carrier of power, taking the place of shafting; and it possesses a great superiority to shafting in the cases of working machines which are scattered over a wide area and intermittent in their action, and also where the quantity of power to be transmitted is subject to great and abrupt variations. Water pressure also possesses the advantage of communicating to machinery a much more controllable and adjustable motion than shafting, while the absence of elasticity in water gives great steadiness and precision to the movements of machines actuated by water pressure; but, on the other hand, expansion being impracticable, the quantity of water expended is not proportionate to the load, but remains the same, whatever may be the resistance overcome. To obviate shocks in machinery worked by water pressure, owing to the non-elastic character of water, the machines generally require the introduction of "relief valves," consisting of small clacks, opening against the pressure in the supply pipes, and yielding to any back pressure on the pistons that exceeds the accumulator pressure. The widest application of water pressure, as a means of transmitting power, is in docks, where the water-pressure machinery is now most extensively used for the purpose of opening and closing the gates, swing bridges, and sluices, and also for hauling ships through the locks, and discharging and warehousing cargoes. One application, presenting very novel features, is for the purpose of shipping coals at Goole Docks, on the River Humber, where the coal barges are floated into a cradle, and then lifted bodily to a considerable height, and turned over into a shoot, which delivers the coal into a ship alongside. At the goods station of the Paris and Lyons Railway in Paris, a number of water-pressure cranes are now in operation, for the purpose of loading and unloading the waggons; and also two hydraulic engines driving capstan heads for hauling the waggons in the station yard. The cranes are adapted to turn as well as to lift and lower by the water pressure, the jib being a fixture to the crane pillar, which is made to revolve by means of a chain passing round a wheel at the base of the pillar, and worked by a pair of hydraulic presses placed horizontally. The lifting press is also placed at the base of the crane pillar, the lifting chain being conveyed upwards through the centre of the pillar, and thence over the end of the jib. The valves for lifting and lowering and for turning are slide valves, worked by hand; and the cranes are either of single power, having a simple ram alone, as in an ordinary hydraulic press; or of double power, having a bored cylinder with combined piston and ram. In the latter case, the lower power is obtained by admitting the water pressure upon both sides of the piston, giving an effective pressure proportionate to the area of the ram only; while for the higher power the upper side of the piston is opened to the exhaust, leaving the pressure to act upon the lower side only, when the effect is proportionate to the area of the piston. A new arrangement of hydraulic crane has also been introduced subsequently, having the lifting cylinder placed vertically, so as to form the crane pillar; and in some cases the crane has been constructed for lifting only, without any turning power, which is the simplest and cheapest form of hydraulic crane that is made. Water-pressure is also employed at the writer's works at Elswick for working the cranes in the foundry and forge, the lifting press and the pair of turning presses for each crane being situated horizontally below the floor; and the lifting chain passes over pulleys on a traversing carriage, which runs upon the top of the horizontal crane-jib, and is hauled inwards or outwards by a pair of hauling presses fixed upon the crane pillar. By means of these hydraulic cranes very heavy forgings are manipulated under the hammer with complete precision and great saving of time and labour. Another application of water pressure has been made to the working of hoists for blast furnaces, for raising the materials for charging the furnace; the two cages being connected by a rope, so as to counterbalance each other, a pair of lifting

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presses, one to each cage, are fixed vertically at the sides of the framework of the hoist, the two being worked in conjunction by a single valve, so that while the pressure is admitted to one press the water is allowed to escape from the other. This apparatus affords a convenient means of obtaining the increased velocity of working required for raising the increased quantity of materials consumed in the present larger and higher blast furnaces.

The next paper was "On the Allen Engine and Governor," by Mr. Charles T. Porter, of Manchester. In the construction of this engine the object aimed at has been to attain the greatest economy in expansive working, by having the full boiler pressure in the cylinder at the commencement of the stroke, with a sharp cut-off, avoiding reduction of the steam pressure by wire-drawing; although the slide-valve is worked with a direct continuous motion, instead of employing a liberating or disconnecting valve-gear. An invariable exhaust is also obtained, allowing the free discharge of the steam with all degrees of expansion. The engine admits of being worked regularly at the unusually high speed of 600ft. to 800ft. per minute speed of piston, and maintains complete steadiness of motion at this high speed; it also gives great uniformity in the driving power throughout the revolution, in consequence of the reciprocating parts being made to move at so high a speed, that their inertia compensates for the high pressure at which the steam is admitted at the beginning of the stroke; while in the latter part of the stroke, when the steam pressure is diminished by expansion, the power previously imparted is given out again in bringing the reciprocating parts to rest. The engine has a single horizontal steam cylinder, and works an air-pump direct from the piston-rod prolonged through the outer end of the cylinder. The steam valves are two separate slide-valves, one for each port, and both in equilibrium, worked with independent motions so as to effect a sharp cut-off in each case, the motion of one valve being rapidly accelerated at the same time that the other is greatly retarded. There are also two separate slide valves for the exhaust, one for each port; but these move together, and are driven by the same valve rod. All four valves are worked from a single eccentric upon the crank shaft of the engine, and the eccentric strap is made with a curved slot on the inner side, corresponding to the ordinary expansion link; the two steam valves are worked from the sliding block in the slot, through the intervention of two bell-crank levers upon an intermediate rocking shaft; while the exhaust valves are worked direct from a fixed point at the outer end of the slot, and have thus an invariable travel, affording a uniform freedom of exhaust, whatever degree of expansion is given by the link motion. The eccentric being set to correspond in position with the crank, without any lead, a correct valve motion is obtained, giving the same cut-off for each end of the cylinder. The position of the sliding block in the link-slot is adjusted by a lever from the governor, which thus controls the engine according to the work by regulating the grade of expansion, instead of by the ordinary means of a throttle valve in the steam pipe. The air pump consists of a cubical box filled with water, in the lower part of which works a plunger attached to the piston rod of the steam cylinder; the inlet and outlet valves are all placed in the top cover of the box, and the plunger thus works always in solid water, as the air entering through the inlet valves from the condenser passes at once direct to the outlet valves, without becoming mixed with the water in which the plunger is working. The valves are india-rubber discs, guided upon centre spindles; and a light spiral spring is added on the back of each valve, to give the required promptness in closing, as the valves have to close 200 times per minute at the high speed at which the engine is worked. The governor has been designed by the writer as a modification of the ordinary Watt's centrifugal governor, for the purpose of increasing its sensitiveness and quickness of action. The balls are made very much lighter, so as to correspond with the much higher speed of revolution; and the connection of the radius rods to the centre spindle of the governor is made with forked ends, having considerable width of fork, and fitting upon a pin which passes through the axis of rotation, whereby the friction at the joints that opposes the rise and fall of the balls is reduced. The balls in rising pull up a heavy weight sliding on the centre spindle. In consequence of the increased sensitiveness obtained with this construction of governor, it is found to regulate the speed of the engine within a range of only two per cent. variation of speed under the extreme variations of load; and a variation of five per cent. in the speed would carry the governor through its entire range of action, and cut off the steam entirely from the cylinder. In practice the steam stop-valve is always set wide open, and the engine runs under all circumstances with complete steadiness and uniformity of motion, without requiring any attention. One of these engines was worked at the recent Paris Exhibition at the speed of 200 revolutions per minute, or 800ft. per minute speed of piston; and other engines have also been running for some time at different works in Manchester, one at the above speed, and the others at 600ft. per minute.

It was announced that the annual meeting of the Institution for the present year would be held at Leeds, in the course of the summer, during the time of the Art Exhibition at Leeds.

The meeting then terminated. In the evening a number of the members and their friends dined together, in celebration of the twenty-first anniversary of the Institution.

THE GIBRALTAR SHIELD AND THE TEN-INCH GUN.

WE reproduce the following critical article upon the above important subject from the "Standard" of Saturday last:—It has lately been our duty, more than once, to call seriously in question statements made respecting certain departmental trials, and we very much regret that we are bound, in the interest of truth and fair play, to question the account given during the present week by a contemporary of the single shot fired from the 10-inch rifled gun against the Gibraltar shield. The particular sources from which that contemporary draws its inspiration is very well known; and, with the most serious interests of the State involved as they are in the present discussion upon the proper nature of iron land defences, it cannot be permitted that misstatements should be allowed to circulate without public contradiction.

The "Pall Mall Gazette" says:—"The Gibraltar shield was again fired at on Wednesday (22nd instant)" by the 10-inch muzzle-loading rifled gun. So far true. Wednesday was a miserably wet, uncomfortable day, and by the ordinary train there arrived at Southend, Colonel Inglis, R.E., the reputed designer of the shield, and his assistant, Lieutenant English, R.E., who proceeded straightway to the shooting ground at Shoebury. The trial was not made before the Ordnance Select Committee, nor the Iron Shield Committee. Only one round was fired—"a Palliser shell of 896lb. weight; the range was 70 yards, but the charge was reduced (to 54lb.) so as to represent a full charge at 400 yards." Not another soul was present but these two engineers, saving Captain Noble, R.A., who took the velocity of the shot on impact. No intimation was given to the press, no one on the part of the public saw what was done, and there was no reporter present to record the proceedings. If the trial had been a recognized official one, we should have published the details, as we regularly do; but it is obvious that a considerable amount of inconvenience might be incurred if all the trials and experiments made in all the Government departments were to become items for newspaper comment. Departmental trials we have been always ready to consider as equivalent with manufacturers' trials in their own factories, and we have not attempted to discuss all the experiments made for the progress of works on account of the inextricable confusion of ideas that might be thus expected to prevail. Of course, under present circumstances, we have no alternative about accepting the figures and details given, although some doubt naturally arises as to a velocity of "1,210ft. per second," being sufficient for "54lb. of powder."

The shell struck the target on "a slight inclination, perhaps as much as 8 deg."—perhaps a little more, as the shield itself has been knocked, by the battering it has had, very much askew, at least 10 deg., and no one but those concerned can now tell where the 10-inch gun was placed, as it has since being removed to the sea-wall battery. "It struck," we are told, "in the centre of the place below the port;" and, we will add, knocked out a notch in the lower part of the 5¼-inch front plate, the piece broken out measuring some 16in. along the base, and not less along its sides. "It—the shell—did not penetrate," we are told—an assertion which undoubtedly leads to a disquisition on the actual meaning of a very common English word. What is penetration? The 10-inch shell pierced the front plate, cracking it into all but four pieces; it pierced the second or inner 5-inch plate, cracking it right asunder up to the port sill, and the protruding nose of the shell, driving up and cracking (with a gaping four-rayed fissure many inches in length) a huge mound in the 1½-inch skin plate, 8in. from the back surface of the 5-inch plate to the centre of its dome. All the four deep longitudinal girders which were riveted on, and bolted up to the rear of the target to strengthen it, were cleared clean away, only stumps of some two or three feet in length remaining attached to the shield at one side, the *debris*—we counted seven pieces, each over 3ft. long—lying strewed on the ground. In short, the shell struck lower down than the centre of the space below the port, and came against that part of the shield which derived support, not only from the girders, but from the flooring and propping of iron 5-inch bars and plates which had been put against it behind to secure it in position. Whether this is or is not penetration we leave the public in their judgment or knowledge of that mother tongue we all desire to speak correctly to decide. The shield is professedly and actually 12in. thick, and the hole made by the shell is certainly not less than 16in. in depth from the surface of the shield to the farthest point of the impression of the head of the shell at the back of the hole. The axis of the shot hole appears to be something like 20 deg. to the face of the plate, showing the high inclination of the line of fire, which practically increased considerably the amount of iron plate to be penetrated beyond the reputed twelve inches. Notwithstanding this, however, but for the girders and props the shell would have gone clean through to the rear, and then there could have been no argument about "penetration."

We will briefly complete the description of the effects of the 10-inch shell. The indent of the front plate is not less at the shot hole than three inches, the buckling extending to the extreme edges of the shield on both sides. The shot hole itself is more than a foot across, a great fissure 1½in. wide running upwards from it through a former shot punched completely to the top edge of the plate. Downwards another great crack runs through the Rodman indent to a bolt hole, and thence completely through to the bottom of the plate. The above on the proper left. On the proper right a third crack goes in a zig-zag direction through a bolt hole towards the bottom of the shield. Below the shot hole a fourth crack extends to a bolt hole within 8in. of the bottom of the plate. The vertical split of the inner plate extends with a gape of 1¾in. from the base of the plate to the port sill, where the plate is seen separated, one half projecting 2in. in front of the other. The back skin also shows a fissure half through on the plane of the port sill. At the rear 14 bolts are broken off round the hummock raised by the point of the shell in the skin plate.

As to the main bolts, we cannot say what was the damage, nor whether they were screwed up tight or not. One, at least, is admitted to have been "probably" broken, and, certainly, another is 8in. from the straight; the rest stick out in disastrous-looking condition, surrounded by their broken wood tubes, with the dilapidated cork and iron washers pendant from their extremities. The wreck is terrific; and if another shot were fired above the port hole, where the girders are still good, the chances are that the entire shield would be rent in twain, and would fall asunder. The whole fault of the Gibraltar shield lies in the design and in the construction. There is no reason for finding any fault with Messrs. Cammel for their iron or their workmanship. The wonder is, not that the shield is so much damaged—we should like it placed in Palace-yard, that all the world might see and judge for themselves—but that the fibre of the iron has so clung to its terrible duty, and been so staunch and true to those who forged it. "It is, indeed, only fair to the designers of the Gibralta shield that they should have the benefit of the publication of this result"—but in which we assuredly do not concur in is, that it "exhibits the shield in a more favourable light than any of the former experiments have done." On the contrary, the effects of the 10-inch shell, and the publication of the truth of those effects must prove—if anything can possibly so prove—disastrous to those who designed the £35,000 worth of shields of this class, the erection of which we hear with sorrow is still going on at Gibraltar, Malta, and Bermuda.

Neither can we admit, after this exposure, that this departmental trial "effectually disposes of the 'laminated' (sum of the squares of the thickness) argument," against which our contemporary and the Royal Engineer's Department have protested. "This argument," our contemporary thinks, "was disposed of by the considerations it lately urged." Those considerations were based upon another departmental trial of no more value than the one we have just described.

That trial referred to in a previous article in the "Pall-Mall Gazette" took place on 29th July. The facts are these. The 7-inch solid plate held the shot in its substance when fired at by a 15lb. charge. The two 3½-inch plates were fired at with charges of 14lb., 13lb., 12lb., 11lb.—the first going clean through altogether; the 13lb. and 12lb. charges went through the front plate, bending out the broken ends of the back plate nearly at the angle of 45deg.; the 11lb. charge nearly pierced the front plate, driving up a great hummock in the rear one. Eleven pounds and a-half charge should, therefore, be much nearer the penetrative power than the 14lb. given in the "Pall-Mall." Against the other target made up of three 2½-inch plates three rounds with charges of 13lb., 12lb., 11lb. were fired, the two first going clean through, and the 11lb. charge piercing both front and back plates, and being a truer equivalent than the 13lb. charge put down by our contemporary. It

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AIR COMPRESSING ENGINE.

BY MR. J. G. LLOYD, OF BLAINA.

FIG. 1.

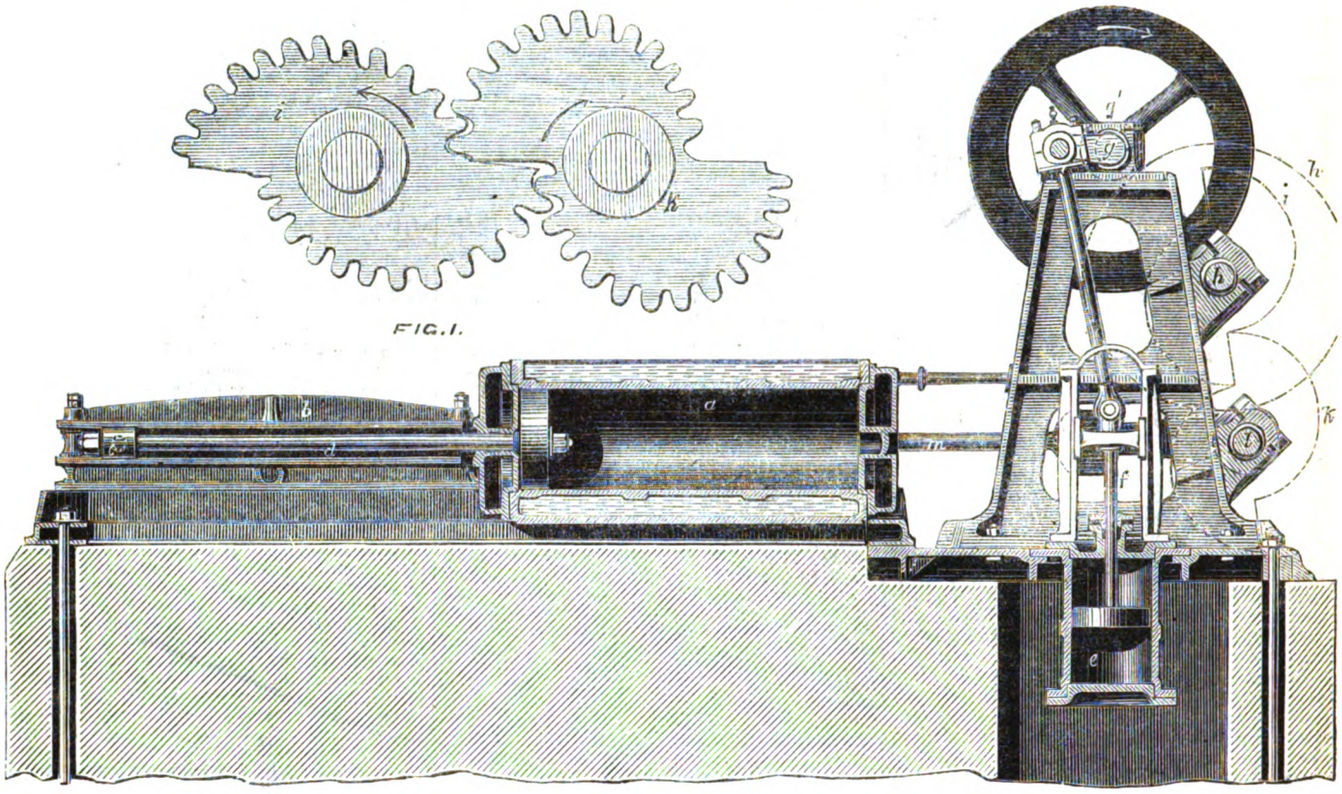
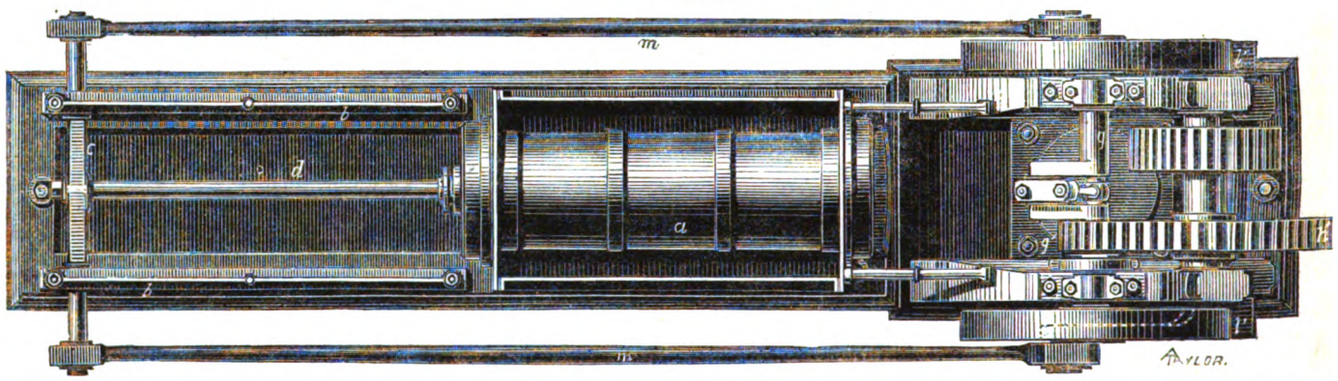


FIG. 2.



would have been well, therefore, if more attention to being "scientifically correct" and "dispassionately just" had been considered before this erroneous statement had been made.

There is something, too, very mythical about the "wobble" of the shot, which, according to the "Pall-Mall" makes bigger holes at 70 yards, and yet does less work than at 200 yards. For ourselves we abide by the rule laid down by the Ordnance Select Committee, and shall continue to do so until that committee proves the error of the rule by their own experiments, or we are ourselves convinced of its fallacy on reasonable grounds. Certainly there is nothing whatever in this last trial to show "that the Gibraltar shield is, as regards simply penetrative resistance, little inferior to a solid 12-inch plate." On the contrary, all the evidence unmistakably goes to prove the weakness of the laminated system, even as against "reduced" charges. And we should ask, how can our contemporary prove the laminated equal to the solid 12 inches, when a solid plate of that dimension has never been fired at? We have a right to infer the qualities of a solid plate from the trials of solid plates; but the equal strength of laminated platescan only be proved or disproved by positive experiments.

AIR-COMPRESSING ENGINE.

THE enormous difference of resistance in the air pump of an air-compressing engine from 0 (leaving out friction) at the commencement of the stroke to the full pressure a little before the end of the stroke, makes it extremely difficult to carry out the true principle of economy, viz., the expansion of steam. It has been proved by different experiments that expansion of steam cannot be carrie out successfully by engines already in use in compressing air above 7lb. per square inch. The object of the engine we have illustrated above, which is the patented invention of Mr. J. G. Lloyd, of Blaina, near Newport, Monmouthshire, is to equalize, or nearly so, the irregularity of resistance, so as to carry out expansion to almost any extent, and thereby effect great economy of fuel. The higher the degree of compression, the greater the economy. This engine, by means of the differential gearing, proportions the power to the resistance. The gearing is so arranged that whilst the driving shaft of a steam engine or any other motive power revolves at an even speed the piston of the air pump may, at the commencement of each stroke, move with a quicker motion than towards the end of the stroke. In our engraving, fig. 1 is a vertical section, and fig. 2 a plan of the machine. The air pump cylinder *a* is placed horizontally, and at one of its ends guides *b b* are formed, between which works a cross head *c*, which is connected to the piston rod *d* of the air pump cylinder *a*. At the opposite end of the air pump cylinder *a* is placed the cylinder *e* of the steam engine employed for giving motion to the piston of the air pump. The piston rod *f* of the steam engine cylinder *e* gives motion by a connecting rod to a shaft *g* placed above the end of the air pump cylinder, and on this shaft is a pinion g^1 gearing with a toothed wheel h^1 on an intermediate shaft *h*, on which there is fixed a differential toothed wheel *i* gearing with another similar wheel *k* on a third shaft *l* which is opposite the end of the air pump cylinder *a*. On this last shaft are cranks l^1 l^2, which by long connecting rods *m m* are connected with the ends of the cross head *c*, to which the piston rod *d* of the air pump cylinder *a* is attached.

By this arrangement the piston of the air pump will complete one stroke for each half revolution of the differential wheels *i* and *k*. These wheels are so formed as to give a quick motion to the piston of the air pump at the commencement of each stroke, and then gradually to reduce the speed of the piston until it has arrived at the point of the stroke at which the air in the cylinder will have been compressed to the same pressure as the pressure in the receiver into which the air is to be forced. The piston may then be caused to move with an uniform motion for the completion of the stroke. At the commencement of the following stroke the gearing will again commence to drive the piston at a quick speed.

The principle is equally applicable where other motive power engines are employed, such as turbines, waterwheels, &c., so that by the interposition of the differential toothed wheels between the driving power and the air pump the size and cost of the driving apparatus may be greatly reduced, and, of course, the consumption of water. The heat developed by compression is carried off by cold water contained in a tank surrounding the air-pump cylinder *a*, so that loss through that is not worth considering. The great utility of compressed air is becoming every day more apparent; it has advantages over steam in many instances, being at once a motive power and ventilator. It is particularly adapted for mining operations, such as tunneling, coal-cutting, &c. The success of compressed air at the Mont Cenis tunnel suggested to two enterprising French capitalists, MM. Biez Fils, and Galard Bearn, and to M. Sommeiller, the illustrious chief engineer of the works at Mont Cenis, to employ compressed air for distributing force from house to house as water and gas-light are now distributed, and even mechanical force, by means of Lenoir's engine.

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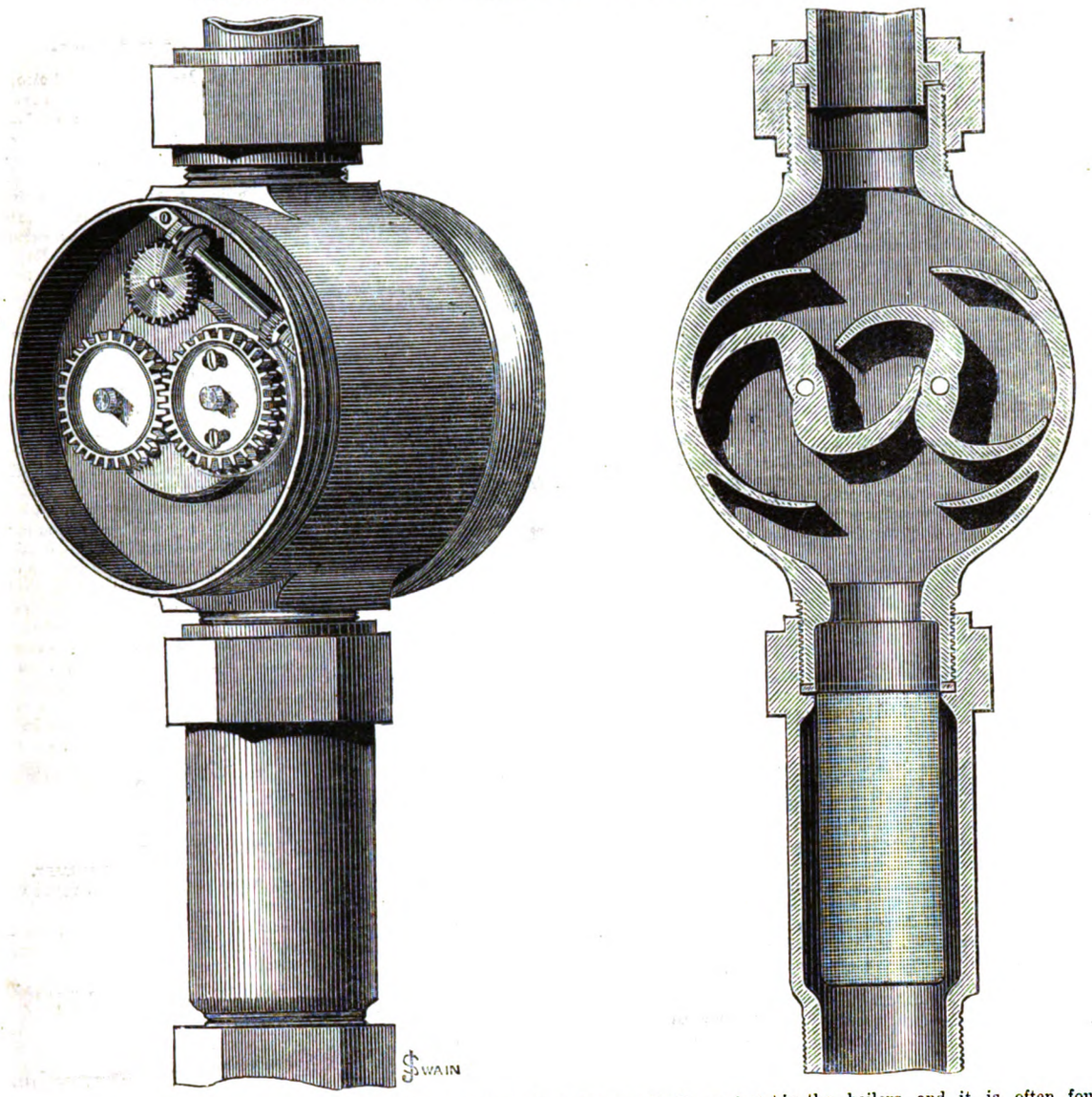
PAYTON'S CYCLOIDAL LIQUID METER.

CONSTRUCTED BY THE LIQUID METER COMPANY, LONDON.



PAYTON'S CYCLOIDAL LIQUID METER.

A SIMPLE, compact, and efficient water meter has long been wanted, and we appear at last to have found one in that illustrated in the above engraving. It is the invention of Mr. Walter Payton, and its action depends on the revolution of a pair of vanes, the interlocking surfaces of which are curved in prolonged epicycloids. The vanes, whatever be their position, divide the cylinder into two chambers, one in communication with the source and the other with the distribution. From the axes of these vanes motion is taken by appropriate gearing for moving the various counters on the index. The apparatus does not rely for exactitude of measure on fitting surfaces in contact amongst its parts, but on its extreme lightness and ease of motion, which, with the points of approximation of vanes and cylinder brought almost, but not actually, into contact, renders the passage of unregistered water practically impossible. In fact, from the absence of friction on the surfaces of the registering vanes, they move with such ease as to give no appreciable resistance, and, consequently, no measurable excess of water passing over that which is registered. These gauges were exhibited in Paris last year, and by experiments made upon them under the auspices of the "Conservatoire des Arts et Métiers" and vouched by M. Tresca and General Morin, we find that the excess of error in eight experiments, each extending over a period of from a quarter of an hour to an hour and forty minutes, and with heads of water ranging from about 12ft. to 40ft., the highest proportional error did not exceed ·034 per cent. It is stated that this arrangement acts well either as a pump or water motor. In this case, however, the leakage of water must be considerably greater than when employed as a meter, for there will then be a considerable difference in the hydrostatic pressure above and below the vanes, instead of that practically perfect equilibrium on which the action of the meters depends. In this matter, however, all rotary pumps and small water motors are under a similar disadvantage. The system will easily be recognzied by our readers as similar to that of Behren's rotary pump, Root's blower, and other contrivances of the same class, the difference lying in the shape given to the vanes, and the purpose to which the principle is applied. We may mention that the experiments in Paris proved that the fractional error to which the machine was liable sensibly diminished with an increase in the head of water, and an increase in the velocity of the vanes. The machine is at once simple and durable, and as there are no packed surfaces, a great source of derangement is avoided.

WOOD'S IMPROVED METHOD OF FITTING BOILER TUBES.

IN affixing cross or diagonal tubes in the flues of steam boilers great difficulty is experienced in getting them to their places, more particularly when the flues are finished and fixed in their places in the boilers, and it is often found absolutely impossible to take them out whole or to put new ones in a boiler which is completed or has been working without taking out the flues or using packing to make up the length of the cross or diagonal tubes, which latter method is obviously very objectionable and entails difficulty in making

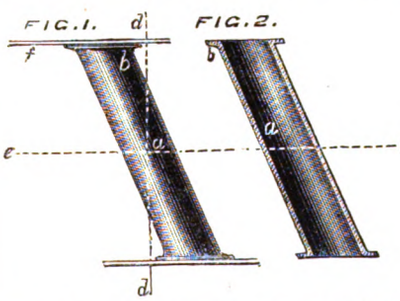
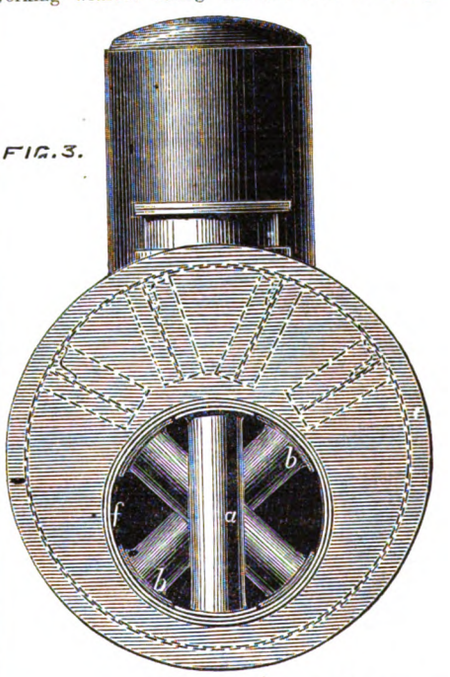


FIG. 3.



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the ends of the cross or diagonal tubes properly tight. By the adoption of the system we are about to describe, all these difficulties may be obviated, as the cross or diagonal tubes may be readily fixed in the flue or fire-box of any boiler, whether vertical or otherwise, after such boiler be completed, or even when fixed on its seat ready for working without altering any part of its present construction or taking any part of it to pieces. This system has been patented by Messrs. Wood, of the Don Boiler Works, Sheffield, and is illustrated in the annexed engraving, in which fig. 1 shows a side elevation, and fig. 2 a longitudinal section of a flue tube; fig. 3 shows an end view of a single flue boiler with the improved tubes applied in position. *a a* is the water flue tube having a flange *b b* at either end, serving to connect the same to the boiler flue or fire-box. The ends *c c* of the tube, instead of being at right angles thereto, are made at an oblique angle to the centre line of the tube. In this manner the tube when placed in the flue will be in such position that a line *d d*, drawn through its centre from the edge of one flange to the opposite edge of the other flange, will be at about a right angle to the centre line *e e*, of the boiler flue *f*, or slightly inclining thereto in the same direction as the cross or diagonal tube. Tubes fitted in this manner possess the advantage of being readily passed into the flue, and of being fixed or removed at any time for the insertion of new tubes, without interfering with the flues in which they are placed whatever the kind of boiler in which they are applied. We hear that these tubes have been applied to several boilers now at work and which are giving every satisfaction. All the Cornish boilers now made by Messrs. Wood are fitted with them, three large boilers with thirty-four tubes having just been completed for one firm. Within the last three months they have been applied to five-and-twenty new boilers. The boilers fitted with the patent tubes and at work are reported to be effecting a saving of from 25 to 40 per cent. on the amount of coal required for the boilers they have replaced. In fact, this appears to be a most successful invention, and is one well worthy the attention of all steam power users.

SOCIETY OF ENGINEERS.

AT a meeting of the Society of Engineers, held on Monday evening last, Mr. Baldwin Latham, president, in the chair, the following paper, "On the Surveys of Proposed Lines for a Ship Canal Between the Atlantic and Pacific Oceans," by Dr. Cullen, was read:—

The necessity that has long existed for a short and direct passage from Europe and the United States to the western shores of America, Australasia, and China, and *vice versa*, by means of a continuous channel, which would obviate the necessity for transhipment, has given rise to several projects for the junction of the Atlantic and Pacific Oceans. These have been discussed in papers read before the Institution of Civil Engineers, by Mr. Glynn, in 1847, and before the Royal Geographical Society, by Captain (afterwards Admiral) Fitzroy, in 1850; but, since those gentlemen wrote, several surveys have been made and much additional information acquired. Early in 1867, a report on "Proposed Interoceanic Railroads and Canals" was presented to the Secretary of the Navy of the United States, by Rear-Admiral C. H. Davis, the Superintendent of the Naval Observatory, Washington, in accordance with a resolution passed by the Senate on the 19th of March 1866; but Admiral Davis has not entered into any detailed description of the lines, referring for information to the thirteen surveys and maps appended to his report. The following paper is, therefore, respectfully submitted with the view of giving a summary of all that is known on the question of interoceanic communication. All the proposed lines have been surveyed, except that of Darien, which will form the subject of another paper. They are from N.W. to S.E., the Tehuantepec, Honduras, Nicaragua, Chiriqui, Panama, Chepo, and Atrato.

THE TEHUANTEPEC LINE.

This, which is the most northern and western, attracted the attention of Cortes soon after the Conquest, from the narrowness of the isthmus and the remarkable depression of the Mexican table-land at that point. In 1771, the idea of opening a canal between the oceans by this route, which had long been entertained, received a sudden impulse from the unexpected discovery in the fort of San Juan de Ulloa, in Vera Cruz harbour, that some cannon cast at Manilla had crossed the isthmus by the rivers Chimalapa and Coatzacoalcos.

In 1774 the line was surved by Don Augustin Cramer, in 1824, by Don Tadeo Ortiz and Don Juan de Orbegoso; in 1842 and 1843, by Senor Moro; and in 1852, by Mr. Williams, on the part of the Tehuantepec Railway Company of New Orleans. On the 25th of February, 1842, Don José de Garay addressed a memorial to General Santa Anna, the President of Mexico, asking permission to cut a canal across the Isthmus of Tehuantepec, to unite the Gulf of Mexico and the Pacific Ocean. On the 1st of March, 1842, a privilege was granted to him, and immediately afterwards a survey was commenced at the expense and under the orders of Garay. The direction of it was confided to Don Gaëtano Moro, who was assisted by a large staff: from his work* and Garay's† the following appear to be the principal features of the route. The width of the isthmus from the mouth of the river Coatzacoalcos to to Tehuantepec, on the Pacific, is about 138 miles in a straight line, and the direction is nearly due south. The Coatzacoalcos falls into the Gulf of Mexico in lat. 18deg, 18min. N., long. 94deg. 17min. W., by two mouths. The principal entrance has a depth of 20ft. on the bar, and within the bar the depth is 6 to 7 fathoms, and the river is about 800 yards wide. Its course up to the confluence of the Malatengo is about 160 miles, with a fall of 132ft., the depth varying from 30ft. in the lower to 6ft. in the upper part of the river. Leaving the Coatzacoalcos ‡ and ascending the Malatengo and the Chichihua, the summit level is reached. This is not a peak or a ridge, but an elevated plain, called the Mesa, or table-land, of Tarifa, extending 35 miles in the direction of the proposed route. The elevation of this water-shed, or lowest summit level, is 685ft. From thence to the Pacific the distance is 35 miles, 15 of which are occupied by three lagoons, having a depth of from 12ft. to 18ft. The entire distance would be 210 miles, and the enormous number of 150 locks would be required. But Mr. Williams,‡ who, with Major Barnard, of the United States' Topographical Engineers, surveyed the line, gives it as his opinion that water does not exist at the requisite level in sufficient quantity to render a canal practicable by lockage, and the enormous length of rock which would require to be cut through precludes the possibility of adopting that alternative. To the above unfavourable features, it must be added that the adjacent coasts are frequently troubled with furious storms, called Nortes, Tapayaguas, or Papagayos, according as their direction is N., S.W., or N.E., and that there is no harbour of any kind on either coast. This line, moreover, is out of the way to any place, except California.

THE HONDURAS LINE.

This was explored in 1853 by Mr. Squier, for the Directors of the British Honduras Railway Company. It was (and is again) proposed to begin at Puerto Caballos (Port Cortes) in the Bay of Honduras, and to proceed directly south, through the state of Honduras, to Fonseca Bay, on the Pacific. Although the route has good harbours, and the head-waters of the Rio Goascoran and the Rio Humuya, one of the chief affluents of the Ulua, interlock and even pass by each other, in either direction, for several miles of their course, the construction of a canal is utterly impracticable, since the summit level to be attained is 2,956ft. above the level of the sea, and there would not be sufficient water to supply a canal. The length of the proposed railroad line is 231 miles, for 17 of which the grade is 95ft. per mile.

THE NICARAGUA LINE.

By this line it was proposed to effect a communication between the Atlantic and Pacific by deepening the River San Juan from its mouth to the Lake of Nicaragua, out of which it flows; and cutting a canal from the further side of the lake to the Pacific. The length of the San Juan, the mouth of which is in lat. 10deg. 56min. N., long. 83deg. 43min. W., is 119·08 miles. There are no cataracts or falls in it, all the obstructions being from rapids, the principal of which are those of Machuca, which extend for about a mile, with broken water running over a rocky bottom, and the Castillo and Toro rapids near the lake. It is at all times navigable along its entire course for large piraguas drawing from 3ft. to 4ft. of water. The fall from the lake to the Atlantic is little over 1 foot per mile. The lake is 95 miles long, and 30 miles wide, with an average depth of 15 fathoms. The elevation of its surface is 125ft. above the mean level of the oceans. Baily found the surface of the lake to be 121ft. 9in. above low water on the Atlantic, and 128ft. 3in. above low water on the Pacific Childs gives the elevation at 128·47ft. above low water on the Pacific. On the Pacific side of the lake there is a mountain ridge rising to a considerable height above it. From its crest there is a sudden descent to the Pacific, the nearest part of which is only fifteen geographical miles from the lake.

In 1781, Don Manuel Galisteo, by order of the Spanish Government, took the levels from the Gulf of Papagayos (parrots), on the Pacific, to the lake. He used a water level, and by a series of 347 stations, about 100 yards apart, found the height of the ridge intervening between the lake and the sea, upon the line he took, to be 133·3 feet above the surface of the lake. The distance was about fifteen geographical miles. In 1837 and 1838, a survey was made by Lieutenant John Baily, of the Royal Marines, at the request of General Morazan, then President of the Central American Republic. Mr. Baily* proposed to cut a canal 15⅝ miles in length from the lake to the port of San Juan del Sur. This little harbour is narrow at the entrance, but widens within. It is surrounded by high land, except from W.S.W. to W. by S.. The depth of water at the entrance is three fathoms, and its width 1,100 yards. Ships can go up for a mile and a-half, but as the winds often blow with great violence from the N.N.E., there is sometimes great difficulty in making the port. Baily found the summit level of the ridge intervening between the lake and the Pacific to be 615ft. or 487ft. above the lake. For a canal 30ft. deep and 50ft. wide, cutting through this ridge would render necessary the excavation of the enormous quantity of 4,927,577,800 cubic feet. Mr. Horatio Allen, the engineer of the Croton aqueduct, in whose hands Mr. L. Stephens placed Baily's survey, thought it would be preferable to rise by locks 72ft. from the lake, then to tunnel two miles through the ridge, and descend by locks to the Pacific. But, as the ridge is volcanic, there being four extinct volcanoes in it one of them, Omotepec, still smouldering, on an island in the lake, it was very reasonably apprehended that a sufficient supply of water could not be obtained for a canal at the elevation of 72ft. above the lake. On the whole, this line presents more formidable difficulties than Galisteo's.

CHILD'S SURVEY.

In 1850 and 1851, this route was surveyed by Colonel Childs for the American Atlantic and Pacific Ship Canal Company, his assistants being Messrs. Fay, Curry, Fitzgerald, and Cropsey. He proposed to cut a canal 28·28 miles long, with six locks, on the Atlantic side, and to canalize the San Juan by means of seven dams and eight locks The communication between the lake and Brito, on the Pacific, was to be effected by a canal 18·32 miles in length with fourteen locks The summit of the ridge to be cut through on the Pacific side was found to be 46·03ft. above the surface of the lake, and the width of the ridge to be eight miles. Some dredging would be required at either end of the lake, as well as piers and embankments, the approach to its shores being obstructed by shoals and sandbanks. At Brito an artificial harbour would be necessary. This line, the direction of which is westerly, would thus require seven dams and twenty-eight locks, and would consist of

Miles.	
29·29	of canal on the Atlantic side.
90·80	of river navigation.
56·50	of lake navigation.
18·32	of canal on the Pacific side
193.90	

Child's estimate for a canal 17 feet deep was £6.570,483. At the same rate a canal 20 feet deep would cost upwards of £10,000,000. He estimated the time necessary for the transit of a vessel from sea to sea at 77 hours, assuming that she would be in continual progres, day and night, and would only spend twenty-eight minutes at the passage of of each lock.

LINE BY LAKE MANAGUA.

To avoid the difficulty of cutting through the rocky ridge, it was proposed to carry the canal from the lake, by the River Panaloya or Tipitapa, to Lake Leon or Managua, and thence to descend to the port of Realejo on the Pacific. Lake Managua is, about 15 leagues in length, and 35 leagues in circumference, its greatest breadth being about 9 leagues. The average depth of water is 10 fathoms, and its surface is 28ft. 8in.

* Moro, Don Gaetano, Isthmus of Tehuantepec, 1846.
† Garay, Don José de, Isthmus of Tehuantepec, 1844.
‡ This Mexican word signifies a snake, and was probably meant to express the tortuous character of the river.
‡ Williams, J. J. Isthmus of Tehuantepec, New York, 1852.

* Baily, John, Lieutenant R.M., Central America, 1850.
† Childs, Colonel O. W., Map and Profile of the Nicaragua Ship Canal Route, New York, 1852.

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higher than that of the Lake of Nicaragua, with which it communicates by the River Tipitapa. It is, therefore, 157ft. 2in. above low water on the Pacific. The length of Tipitapa is 30 miles, and for a distance of 24 miles from the Lake of Nicaragua, it has a depth of from 1 to 3 fathoms; but beyond this there are rapids, and in a distance of 4½ miles, a fall of 13ft., caused by a dyke of recent lava. It could, therefore, only serve as a feeder for a canal. By this course the difficulties of getting over the ridge would be obviated, but the length of the navigation would be increased nearly 100 miles, and it is doubtful whether Lake Managua could furnish the water necessary for the lockage, in both directions, which it would have to supply.

OTHER BRANCH LINES PROPOSED.

It was also proposd to connect the N.W. end of the Lake of Nicaragua with the Gulf of Fonseca, or Conchalagua, the shortest line between them being more than 90 miles. Another plan was to make a cut from its S. end to the Gulf of Nicoya. By each of these modifications, however, the length of the canal, the amount of excavation and lockage required, and the cost, would be very considerably augmented. Lastly, Œrsted, a Danish engineer, proposed a line from the mouth of the Sapoa river, at the S.W. part of the lake, to Salinas Bay, and estimated the height of the ridge at 130ft. above the surface of the lake. This line would be altogether in Costa Rica. In 1858, Œrsted's line was surveyed by M. Thomè de Gamond, who ascertained the elevation of the Col de Salinas to be 130ft. above the surface of the lake. His report was published by M. Belly.* Early in 1859, M. Belly, M. Gamond, M. Élie de Beaumont, Mr. O'Gorman Mahon, and a large staff of assistant engineers, went out to survey the line for an association of French and English capitalists, but, after a careful examination, the project was pronounced to be impracticable.

Besides the unfavourable features of this route, the consideration of the insecurity of the works, if ever completed, would justify great hesitation in undertaking any extensive operations in this district. Earthquakes are of very frequent occurrence. Volcanoes have risen within very recent periods, and prodigious quantities of ashes, water, and lava have been from time to time thrown over the country; and the relative elevations of land and water have been materially changed, all within the memory of living men. Humboldt says, "there is no spot on the globe so full of volcanoes as this part of America, from the 11th to the 13th degree of latitude." Mr. Stephens describes several volcanoes now in a state of activity not far from the line the canal would take; and Baily relates a curious instance of the rise of a volcano to the height of 1,500ft. above the level of the sea from a spot where living men had milked cows. Indeed, the volcanic character of this country is officially recognized, for the arms of Nicaragua and the seal of the Government are five volcanoes in action. A new volcano burst forth near Leon on November 14, 1867, and continued to burn till the 30th, when it died away, apparently smothered by its accumulated eruptions.

The insalubrity of the climate, owing to the swampy character of the banks of the San Juan, is another disadvantage under which the route labours. On this point it may not be irrelevant to mention that, in 1779, an expedition was sent from Jamaica by Sir J. Dalling, to take the fort of San Juan on the river, and the cities of Granada and Leon, so as to command the lake. Lord Nelson, who was engaged in this expedition as captain of the "Hinchinbrook," in writing to Dr. Moseley, who was preparfng a second edition of his "Treatise on Tropical Diseases," remarks that, "in the 'Hinchinbrook,' with a complement of 200 men, 87 took to their beds in one night; and of the 200, 145 were buried in mine and Captain Collingwood's time, and, I believe, not more than 10 of that crew survived." On the return of the expedition, Nelson himself was carried ashore at Jamaica almost in a hopeless state.

Politically, there are, at present, no difficulties with regard to this route; but there was long a disputed boundary question, in which Nicaragua, Costa Rica, and the Mosquito territory were concerned. For many years, too, the occupancy of the mouth of the San Juan was a bone of contention between the British and United States' Governments, and a bewildering mass of diplomatic rubbish was written on the subject, which was, happily, brought to a close by the Bulwer and Clayton Treaty of 1850. But hardly was the ink dry when they disagreed about the meaning of the first few words of the first sentence, each interpreting them in a directly opposite sense, whereupon the distracting correspondence recommenced, and culminated in the burning of Greytown, or San Juan de Nicaragua, by Captain Hollins, of the United States' corvette "Cyane," on July 13, 1854. This act brought matters to a crisis, and the paltry and undignified squabble was at last settled by the Dallas-Clarendon Treaty of 1857.

The want of adequate harbourage on either coast is the grand disadvantage under which this route labours. Brito has no pretension whatever to be called a harbour, the line of the coast thereabouts not presenting even an indentation. The harbours at the other proposed termini on the Pacific are wanting in either capacity or security, or both. The so-called harbour of San Juan de Nicaragua, or Greytown, is formed by a broken, low peninsula, which forms with the coast an inlet or basin, about three-quarters of a mile in extent, at the mouth of the San Juan. This narrow strip of land is composed of loose, black, ferruginous sand, which is so highly magnetic as to interfere with the proper action of the compass. Outside of it a shoal extends to the distance of a quarter of a mile, over which the sea breaks heavily. Off Punta Arenas, the western point of this strip, there is a shoal with only three-quarters or half a fathom on it, which often shifts, and is subject to considerable changes, from the heavy floods that occasionally come down the river. Punta Arenas itself has of late years advanced so rapidly as to close the harbour, except to small vessels. In fact, this harbour is only the recipient of the waters of the San Juan, after they have passed through its delta, or percolated through the low grounds and out of the lagoons in the vicinity, bringing with them much drift bush and dead trees. These ground on the shoal off Punta Arenas, and become the nuclei of future islets, which, by their gradual increase, threaten to block up the harbour, and force the river to seek an outlet somewhere else. The delta, which is increasing, is formed, in the first instance, by mud brought down by the river. On this, dead trees ground and form islets, which in time become connected, the quick rank vegetation of the moist climate assisting in the process. The three channels into the river have only a depth of three-quarters or half a fathom over the shoal which extends in front of them, from the west extreme of Greytown towards Point Mandeville. Within them are from one and a-half to two fathoms in the river.

The West India Mail steamers and the New York steamers, which call at San Juan de Nicaragua, do not enter the harbour, but lay-to outside; and, as the prevalent winds make the coast a lee shore, they have to keep steam up all the time. Should it blow much, they cannot communicate with the shore, but are obliged to put to sea at once. Northers are not unfrequent, and much damage was done by one on the 22nd of November, 1862. Lieutenant (now Captain) Pim, R.N., who surveyed the harbour in April, 1860, says: "The deepest water I could obtain between the two points of the entrance was only 12 feet, and that not continuously across." On a subsequent visit he found that "the sand spit which forms the seaward face of the port had extended itself, and therefore narrowed the entrance, during 15 months, no less than 200 yards." More recent information is to the effect, that the harbour is almost completely filled up, and the river has forced a channel for itself elsewhere. It is evident that such a harbour could never be made suitable for the terminus of a ship canal. For this and the other reasons given above, the idea of opening a ship canal communication by this route has been finally abandoned.

For many years past, passengers and goods have been carried across by the Accessory Transit Company formed by Vanderbilt, of New York. They are conveyed by steamers and boats, on the lake, and mules from thence to the Pacific; and, although there are six transhipments on the way, the line is so frequented by outward and homeward bound Californians that it pays very well. A railroad from Monkey Point to Realejo has been proposed by Captain Pim, R.N. Monkey Point, 38 miles due N. of Greytown, is in lat. 11deg. 46min. N., long. 82deg. 45min. W. The little bay under its lee, which is protected by two islands, has good anchorage and an average depth of 3½ fathoms. The line runs close to the Chontales gold district. It length would be 225 miles. The lowest summit level, according to Mr. Collinson, C.E., is 619 feet above the lake, or 740ft. 9in. above low water of the Atlantic.

THE CHIRIQUI ROUTE.

This would lead from Chiriqui Lagoon, on the Atlantic, to Golfo Dolce, on the Pacific. The survey of the former by Captain (now Rear-Admiral) Barnett, R.N., proves that the former is an excellent harbour. Of Golfo Dolce, Commander Jeffers, U.S.N., the hydrographer of the Chiriqui Commission of 1860, says: "It is unsurpassed in natural facilities; three streams, the Golfito, Coisal, [and the Canaza enter the harbour, and afford an ample supply of fresh water." This line was examined, in 1848, by M. Hellert, a German traveller, who found that the supposed passage through the lofty range of mountains between the above ports presented the most formidable difficulties, and could in no way be considered practicable. In 1860, Lieutenant Morton, of the Chiriqui Commission, landed at Frenchman's Creek, in the Lagoon, explored a swamp of great extent, and discovered a hitherto unknown pass through the Cordillera. His examination resulted in the conviction that "it is entirely practicable to connect the harbours by a line of railroad." However, considering that immediately inland of the Lagoon, the Cordillera presents the summits of Cerro Robalo 7,012 feet high, the volcano of Chiriqui 7,001, and another 7,452 feet high, it is not probable that any pass exists sufficiently low for a canal.

This isthmus of Chiriqui is traversed from north to south by coal seams, varying in quality from lignites to semi-bituminous and semi-anthracite coals, which were first examined by M. Salomons, Mr. Wheelwright, and Sir Edward Parry. Mr. W. W. Ridley, civil engineer, of New York, who visited the district afterwards, says:—"Concerning the quantity of coal that can be obtained here, no doubt can be entertained that it is sufficient to supply the steamers on the Pacific for ages." Messrs. Shuman and Whiting, in their report dated April 1, 1851, on the coal formation of the island of Muerto, near David, on the Pacific, say:—"We have found the Muerto coal to burn equally as free as the very best English coal, emitting a bright beautiful flame, with as much bitumen." Dr. Lagarde, the surgeon of the French frigate "Obligado," which was sent to survey the Pacific coast of Veraguas,* brought specimens of the Muerto coal to Professor Rogers, of Pennsylvania, who, on analysis, found it to contain bitumen, 36·27; solid carbon, 58·48; ashes, 5·25.

On the Atlantic side, Dr. Evans, the geologist of the Chiriqui Commission, found a coal-field, extending from Secretary and Saddle Hills at Cape Valiente, for 50 miles in a N.W. direction, through Popa Island to the Changuinola river in Chiriqui Lagoon. Its breadth was from 5 to 14 miles, and the aggregate thickness of the seam of coal was 74ft. Dr. Evans deposited specimens in the Smithsonian Institution at Philadelphia. This coal-field is now worked by English and American companies for the supply of the Pacific steamers. Some years ago, a discovery was made at the village of Tarraba, in Costa Rica, of a bed of coal upwards of 6 miles in length and 150ft. in breadth. Dr. Evans also found in Chiriqui gold, and ores of iron, copper, and platinum. Although the entire of this line, with the exception of the Pacific terminus, is included within the territory of New Granada, the Government of Costa Rica granted a privilege for making a road along it to Mr. Silk Buckingham. This gave rise to a controversy between A. Montoya, Vice-Consul of New Granada, and E. Wallerstein, Consul-General of Costa Rica, and the privilege became null and void.†

(To be continued).

ON CRYSTALS CONTAINING FLUID.‡

By MR. J. B. DANCER, F.R.A.S.

THE author gave a brief history of the discovery of fluids in crystals, including Sir H. Davy's chemical experiments on the fluids and gases obtained from the cavities in quartz crystals; Sir David Brewster's discovery of the pressure cavities in the diamond, ruby, emerald, amethyst, chrysoberyl, &c.; the existence of minute crystals in these cavities and the two new and remarkable fluids, which are immiscible, but sometimes found together in the same cavity—one a liquid hydrocarbon, named Brewstoline, the other Cryptoline; his experiments and examinations of artifical crystals deposited from aqueous solutions; his examination of the Koh-i-noor diamond and others in the

* Belly, M Felix, Canal de Nicaragua, Paris, 1858.

* De Rosencoat, Captain, Reconnaissance Hydrographique, Dupont, Paris, 1857.

† Montoya, A., New Granada and Costa Rica Boundary Question, 1852.

‡ Read before the Literary and PhilosophicalSociety.

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East India Company's museum; and the geological speculations to which these discoveries gave rise. Mr. Dancer mentioned the experiments of his late father and others in producing artificial gems by intense heat, and stated that his own attention was drawn to this subject some twenty-four years since, by Sir David Brewster presenting him with a specimen of topaz containing fluid. Since that time he had examined a large number of crystals of various kinds, from the collections of friends, and had found fluid in quartz from South America, Norway, the Alps, Ireland, Snowdon, and the Isle of Man; and in fluor spar from Derbyshire; this latter specimen contained a considerable quantity of fluid, which burst the crystal of 180deg. temperature.* He suggested the employment of the microscope as a valuable assistance in detecting spurious from real gems; very few of the latter are perfect, and the flaws and cavities are so distinct in character from those which are so abundant generally in artificial gems that very little experience is sufficient for the purpose. This mode of testing of course is limited to transparent crystals, but might be employed when the usual methods are not practicable. He also mentioned Mr. Sorby's discovery of fluid cavities in the quartz of granite, in the quartz of volcanic rocks, and also in the felspar ejected from the crater of Vesuvius, and Mr. Sorby's method of determining the temperature at which various rocks and minerals are formed. At the conclusion of the meeting, crystals containing fluid were exhibited under the microscope, and the expansion of the fluid by elevating the temperature of the crystal whilst under examination.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

THE ordinary monthly meeting of members of this society took place on Saturday, the 1st, inst., at their rooms, Aldermanbury, City. The sitting commenced with the reinstallation, for the tenth consecutive year, of Mr. Joseph Newton as president. That gentleman, in resuming the office expressed his sense of the honour conferred upon him, and promised to devote his energies to the furtherance of the interests of the institution. The election of several new members—honorary and ordinary—followed. Among the former of these were Joseph Whitworth, Esq., L.L.D., F.R.S., John Lea, Esq., and W. F. Stanley, Esq.: and among the latter Mr. Peter Keay, of the Royal Arsenal, Woolwich, and Mr. Joseph Stone, of Messrs. Cottam and Co.'s.

Mr. William H. Keyte next proceeded to read a paper on the lining of large iron vessels or boilers with lead. The subject was treated in a thoroughly practical manner by the author, who detailed his own experiences in superintending works of the description in question. He had encountered many difficulties in the operations and found that it was almost impossible to overcome them. It was found that the vessels when charged with acid and heated beyond a certain degree showed symptons of weakness. The unequal expansion and contraction of the two metals induced a separation between them. The lining of lead, though applied in the first instance with great care, became permanently collapsed and distorted, and no means could be found for preventing that disaster. Illustrative of this fact Mr. Keyte introduced diagrams, exhibiting longitudinal and cross sections of a large boiler after being in use for a short time. The lead lining was seen to have become buckled and misshapen to an extraordinary extent, and to present other curious phenomena. The writer of the paper then invited his fellow-members to favour the meeting with their views as to the best way of solving the problem which had so far puzzled him.

Several members responded to the appeal, and numerous sketches were made on the spot and handed round for inspection. Some of these exhibited much ingenuity, and comprised a variety of plans for jointing the lead so as to facilitate expansion and contraction. The discussion demonstrated very forcibly the usefulness of the Association to the foremen and employers. It was sustained mainly by Messrs. Miles, Irvine, Fishwick, Bragg, Walker, Edmonds, Briggs, Stabler, and the president. Mr. Stabler very justly observed that in these days of gas and acid engines it was highly desirable for engineers to study chemistry as well as steam.

In putting to the meeting the customary vote of thanks to the contributor of the paper, Mr. Newton earnestly pressed the associated foremen to follow Mr. Keyte's example, and to produce subjects for consideration in constant succession. He wished to make the society an adult college for the promotion of technical, scientific, and practical knowledge. It was gratifying to be able to state that its proceedings were regarded with interest both at home and abroad, and he had it from Mr. Mackinlay, chief engineer of the Royal Dockyard, Bombay, and who had that evening started for India, that it was in contemplation to form a similar institution in Bombay. The vote of thanks having been unanimously passed, the sitting closed

* After this paper was written, Sir David Brewster informed the author that the fluid contained in crystals of fluor spar was water, and that the cavities burst at a temperature of 150deg.

Correspondence.

THE SQUARE OF THE CIRCLE, AND THE GREAT PYRAMID OF GIZEH.

LETTER IX.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I really did not expect to have to defend my discovery of the square of the circle, and the ratio of the diameter to the circumference of a circle, against such a powerful body as the Royal Navy resident at Pembroke Dockyard; but I suppose I must do so in the person of your correspondent, "R. N.," who dates from there in your issue of January 17, 1868. The weapon, too, with which "R. N." assails my discoveries is so peculiarly naval, viz., "The Nautical Magazine" or "Approximate Ephimerides" of the heavenly bodies, that I should have thought "R. N." would not have advanced it without due thought and precision. Apparently, however, such is the case, for he does not seem to be aware that the paths of the planets, &c., are ellipses not circles; or what a powerful part the astronomical clock and its active young assistant the "chronographer," with other "thuribula" play in the department centered in the centre of Greenwich-park. He will perhaps inform himself, and become aware that the "Nautical Magazine" is not a fit weapon to use in the discussion of the question of the square content of a circle, or the ratio of the diameter of a circle to its circumference, and in a manner so "ex cathedra."

Reverting to the subject of the Great Pyramid of Gizeh, I think it will be better, before completing the elucidation of the internal structure of the Pyramid by diagram, to put before you and your readers some numbers and theories which may at first sight appear startling, but which, in this inquiring age, are worthy of discussion; and bearing relation, too, as they do, to the ideas and symbolisms of a long past age, clear up much which would otherwise be obscure. At all events, they will assist in rendering the internal description of the Pyramid afterwards from Colonel Vyse's measurements more lucid and easy.

In my last letter I alluded to Masoudi's account of the Great Pyramid and the objects of its builder. The store of astronomical and geometrical facts and instruments of which he writes was mainly confined to the Grand Gallery. This great depository of the recorded facts and learning of perhaps antediluvian age, speaking with reference to our common chronology, remained untouched, because undiscovered by the drunken epileptic and ruthless destroyer Cambyses, King of Persia, about 600 years before Christ, as well as by previous plunderers. It was not until, from a strong desire for learning, that at great expense the second son and successor of the celebrated Caliph Haroun Al Raschid, the highly cultivated and intellectual Caliph Al Mahmoun, succeeded, by the use of gunpowder, in obtaining access to its stores. This was nearly cotemporaneous with the wars of the Crusades, and I am confident that here was the source whence the Arabians derived their afterwards celebrated astronomical and astrological knowledge, as well as the arithmetical digits which are called the Arabian numerals to this day. I am equally convinced that the intellect and race which conceived and reared the Pyramids was not native Egyptian, but came from a distant source, which a fully reasoned orthographical and lingual search would lay bare, but which, I fear, your space will not enable me to do more than notice, if you will permit me, in a subsequent letter. At present, I will shortly state the objects of the Grand Gallery. Its length is filled on each side of the pathway (ascending from the entrance passage on a slope of 26deg. 18min. with the horizon) for about 21in. from the floor, by what are now bare sloping benches of stone, with twenty-eight equidistant broken holes termed ramp holes, and above these benches, on each side of the so-called roof of the gallery, are seven tablets of equal perpendicular width, but gradually narrowing in on each to the centre, over the whole length of the gallery. The twenty-eight ramp holes contained carved representations, now torn away, having reference to the appearance of the eastern and western sections of the celestial sphere during the sun's cycle of twenty-eight years. It is hence we derive the knowledge which guides us in the use and force of seven Dominical letters marking the dies solis or Sunday, which appear in our prayer-books and almanacks, originally derived from the Egyptian use of their seven planets in ruling over each day of the week of seven days, and over every hour of every day again encircling in the same gyration. The seven entablatures, the carved descriptions on which are now also torn away, recorded the positions of the seven planets during each of the twenty-eight years of the solar cycle. The highest entablature was dedicated to Saturn, the second to Jupiter, the third to Mars, the fourth (along which on each side of the gallery runs a groove which has been a sad puzzle to all Pyramidographers hitherto) to the Sun, the fifth to Venus, and the seventh and lowest to the Moon. Herodotus has long since, in his second book, "Euterpe," told us of the Egyptians valuing the number 12 as well as 7; and the Israelites derived a value of the same numbers from them; but he has not told us why this was, nor am I aware that the reason has ever yet been guessed at. But the Egyptians, or those who taught them, knew the powers of numbers better than any other nation; and the value of duodenary over denary arithmetic, which last is now in France, as well as elsewhere, so much the fashion, without due inquiry. The origin of the preference of the Egyptians for duodenary arithmetic was in the continued and endless gyration of their seven planets, to each of which the undernoted numbers were attached as follows:—

3 Saturn.	4 Jupiter.	5 Mars.	6 The Sun.	7 Venus.	8 Mercury.	9 The Moon.
9 The Moon.	8 Mercury.	7 Venus.	6 The Sun.	5 Mars.	4 Jupiter.	3 Saturn.
=12	=12	=12	=12	=12	=12	=12

The addition of these seven sums of 12 gives 84, which was the number of dactyls, fingers, or inches in the whole width of the Grand Gallery of the Pyramid. These inches were each 1-84th of the grand unit of measurement already mentioned (6ft. 10⅓in. British), and this unit is the longest and most natural human measure, viz., from the gaps of the first finger and thumb of the closed hands with the arms fully stretched down each side, the measuring line being extended from these points over the top of the head. This unit of measurement is still preserved nearly intact in the canna or reed of Naples and other standards of measure. This unit was first divided into seven parts, representing the measure over the top of the head from tip to tip of the ears; again, into the palm of four fingers and the hand of three fingers or inches. The multiplication of the two last divisions is the origin of and forms our own foot of twelve fingers or inches. The great human unit thus consisted of $1 + 7 + 4 + 3 = 84$. How near our own measures still are to these values may be tested by your readers for themselves, and the following two instances will exemplify the great convenience of this system of notation, viz. $7 \times 4 = 28 \times 3 = 84$, and $3 \times 4 = 12 \times 7 = 84$. It will be observed that the origin of all this is 7, and its constituent elements 4 and 3, and the first of these 4, which is the first square number, produces with 7 the second perfect number 28, which is the number of the solar cycle, while the number of the sun (6), is that of the side of the sun's magic square, and is also the first perfect number. With these two first perfect numbers all other perfect numbers terminate.

I must here bring Hutton to my side, or your readers will perhaps think I have embarked on the sea of imagination without a rudder. The following is from his Dictionary, under the heading "Magic Square." "The magic square was held in great veneration by the Egyptians. To Saturn they attributed the square of 9 places or cells, the side being 3, and the sum of the numbers in every row 15. The following table will explain:—

Planets.	Side of Square.	Places or cells in Square.	Sum of Numbers in each Row.
Saturn	3	9	15
Jupiter	4	16	34
Mars	5	25	65
The Sun	6	36	111
Venus	7	49	175
Mercury	8	64	260
The Moon	9	81	369

Finally, they attributed to imperfect matter the square "of four divisions, having two for its side, and to God the square of only one cell, the side of which is also an unit, which, multiplied by itself, undergoes no change."

I have shown in my last letter how the base of the Great Pyramid is restricted to 764ft. British by the circle of the sun's annual revolution, measured in Great Pyramid units; and although these magic squares of the Egyptians have been much derided, I shall presently show, as in the case of that of the sun, to which I shall confine myself, that they were really the expression and representation of true

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astronomy. Before doing so I shall make a short quotation from "Hutton's Translation of Montucla's Edition of Ozanam's Recreations in Mathematics," newly edited by Edward Riddle, Master of the Mathematical School, Greenwich, in one vol., 8vo. London: Tegg, 1840. This is it:—"The sun is, or seems to be, a globe of fire, the diameter of which is equal almost to 111 times that of the earth; its surface, therefore, is 12,321 times greater than that of the earth." In writing this the author seems not to have observed that from want of due inquiry, he had, when treating of magic squares, overlooked the true meaning and value of the magic square of the sun. The base of the Great Pyramid is a comparison of the Pyramid, human, or earthly great unit of square surface with that of the surface of the sun, as just quoted. There are 111 pyramid or human units in 764ft. British, and 111 × 111 = 12,321. I now, then, produce the magic square of the sun's number:—

29	12	28	9	7	26
32	31	8	4	36	5
23	18	15	16	19	20
14	24	21	22	13	17
2	1	34	33	6	35
11	25	10	27	30	8

It will be seen that all these numbers vertically, laterally, and from corner to corner, give the number 111.

These suggestions are but a small portion of one branch of the derided and overlooked wisdom of the ancients, which may be drawn from the remnants we possess of their works duly weighed without prejudice, and with vigilant self-corrective search. I will not now continue them further, but I hope to do so in another branch of the internal teaching of the Great Pyramid in my next letter, in noticing the suggestions of Sir John Herschel respecting the star a Draconis, alluded to in my last letter.—I am, Sir, yours, &c., WILLIAM HARVEY.

London, January 29.

ANILINE BLACK.

SIR,—Can you inform me if Lightfoot's aniline black is applicable for dyeing woollen fabrics, and if a permanent colour, and, if so, where I can procure it; you allude to it in page 65 of your last number, under the "Notes on recent scientific discoveries and their practical applications."—I am, Sir, yours, &c., H. D. D.

[The colour can be printed on woollen as well as cotton fabrics, and will, no doubt, be equally permanent. We do not know Mr. Lightfoot's address, but think it is Accrington. Ed. M. M.]

INTENSITY OF COLD.

SIR,—There is a point in a subject of great importance to which philosophy has not hitherto paid that particular attention it deserves. This is the intensity of cold. In a theory of the universe the subject of cold is as important as that of heat. In the present position of the earth our knowledge is limited to a certain degree, beyond which it is impossible to advance. All that we know is, that the most intense cold we can experience approximates in its effect to that of heat. But, how insignificant are the degrees of cold to those of heat. As I said before, the position of the earth is the boundary of our knowledge. The physical impediment to our forming a correct opinion of the one as of the other is insurmountable. Arguing from the imperfect knowledge we possess, we may arrive at the conclusion that extreme heat and extreme cold are in effect the same, i.e., the decomposition of matter. The sun is a sufficient example; it is the source of heat As a planet increases its distance from its sun so must the cold increase in intensity, until, arrived at the confines of its system, it assumes that form which we behold in the central body of our own.—I am, Sir, yours, &c., H. SALOWAY.

6A, George-street, Dover-road.

WELL BORING IN ABYSSINIA.

SIR,—In your number of January 24, under head of Naval, Military and Gunnery items, you mention the fact of Captain Le Messurier having arrived at the Abyssinian camp with some "well borers" and a staff, and that the result has been highly satisfactory. Will you allow us to explain that the "well borers" mentioned are nothing more nor less than "Norton's Patent Tube Wells," noticed by you in the MECHANICS' MAGAZINE of December 13, 1867; and the beauty of the invention consists in the fact that these wells need no boring nor digging, but are simply driven into the earth where indications of water appear, and the result is produced. We may mention that we are now operating at Terling, in Essex, the seat of the present epidemic, where we have already founed a supply of good, clear water, though, at present, as we have only our small tube down, limited in quantity.—We are, Sir, yours, &c., G. C. WARDEN & Co.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—W. H. H.—T. F. C.—O. T. R.—Messrs. W. Bros.—M. J.—A. W.—M. S.—S. L. L.—S. S.—E. M.—A. C.—J. G.—T. C.—H. D D.—J. H.—J. N.—R. J.—H. S.—F. A. P.—C. D.—J. B. T.—J. E. P.—R. F. F.—Messrs. G. C. W.—J. G.—W. H. H.—J. M. E.—R. T.—W. P. M.—H. H.—W. T. F.—S. E.—R. S.—J. McG.—E. S.—R. T.—F. W. B.—R. G. S.—Messrs. C. and M.—W. H. Le F.—Messrs. S. W. and Co.—J. N.—F. E.—D. C.—J. F.

Meetings for the Week.

MON.—Society of Arts.—Dr. Letheby on "Adulterations of Food," at 8 p.m. Conclusion.

Royal Geographical Society.—Sir R. J. Marchison, Bart., President. Captain Sherard Osborn, R.N., on "The Exploration of the North Polar Region," at 8.30 p.m.

TUES.—The Institution of Civil Engineers.—Renewed discussion upon, 1st, "The Fresh Water Floods of Rivers:" and, 2nd, "Floods in the Nerbudda Valley"; and should time permit, the following paper will be read by W. J. M'Alpine, M.I.C.E., on "The Supporting Power of Piles, and on the Pneumatic Process of Driving Iron Columns," at 8 p.m.

Royal Institution.—Professor Tyndall on "The Discoveries of Faraday," at 3 p.m.

THURS.—Royal Institution.—Professor Tyndall on "The Discoveries of Faraday," at 3 p.m.

FRI.—Royal Institution.—Professor Roscoe on "Vanadium and its Compounds," at 8 p.m.

SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

Naval, Military, and Gunnery Items.

DR. DEANE, Q.C., has been appointed Admiralty Advocate, in the place of Sir Travers Twiss, who resigned on his appointment as Queen's Advocate.

IT is expected that before the next monsoon, the Godavery river will be opened for navigation as far as the second barrier, 225 miles from the sea.

THE Liverpool, New York, and Philadelphia Steamship Company have contracted with Messrs. Tod and Macgregor, of Glasgow, for a new steamer, 345ft. keel and forerake, and about 2,600 tons measurement, to be called the "City of Brooklyn."

CAPTAIN PETON, commander of a Turkish steam frigate, the "Abdul Medjid," was recently fined £26 16s. by the Liverpool magistrates for illegally removing some cigars, wine, and brandy from the ship, which is now undergoing repairs in a graving dock. This is a grave case of smuggling.

PREPARATIONS are being made at Chatham Dockyard for the launch of the iron-clad frigate "Hercules," 14, 5,226 tons, 1,200-horse power, which will take place on Monday afternoon at about one o'clock. The gates of the dockyard will be thrown open some time before the launch, to enable the public to witness the ceremony.

MESSRS. KIRK, building contractors to the War Department in the Royal Arsenal, Woolwich, on Saturday last, commenced laying the foundations of the seven magazines ordered to be erected on the river bank in the Arsenal marsh. They are to be bombproof, and detached from each other by lofty mounds of earth, to guard against injury in case of accidental explosion. They are intended for filling and preparing live shells and 40-pounder gun cartridges.

A WAR DEPARTMENT circular has been received by Colonel Campbell, superintending the Royal Gun Factories at Woolwich, acceding to his request to be permitted to utilize some of the old cast-iron guns of small calibre, to be converted by the puddling process into bars and coils for the manufacture of the new Fraser guns recently adopted for the service.

A NARROW escape from a very serious fire breaking out at the Keyham Factory, Keyham yard, Devonport, took place last week. The major part of he men had left work, when some millwrights that twere employed extra hours discovered a large portion of the timber framework supporting the tramroad passing through the quadrangle a mass of smouldering fire, and on the point of breaking out into a very serious fire. Assistance was promptly obtained and the fire extinguished.

THE foundation stone of the new fort about to be erected on St. Catherine's Rock, Tenby, has been laid by Captain Clements, Royal Engineers, in the presence of a number of officers and others connected with the Pembrock dock garrison. The clearing and levelling of the apex of the rock in order that the foundations might be firmly laid had been going on for months past, and the fort buildings will be at once proceeded with.

THE Swedish brigantine "Cherubim," which was rescued from going ashore at Credan Head in the storm of the 18th inst., by the Milford steamer "Great Western," and brought safe into Waterford harbour, has been detained by the receiver of wreck, Mr. Delahunty, at the suit of the "Great Western," pending a writ from the Court of Admiralty for salvage claims. The captain (Thalberg) repudiated the claim, and two custom house officers are now in charge.

THE directors of the Peninsular and Oriental Steam Company have resolved to present a handsome gold chronometer, with a chronograph, worth 100 guineas, to Captain Kuhn, the commander of the corvette "Venita," of the Prussian Navy, as a token of gratitude for services rendered by him to the passengers and crew of their steamship "Singapore," after the wreck of that ill-fated vessel in August last. The chronometer, which is an excellent specimen of its branch of art, has been manufactured by Mr. Jones, of the Strand.

The following lectures will be delivered in the lecture theatre at the Royal Engineer establishment, Chatham, to the officers and men of the corps of Royal Engineers during the spring:—February 3, on Stress on Beams by Mr. W. C. Unwin; 6th, on Continous Web Girders, Mr. W. C. Unwin; 10th, on Braced Girders, Mr. W. C. Unwin; 13th, on Roofs, Mr. W. C. Unwin; March 17th and 24th, on the Acoustics of Buildings, by Mr. W. F. Barrett. A course of lectures on Iron will also be delivered during the session.

Miscellanea.

THE corn crop of California for 1867 exceeded the value of the gold product. 161 vessels laden with wheat were despatched to Europe.

WE read that the passenger cars on the Boston and Albany Railway are heated by steam. The steam pipes run under the seats, and effectually warm the cars.

AT a book sale in the United States, a short time since, a copy of John Eliot's Indian Bible fetched 300 dollars, and a Dibden edition of Milton fetched 1,500 dollars or £300 sterling.

THE Masonic brotherhood of Philadelphia are about to build a granite structure 250ft. long by 150ft. wide, with a tower 300ft. in height. A very tower of Babel, and which will cost nearly 1,000,000 dollars.

WE understand that proposals have been issued for the formation of a society to be composed of scholars who feel an interest in the writings of Homer and early Greek poetry, and to be called "The Homeric Society."

A FRENCH *restaurateur* in New York is about trying the experiment of introducing horse-flesh in that city as food. He says its rivalry may have the effect of reducing the present exorbitant price of beef.

THE Princess of Leuchtenberg has just sent as a present to the Mineralogical Society of St. Petersburg, on the occasion of her marriage, a collection of fossils which she had made in her various tours in Europe. The association, in return, has elected her to be an honorary member.

THE yield of gold and silver in the United States in 1866 is estimated at 80,000,000 dollars; in Mexico and South America, at 40,000,000 dollars; in Australia, at 61,000,000 dollars; in British America, at 10,000,000 dollars; in Siberia, at 16,500,000 dollars; and elsewhere at 7,000,000 dollars.

RICH deposits of gold, it was some time ago announced, had been discovered in Russian America. A despatch to the State Department reports that an assay had been made of the gold ore found there at San Francisco, and it yields at the rate of 13,000 dollars per ton.

LIGHTNING recently struck a windmill at Kerlard, France, and killed one of the men, who had his head in a measure split open. The electric fluid, after tearing the canvas sails to shreds, darted across to the lighthouse of Grognoy, 300 yards distant, and shattered the paratonnere.

A CURIOUS record of fires in London, their causes and their proportion to trades and professions and private houses, has been kept for the last thirty-three years, during which time 29,000 fires have occurred, and nearly 36,000 fire alarms have been given at the fire-engine stations.

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DURING one week the number of foreign letters received at and despatched from New York are reported to have been as follows, viz.:—British letters, 65,439; German letters, 42,117; French letters, 24,369; and Belgian letters, 809. The number of letters between the West Indies, Australia, South Pacific, and China and New York by united steam ships was 32,308 during the same period.

THE ceremony of opening the Lewes and East Sussex Industrial Exhibition, which has been for a long time in progress, will be performed on Monday next, by Mr. J. G. Dodson, M.P. Products of industry and art will be brought together from various parts of East Sussex, the works chiefly of artizans in their leisure hours.

LAST week a large meeting of the Tynemouth Society took place. Messrs. Ransomes' crack ploughman, from Ipswich, and twenty north-country ploughmen competed for the honours, among whom was a farmer's son, John Moore, from near North Shields, who, in a masterly style, carried off the first prize with a Howard's plough. The society also gives a silver medal to Messrs. Howard as the makers of the first winning plough.

THE number of visitors at the South Kensington Museum during the week ending February 1 were:—On Monday, Tuesday, and Saturday (free), from ten a.m. to ten p.m., 7,406; Wednesday, Thursday, and Friday (admission 6d.), from ten a.m. till four p.m., 1,514—total, 8,920. Average of corresponding week in former years, 9,745. Total from the opening of the museum, 7,173,934.

A CIRCULAR from Mr. F. M. Page gives the particulars of the shipments of specie to the East during the last eight years, from 1860 to 1867 inclusive. The average has been £14,401,100. From the year 1860, when the amount was £13,500,372, there was an increase to £24,318,189 in 1864, the highest total ever reached, and from that point a decline took place, which assumed extraordinary features last year, when the exportation was only £3,659,154.

LAST week the gardener of Mr. John Brogden, in trenching some meadow land at Highbury, Middlesex, found a vase containing nearly 7,000 silver coins, consisting of silver pennies (London, York, Middlesex, Bristol, and Canterbury), groats, and half-groats, halfpennies, &c., (Irish and Scotch, Venetian and foreign, Teutonic), and two gold coins of Edward III., also an amber rosary. The coins have been partially arranged by Mr. Vaux, of the British Museum, previous to delivery to the Crown.

AN avalanche lately fell at four in the morning at Bareges, in the Hautes-Pyrenees. It came from the Turon de Venne by the Gavin Thell, and struck near the officers' quarters of the military hospital. The *debris* choked up the bed of the Bastan, and turned the stream into the principal street of Bareges, inundating a great number of houses, and tearing up the way to a depth of three feet. The inmates in many cases had difficulty in escaping with their clothes. The loss, not yet ascertained, is believed to be considerable.

AT a meeting of the members and associates of the Royal Academy, held last Friday evening, the following gentlemen were elected Associates:—Mr. Thomas Landseer, Mr. George D. Leslie, and Mr. William Q. Orchardson. Mr. Landseer, himself the son of a late Associate engraver, and the brother of two living Academicians, has been elected in the place of Mr. George T. Doo, one of the first line engravers of the English school, who recently retired; Mr. Leslie worthily sustains the name of his most distinguished father, Charles Robert Leslie; and Mr. Orchardson fitly represents the force of talent unaided by ancestral claims.

AT the last meeting of the Institution of Civil Engineers, twenty-two candidates were balloted for, and duly elected, including, as Members, Mr. J. W. Barry, Mr. James Craig, Mr. C. H. Denham, and Mr. D. R. Edgeworth; as Associates, Mr. F. B. Behr, Mr. Richard Broome, Mr. W. H. Cock, Mr. F. C. Danvers, Mr. E. W. De Rusett, Mr. C. W. Dixon, Mr. W. F. Faviell, Mr. A. F. J. Fisher, Mr. J. H. Greener, Captain John Tunstall Haverfield, R.M.L.I.; Captain W. R. Johnson, M.S.C.; Mr. J. O. Macdonald, Mr. T. B. Nelson, Mr. A. R. C. Selwyn, Mr. L. H. Shirley, Mr. A. T. Simpson, Mr. H. E. Thornton, and Mr. Thomas Walker. It was also announced that the Council had admitted as students of the Institution, J. H. Blake, Joseph Cash, Raymond Edmiston, Malcolm Graham, C. E. Jones, J. V. Ley, M. K. Peto, W. H. Peto, C. E. Robinson, A. T. Smith, E. H. Stone, and F. N. Thorowgood.

AT the general monthly meeting of the Royal Institution of Great Britain, held Monday, February 3, Sir Henry Holland, Bart., F.R.S., president, in the chair, A. T. F. Clay, Esq., the Rev. B. W. Gibsone, M.A., John Kymer, Esq., James Murray, Esq., and Mrs. S. Ralli were elected members. The special thanks of the members were returned to Mrs. Barlow for her seventh annual donation of £5 5*s*. The special thanks of the members were returned for the following additions to the donation fund for the promotion of experimental researches:—Alfred Davis, Esq. (2nd donation), £21; J. Garrick Moore, Esq. (5th annual donation), £10; John Peter Gassiot, Esq. 5th annual donation), £20; William Dell, Esq. 2nd donation), £5 5*s*.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—1854, 1861
BUILDINGS AND BUILDING MATERIALS—1855, 1919
CHEMISTRY AND PHOTOGRAPHY—1845, 1886, 1888, 1900
CULTIVATION OF THE SOIL, including agricultural implements and machines—1829, 1842, 1883
ELECTRICAL APPARATUS—1856, 1917
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—1862, 1864, 1871, 1877, 1887, 1889, 1895, 1896, 1897, 1901, 1906, 1909, 1913
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1844, 1884, 1893, 1915
GENERAL MACHINERY—1826, 1827, 1828, 1830, 1847, 1851, 1872, 1890, 1894, 1898, 1902, 1907, 1916
LIGHTING, HEATING, AND VENTILATING—1837, 1838, 1846, 1849, 1908, 1910
METALS, including apparatus for their manufacture—1833, 1905
MISCELLANEOUS—1832, 1834, 1836, 1841, 1843, 1850, 1853, 1857, 1860, 1863, 1866, 1868, 1869, 1874, 1875, 1876, 1880, 1882, 1885, 1891, 1899, 1914, 1918
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1859, 1867, 1878, 1879, 1903
SHIPS AND BOATS, including their fittings—1831, 1840, 1848
STEAM ENGINES—1839, 1865, 1892
WARFARE—1835, 1858, 1873, 1881, 1904

1826 A. M. CLARK. *Improvements in nippers.* (A communication.) Dated June 22, 1867.

The movable jaw of these nippers is secured to one end of a lever, the other end of which is acted upon by a toe attached to the inner end of the handle, so that a great leverage is effected, and the operation of the nippers in cutting wire, &c., facilitated.—Patent completed.

1827 S. HOLMAN. *Improvements in double-action pumps, part of which improvements are applicable to other reciprocating machines.* Dated June 22, 1867.

This invention consists, first, in making valve passages in the pump covers or ends of double action pumps in close proximity to the reciprocating piston or pistons, which pistons are solid pistons without valves. Second, in an extension of the foregoing arrangement whereby pumps of greater working capacity are obtained. Third, in an arrangement of pump whereby two pistons are attached to one rod, each piston having a valve which reciprocates in the cylinder with it; one valve is also fitted to each cover; as the pistons are reciprocated in the cylinder, the single valves in each cover, whether a suction valve or a delivery valve, will open alternately, and the valves in the pistons will open and shut corresponding to the opening and closing of the valves in the covers; one water passage only is cast on the barrel, and the water or other fluid is drawn into the pump, through an induction pipe between the pistons, and forced out through the pistons and through the valves in the covers. Fourth, in a simple method of operating the pump referred to in the third part of this invention. Fifth, in an arrangement of compound pump valves, the object being to permit these and other pumps to be worked at quick speeds with a minimum of concussion at the time of the opening and closing of the valves at every reverse of the stroke.—Patent completed.

1828 T. WILSON and W. HALL. *Improvements in machinery or apparatus for raising and forcing water and other fluids.* Dated June 22, 1867.

This invention relates to an eccentric rotary pump, applicable to the purposes to which ordinary centrifugal or steam pumps may be applied, and serviceable also as a fire engine. The patentees construct a cylindrical case of metal, through the ends of which there is fitted eccentrically a revolving spindle working in shifting boxes. On this spindle, inside the case, is a cylindrical disc of metal having grooves radiating from the centre. Within these grooves are fitted diaphragms or pistons of metal, and on the ends thereof are projections or studs furnished with anti-friction rollers, or not, such projections engaging in an annular groove made concentrically in the inner face of each of the ends of the cylindrical case. The backs of the diaphragms are recessed so that they work through or across each other, each piston sliding partly into the opposite groove or slot, whereby they are firmly supported in the cylindrical disc at all points of their rotation. The inlet and outlet passages are placed on opposite sides of the cylindrical case. On imparting a rotary motion to the spindle, the several diaphragms will be caused to rotate in the interior of the cylindrical case, and will be simultaneously caused to slide to and fro along their guiding grooves by the cam action of the annular concentric groove in the ends of the cylindrical case on the projections on the ends of the diaphragms, thereby keeping the outer edges of the latter in contact with the inner circumference of the cylindrical case.—Patent completed.

1829 J. SURRIDGE. *Improvements in anchors suitable for steam ploughs and implements.* Dated June 22, 1867.

In order that the anchor may be removed readily out of the ground preparatory to shifting it to another position, the shank and the flukes are not rigidly fixed the one to the other, but jointed, and wedges or locking instruments used to stiffen the joint whilst the anchor is required to resist the strain upon it; but which are withdrawn when it is desired that the anchor should draw out of the land. The inventor makes the shank of the anchor of a forked form with sufficient spread to render the anchor steady without requiring a stock. The two arms of the shank are slotted at their ends to receive the ends of the flukes; these are both on the same side of the shank, and are connected therewith by a bar passing through them, and also through the slotted ends of the shank; this bar thus both forms the axis for the flukes to turn upon, and serves as a stay between the arms of the shank. The inner ends of the flukes project a short distance through the slots in the shank, and a bar with wedge-formed ends drives in, in front of the inner extremities of the flukes, and between them and projections on the shank, and so the flukes are rendered fast, being wedged fast against the hinder ends of their slots. When the wedge locking bar is drawn out, a slight strain on the anchor draws the shank forward, and throws the flukes to such an inclination as to cause them to rise out of the land.—Patent abandoned.

1830 S. HALL and W. H. PARSONS. *Improvements in apparatus for moulding artificial fuel.* Dated June 22, 1867.

The patentees claim the combination of a moulding passage with a ram working to and fro in it, and a measuring chamber with a plunger working within it, which, for each stroke of the ram, supplies a measured quantity of material into the moulding chamber, as described.—Patent completed.

1831 J. L. V. LE MARQUIS DE COSENTINO. *Improvements in apparatus for obtaining motive power from rivers or streams of water, and for facilitating boats ascending and descending rivers or streams.* (A communication.) Dated June 22, 1867.

Here two parallel endless chains are extended between and gear with chain wheels on two horizontal axes at a distance apart from one another. The chains are connected to one another by rods which pass transversely across the space between the two chains, and these rods carry paddles or floats which project out at right angles from the chains. The running water, acting upon the paddles or floats, will give motion to the chains, and the power thus obtained may be employed in various ways, and for various purposes.—Patent abandoned.

1832 J. H. KEARNS. *A diary blotting pad.* Dated June 24, 1867.

This invention is not described apart from the drawings.—Patent completed.

1833 J. BIRCH. *Certain improvements in casting ingots of Bessemer or other steel.* Dated June 24, 1867.

This invention consists in suddenly cooling the upper surface of the molten steel when in the mould, and so forming a crust on the metal ready to receive the sand which is "wedged down" as usual, thereby dispensing ing with the iron plate ordinarily employed.—Patent abandoned.

1834 T. RAFFERTY and J. H. STOREY. *An improved apparatus to be employed in moving from place to place, laying down, and jointing metal pipes.* Dated June 24, 1867.

The patentees claim, first, the construction and employment of travellers of the form or forms, and for the purposes described, fitted with wheels, either with or without gearing for actuating the wheels, or any number thereof, the wheels being adapted to run upon rails laid upon each side of the trench in which the pipes are to be "laid," or being adapted to run upon a rail laid on one side of the trench, and upon a plank laid upon the other side of the trench, the traveller being fitted with the "tup," and for adjusting the height of the same. Second, the general construction and arrangement of the apparatus and of the lifting and other "tackle" attached thereto, or connected therewith, as described.—Patent completed.

1835 E. LEAHY. *Making cartridge cases.* Dated June 24, 1867.

Here each cartridge case with its swelled head and inner perforated chamber for holding the igniting material or percussion cap is formed all of one mass by compressing a piece of soft metal into a suitable die.—Patent abandoned.

1836 J. K. FIELD. *Improvements in the manufacture of candles.* Dated June 24, 1867.

The patentee claims, first, forming enlarged, conical, or tapering lower ends on candles by first casting the candle with a cylindrical or parallel enlargement, or with parallel projections, and then cutting such enlargement or projections to a conical or tapering form, with or without longitudinal, helical, or circular grooves upon it, as described. Second, forming candles with enlarged lower ends upon which longitudinal, helical, or circular grooves are cut, such grooves being made to increase in depth towards the lower end of the candle, as described. Third, cutting longitudinal, helical, or circular grooves upon the lower ends of the candles having no enlargement, as described.—Patent completed.

1837 E. P. GLEASON. *Improvements in cylindrical or Argand gas burners.* Dated June 24, 1867.

This invention consists in placing an adjustable deflecting point or surface immediately over or in front of the inlet aperture through which gas is supplied to the burner, and in duplicating its jet or flame openings.—Patent completed.

1838 L. C. F. CLERC. *Improvements in lamp burners for burning petroleum spirit.* Dated June 24, 1867.

Here the inventor employs a flat wick which passes up a tube, the upper part of which is elevated at such a distance above the reservoir of the lamp as will prevent too great a degree of heat being communicated to the liquid in the reservoir. At the upper part of the wick tube is a chamber, in which a quantity of the vapour is collected to maintain the flame; the spindle of the pinion for regulating the height of the wick is protected so as to prevent escape of vapour at that part. He connects a tube to the top part of the wick tube, through which the spindle of the pinion is passed, and in which such spindle closely fits. The upper part of the wick tube is removable, to afford facility for inserting the wick, and when in position fits closely, and prevents escape of vapour at that part. A gallery is used for supporting a globe or chimney, and a cap covers in the top of the wick tube when the lamp is not in use.—Patent abandoned.

1839 W. E. NEWTON. *Improvements in governors for marine engines.* (A communication.) Dated June 24, 1867.

This invention consists of two weighted rods suspended in opposite directions, and coupled together by cross rods which are, by connecting rods, coupled to the sleeve which regulates the opening of the throttle valve. These two weighted rods balance each other, as far as their weight is concerned; consequently, together, they are completely

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independent of exterior force. To attain this end with greater facility, the top balls are made heavier than the lower ones, so as to balance the accessory weights, which move parallel with the axis of rotation. This arrangement of coupled weighted rods, possessing by rotary motion a considerable centrifugal force, becomes isochronized by the tension of a transverse spring attached directly to the arms, whereby its movement is constantly proportionate to that of the centrifugal force. These two weighted rods have crossed arms, because the isochronism caused by the transverse spring can neither be real, nor, in fact, exist when the resistance of the organ which acts upon the steam is produced on the hollow shaft or sliding collar, unless the movement of this resistance remains in every position of the balls in constant rotation to that of the centrifugal force, and of the tension of the springs. The invention is not fully described apart from the drawing.—Patent completed.

1840 R. CAPPER and G. READ. *An improved arrangement of ships' signal lights.* Dated June 24, 1867.

This invention relates to indicating by signal lights the course a ship is steering. The lantern at the mast head, or a screen or covering containing the mast head light, is fitted with coloured glasses corresponding to the port and starboard lights, and is connected (in any suitable way) with the steering wheel, tiller, or rudder, so that it may receive from the motion of the wheel or tiller an axial motion, and present to the distant spectator a colour corresponding to the light exhibited to him at the bow.—Patent abandoned.

1841 H. RUSHTON. *Improvements in the manufacture of artificial hair.* Dated June 24, 1867.

The patentee claims the use of wool, particularly that kind known as "Russian tops," or other similar wools or fibre, in the manufacture of artificial hair, in imitation of human hair; and also in the manufacture of crisped or curled hair for furniture, upholstery, &c.—Patent completed.

1842 H. R. J. DENTON. *Improvements in hay-making machines.* Dated June 24, 1867.

This invention consists, first, in substituting the trailing hay turners hereinafter described for the ordinary rotating fork turners; and, secondly, in so arranging the trailing hay turner that it can be adjusted according as the weight of the crop to be turned may require. The travelling hay turner is formed by connecting longitudinally, and transversely or diagonally, a number of large angular links of iron of a square or other shape; this flexible framework is suspended by a number of chains from a rotating bar fitted with a handle or lever for turning it, and with a toothed wheel and pawl for fixing it. This bar is fitted at the rear of a frame and shaft mounted upon travelling wheels, and linked angular frames, having their angles vertical, can, by the suspending chains and bar, be adjusted so as to clear the ground, or trail more or less upon it, according as the chains are let out, and thus, when drawn across the cut crop, will turn it over.—Patent abandoned.

1843 T. PEBARDY. *Improvements in surgical appendages, to consist of a corset and abdominal supporter combined.* Dated June 25, 1867.

This invention is too voluminous for insertion.—Patent abandoned.

1844 J. WILKINSON and W. GRIMSHAW. *Improvements in watches.* Dated June 25, 1867.

This invention relates more particularly to lever and flat watches, and consists of a novel arrangement of parts for dispensing with bars, fuzee, chain, maintaining power work, and fourth wheel and pinion.—Patent completed.

1845 J. WEBSTER. *A new metallic zinc paint.* Dated June 25, 1867.

The patentee takes spelter and melts it in a furnace, and raises it to 800 deg. Fah. He then covers the metal with a flux of borax mixed with caustic of soda or chloride of ammonia. He then adds about 7 or 8 per cent. of finely divided iron wire or scrap, agitating the whole with an iron rod until the whole of the iron or scrap particles are taken up by the zinc. He then adds sufficient antimony to cause the metal to run freely from the furnace. When the metal thus prepared has cooled down, it is next pulverized and ground, when it may be mixed with any oleaginous matter or varnish, and the metallic zinc paint results.—Patent completed.

1846 T. CROW. *Improvements in the manufacture of illuminating gas from gas tar oil or from gas tar.* Dated June 25, 1867.

The oil or gas tar (commonly called creosote or dead oil) is extracted from the gas tar in the usual way, and, when obtained, is placed in a tank or reservoir situated at such a height as to produce the degree of pressure required. From this tank the oil flows down through a pipe into a heated vessel or vaporizer. A continuous stream of the oil is allowed to flow over the bottom of the vaporizer only just sufficient in quantity to wet it, and in so doing it is instantly converted into vapour. The vapour so formed passes into a superheater which is maintained at a bright red heat. The outlet of the superheater must be sufficiently small in proportion to the generating capacity of the vaporizer, so as to maintain a constant accumulation of vapour, and consequent high state of pressure in the superheater. The vapour thus exposed simultaneously to a great heat and a high pressure is converted into permanent gas of great illuminating power, which can be dealt with as ordinary coal gas.—Patent completed.

1847 J. E. WHITING. *Improvements in apparatus for transmitting power or motion* Dated June 25, 1867.

This invention consists in means for extending the use of tension alone for transmitting power or motion, and is applicable for double-acting and rotary pumps, and for working other engines and machines where power or motion is required to be transmitted to a distance. The patentee provides two similar and corresponding cranks systems, each system having three or more cranks with their arms or throws projecting at right angles to the axis of that system, and so arranged as to divide the circle which the crank pins or their equivalents describe into equal parts. He connects the crank pins of one system with the corresponding crank pins of the other by rods, chains, or other appliances capable of exerting tensile force, taking care to make these connections equal as to effect.—Patent completed.

1848 F. HOOK. *Improvements in reefing and furling upper topsails.* Dated June 25, 1867.

The inventor supports, by stanchions secured to the lower topsail yard, a spar to which the foot of the upper topsail is made fast. The spar is free to rotate, and has at is arms grooves or spaces whereon the reefing tackle is wound during the furling of the sail. Furling is effected by raising the yard by halyards in the ordinary manner. The reefing tackle is led from the spar arms over sheaves on the lower yard, thence through blocks to the deck. To support the revolving spar he connects to the lower topsail yard one, two, or more sets of rollers carried in a jaw or jaws free to traverse round a certain distance, so that, on suddenly lowering the sail, the mouth or opening in each jaw, through which the sail passes, will take the same direction as the sail.—Patent abandoned.

1849 A. AITCHISON and T. SOUTH. *Improvements in means or apparatus for the production of gas for illuminating and other uses from hydrocarbons.* Dated June 25, 1867.

Here the hydrocarbon is conducted by a pipe from a reservoir into a retort which has a lump or lumps of fire clay adapted to receive sufficient heat to convert the hydrocarbon which is caused to fall thereon into gas. The vapour or gas thus generated, rising in the retort, passes through perforations in a surface of fire clay, &c., applied so as to become highly heated, and form surfaces towards the upper part of the retort, by the heat thereof to further heat the vapour or gas obtained, and which thence passes into the upper part of the retort, and is conveyed away to a purifying and storing apparatus for use.—Patent completed.

1850 L. BRUNETTI. *An improved process of embalming and preserving animal substances from decay, for anatomical purposes.* Dated June 25, 1867.

This process, which, though based on the principle of injection, leaves no trace of injection, includes three operations, namely, the preparation of the tissues, the tanning thereof, and their desiccation. The preparation consists in washing, the removal of fat, and the expulsion of the fluids employed for that purpose. The human or animal body is first washed, and the blood removed by injections of water in the excretory vessels and ducts, an aperture being provided for the escape of the water. The fat is then removed by the injection, first, of alcohol, and then of sulphuric ether; the ether is then expelled by injections, first of alcohol, and then by injections of water. For tanning the tissues, tannic acid is dissolved in boiling distilled water, and is then injected into the arteries, veins, or ducts. The desiccation is afterwards effected by heat applied internally and externally.—Patent abandoned.

1851 W. T. WATTS and D. J. FLEETWOOD. *Improvements in the manufacture of hollow vessels, and dished, sunken, or tubular shapes or forms in metal, or other material capable of being moulded.* Dated June 25, 1867.

This invention consists, firstly, in the use of water or other fluid as a mandril, core, cushion, or packing medium upon which to shape various forms in materials capable of being moulded. A cylindrical or hollow vessel or blank having been first produced by any suitable means, is fitted with a plug, hydraulic gland, and safety valve, the vessel being charged with water by preference. It is then subfected to the action or pressure of suitable tools, dies, or moulds applied externally, by which any desired shape or contour may be produced. Air may be used instead of water.—Patent completed.

1852 J. BUCKINGHAM. *An improved tool for opening metallic cases.* (A communication.) Dated June 25, 1867.

Provisional protection has not been granted for this invention.

1853 H. VEILLON. *Improvements in hot-air ovens for baking bread, biscuits, pastry, cooking, drying, or desiccating flour and other materials.* Dated June 25, 1867.

Here, as the interior of the chamber (or chambers) of the oven where the baking takes place does not communicate with the furnace for heating the same, no cinders, smoke, &c., can enter therein, and the baking proceeds continuously, as the heating and baking take place simultaneously.—Patent completed.

1854 G. ALSTON. *Improvements in the means of consuming smoke in furnaces and other fireplaces.* Dated June 25, 1867.

Here the inventor admits air on the top of the fuel above the fire bars from the front of the furnace, the draught being regulated by a damper at which the fuel is introduced. The ash pit is kept closed at all times, except when removing the cinders; the back of the furnace chamber is also closed by a plate or partition. In this manner the fresh air passes down through the fuel and fire bars, drawing with it the smoke and flame, and so effecting its almost entire combustion, the smoke afterwards passing away through the flues. The fire bars he makes of fire clay.—Patent abandoned.

1855 W. COOKE. *Improved apparatus for hoisting building materials.* Dated June 25, 1867.

This invention consists, principally, of a single fall or endless rope passing over a grooved pulley above, and having fixed, or connected to it, appliances for attaching two hods thereto, so that when the full one is being hoisted the employ one is descending.—Patent abandoned.

1856 M. F. MAURY. *Protecting submarine cables, when placed on board ship, and for facilitating the paying of them out.* Dated June 26, 1867.

This invention relates to submarine cables without any coating of hemp or wire for the deep sea, the shore ends in all cases being the same. Before putting such a cable on board ship the inventor divides it into sections consisting each of about twenty miles. Each section is coiled into a ball, and thus coiled it is packed into a watertight tank, which is then filled with water and sealed, leaving the two ends of the section on the outside, so that they may be got at for testing the cable.—Patent abandoned.

1857 T. TAYLOR. *New or improved implements or apparatus for playing games of skill and chance.* Dated June 26, 1867.

This apparatus consists of a table with recesses in the central portion thereof, upon which table are used pieces of ivory, &c., formed so as to slide easily along the surface of the table, to rebound freely from one another, and to fit the recesses. The pieces may be of a circular, diamond, heart, or other shape. The sides of the table are fitted with an elastic cushion, and a semicircular piece which forms the head has a similar cushion upon it, and is made so that it can be reversed to enable another person to play from the opposite end The pieces are struck with a flat circular-headed mace or hammer.—Patent abandoned.

1858 J. HUMAN. *Improvements in breech-loading cannon and firearms.* Dated June 26, 1867.

The patentee claims, first, the general form of the breech blocks, and the principle of their sliding axles, by which a portion of the forward block is made to enter the bore of the gun, and the rear block is also made to support and secure the forward block in its place; and also the arrangement by which both blocks fill the slot in the gun in a solid manner, as described. Secondly, using the rear breech block as a ram to force the forward block into and out of the bore of the gun, as described. Thirdly, the arrangement by which the faces of the breech blocks are planes at right angles to the axis of the bore of the gun, and by which the breech blocks are worked by hand spikes only, and without wedges, screws, levers, or other appliances, as described. Fourthly, the self-acting vent stopper working in combination with the rear breech block, as described.—Patent completed.

1859 R. EADIE. *Improvements in axles.* Dated June 26, 1867.

It is here proposed to cover the whole or a portion only of an ordinary forged iron axle with steel.—Patent abandoned.

1860 W. E. NEWTON. *Improvements in filtering apparatus* (A communication). Dated June 26, 1867.

The patentee claims, first, the introduction of the juice into the filter press from below, as set forth. Second, the use and application of certain movable pockets by which a continuous passage for the liquid to be filtered is formed, which passage serves for the double purpose of introducing the juice into the chambers, and drawing off what remains of juice when filtration is over or ceases, as set forth.—Patent completed.

1861 R. P. FORLONG. *Improvements in the means of consuming smoke in furnaces.* Dated June 26, 1867.

The inventor piles a number of pipes, made of refractory clay, upon the bridge of the furnace; the pipes are placed in the direction of the flue, and occupy the space between the bridge and the roof of the furnace, so that all smoke from the fire is forced to pass through the interstices between the pipes, which, from their proximity to the fire, are always red hot, and ensure the consumption of the greater part of the smoke passing through them. He also provides a pipe behind the bridge, immediately under the ends of the clay pipes farthest from the fire. This pipe passes over the bridge, and down on either side of the ends opening into the ash pit, immediately under the fire bars. The part of this pipe behind the bridge is perforated, and the hot air entering at the ends under the fire bars passes out at these perforations to ensure the combustion of the remaining smoke, and also improving the draught of the furnace.—Patent abandoned.

1862 W. B. GRAY and S. G. SINCLAIR. *Improvements in spinning and twisting machines.* Dated June 26, 1867.

This invention relates to the regulating of the tension of the thread or yarn during the filling of the bobbins, and consists in the use of a cylinder fixed on the builder rail. On this cylinder the bobbin is placed. The diameter of the cylinder is greater or less either in a part or parts of, or throughout, its length, so that the bobbin may fit upon it more or less closely, and thus increase or diminish the friction.—Patent abandoned.

1863 W. R. LAKE. *Improvements in churns.* (A communication.) Dated June 26, 1867.

This invention relates to the construction of a churn wherein the butter is produced by the combined action of revolving wings formed of wire gauze, and a series of obliquely arranged arms and paddles attached to a horizontal shaft. The arms and paddles are enclosed in a box, and the gauze wings are arranged within another parallel box with an aperture for the introduction of the milk, and communicating with the other box through an opening covered with wire gauze.—Patent completed.

1864 W. R. LAKE. *Improvements in cotton gins.* (A communication.) Dated June 26, 1867.

This invention consists, first, in the use of a pair of rollers in connection with a longitudinal bar or breast beam of such form that, when pressed up against the rollers, no more of the surfaces of the bar and rollers come in contact than is sufficient to hold the cotton while the comb is acting upon the seed of the cotton, the two rollers chiefly serving to feed the cotton forward. To provide a feed roll possessing great durability is the object of the second part of the invention, which consists in the use of a pair of clearing plates or clearers with teeth, and so connected with the stripping plate as to ensure their simultaneous operation. The stripping plate is braced to the upper "clearer" to stiffen the former, and prevent its being pressed away from the upper feed roll by the crowding of the cotton. The invention also consists in incorporating within the material of the upper feed roll emery, &c., or in employing wire or other metal strips in connection with the material of the roll, whereby great strength and durability are attained.—Patent completed.

1865 A. C. F. FRANKLIN. *Improvements in steam engines.* Dated June 26, 1867.

This invention is applicable where two cylinders are employed, the pistons of which are connected to one crank shaft (the number of the cylinders may, however, be more than two, or less than two), and consists in so arranging the engine that the steam only acts on each piston to move it in one direction, so that if two cylinders be employed, the pressure of the steam will be acting on the piston of one cylinder, and thus turning the crank shaft, whilst the piston or other cylinder is being moved back without being acted on by the pressure of the steam.—Patent completed.

1866 E. WHELE. *An improved method of gauging and cutting soap.* Dated June 27, 1867.

Here the inventor planes and gauges the bar of soap on two sides at right angles, so as to reduce them to one size, in such a way that a given length will weigh a given weight. He does this by placing the bars in a trough, and passing a plane or scraper over them; after this he takes a frame with a fixed knife standing upwards upon it, and by a lever he forces the soap against it, cutting it through to a given length; then using a slide and screw gauge for this purpose similar to the one now in use, and in cutting a second piece it pushes the first one before it, and so on in succession.—Patent abandoned.

1867 J. G. ROWE. *Improvements in railway signals, point apparatus, and lamps.* Dated June 27, 1867.

In one arrangement a series of levers (charged with detonators or fog signals) is arranged so as to move both longitudinally and transversely upon an iron bar or tube. This bar or tube has a linch pin driven through it, or stops placed at the side of it, to keep the levers in place, and the levers have key ways or slots in the boss when set for action; the outer ends of the levers rest on a stop bar, but when one of the signals has been exploded, an l

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its lever is, consequently, not in a position to act, the latter falls into a vertical position, the key way or slot being then in a straight line with and clear of the linch pin or stops; the whole of the levers slide laterally a distance equal to the thickness of one lever, and hence the second lever takes the place of the first. The fog signals are placed on and taken off the metals (by the action of the ordinary signal wire) by a quick threaded screw and weighted lever, or by a winged pulley and spring, which impart a longitudinal to-and-fro motion to the first lever only of the series, and the whole of the levers receive lateral or transverse pressure by means of a weight or spring. The patentee employs a lamp so arranged in connection with a pyrometer, and other parts, that a fresh wick can be brought into use without personal attendance.—Patent completed.

1868 W. E. GEDGE. *An economical system of raising running waters by the simple use of the force produced by the current of a river or watercourse.* (A communication.) Dated June 27, 1867.

Provisional protection has not been granted for this invention.

1869 J. M'EWEN. *Improvements in the manufacture of roll tobacco, and in apparatus therefor.* Dated June 27, 1867.

One of these improvements consists in at once winding the tobacco so as not to require re-winding to form the roll. It is wound between two plates on a flat spindle or centre, which is afterwards withdrawn, and with this arrangement the ordinary pegging and binding can be dispensed with, whilst the central parts are better conditioned than with the ordinary method.—Patent abandoned.

1870 J. GARBOTT. *Improved machinery or apparatus to be employed in the manufacture of wire healds for looms for weaving.* Dated June 27, 1867.

The patentee prefers to use brass or copper wire for healds, which is placed on a creel, and thence wound on bobbins; the bobbins are then placed on spindles attached to the arms or rim of a wheel, through holes in which the end of wire is passed and received by a pair of draw rollers covered with flannel so as not to damage the wire. On motion being imparted to the wheel carrying the bobbins and wire, such wire is twisted or "doubled" together. A length of wire equal to the length of the heald having been drawn forwards and doubled, a bell, actuated from the wheel above mentioned, calls the attention of the operative, who inserts (between the wires at the point they come in contact with each other) a wire of larger diameter, which, on being withdrawn on the completion of the healds, forms the eye thereof. The length of twisted or doubled wire is cut, and the eye, in the centre of which is then placed a pin, and each end of such wire is received in the end of a hollow shaft through which is a hole and pin; each end is wrapped round the said pin, and on motion being imparted to the shafts and wire, the ends are wound thereon, forming a loop at each end of the heald, and afterwards a hollow tube of metal (answering the purpose of the ordinary heald staves) is passed through the loops; they are then complete.—Patent completed.

1871 W. BULLOUGH. *Improvements in looms for weaving.* Dated June 27, 1867.

This invention has for its object, first, the construction and application of mechanism to looms for weaving, and to the shuttles of such looms, whereby the motion of the loom is arrested when from any cause the weft thread is broken. Second, the construction and application of mechanism for the prevention of "floats" and breakage of warp threads.—Patent completed.

1872 J. and J. CASH. *An improved apparatus for winding bands or tapes.* Dated June 27, 1867.

This invention relates to the winding of surgical and other bandages. A cylindrical block of wood, &c., has a slit of sufficient width to admit of the insertion of a doubled part of the bandage or tape carried along its entire length, and inside and parallel to this slit a circular hole is formed having a greater diameter than the slit, which hole is also carried through the entire length of the block. The band is inserted double through the slot into the circular aperture; a peg is then inserted inside the doubled band, thus holding it, and enabling it to be wound easily upon the block.—Patent abandoned.

1873 E. FARRINGTON. *Improvements in breech-loading fire-arms, and in the manufacture of cartridges to be used therewith.* Dated June 27, 1867.

The chief object here is the construction of an improved arm with breech bolt and striking pin or needle, the percussion being produced by an ordinary hammer and lock. The improvements, in addition to the general action of the mechanism, and of the arrangement of the lock which is behind the breech, are the following:—First, the combination with a system of closing with a breech bolt and ordinary lock of a breech-piece screwed upon the barrel; this piece is provided with an inclined plane intended to draw back the plunger or rod which carries the needle; it also has a lump to withstand the blow of the hammer; also a hook and a tail-piece which weaken upon the stock the effects of the recoil. Second, the employment of a spring tenon, and having three objects, viz., to guide the bolt, to maintain it when closed, and to permit of withdrawing it by a quick tortuous movement without the aid of a special appliance. The invention further relates to the cartridges to be used with these arms, and the object is, chiefly, to produce hermetic closing of the joint at the breech, and of the passage for the needle, as well as to prevent the oxidation of the latter and the fouling of the chamber.—Patent abandoned.

1874 C. E. BROOMAN. *An improved regulating jupon.* (A communication.) Dated June 27, 1867.

This invention consists in the manufacture of jupons with tapes, strips, or bands, or some of them which can be lengthened or shortened, and the jupon thereby regulated.—Patent completed.

1875 W. E. NEWTON. *Improvements in apparatus for the manufacture of iced beverages.* (A communication.) Dated June 27, 1867.

This invention is designed to make iced soda creams. The apparatus is composed of a box made of marble, and contains, first, cans or compartments containing various syrups to be used in the manufacture of the iced beverages. Second, reservoirs for cooling the syrups, and the cylinders containing water charged with carbonic acid gas. Third, an arrangement of pusher and a cutter to chop up block ice and reduce it to powder. Fourth, a reservoir containing the cream. On the sides of the apparatus are arranged taps which communicate with the syrup cans; taps are also attached to the pipes communicating with the soda water cylinders.—Patent completed.

1876 M. H. TAYLOR. *Improvements in tuyeres for smiths' hearths.* Dated June 27, 1867.

Here the inventor proposes to employ a chamber set in the hearth, and into which the air is passed from the blowing apparatus. At one part of this chamber is an aperture through which the air issues to the fuel, and this aperture is capable of being closed by a valve mounted upon a spindle which is connected to a hand lever. The lower part of the chamber is provided with another aperture capable of being opened or closed by a valve, and allowing the passage of ashes from the said chamber.—Patent abandoned.

1877 W. HODGSON. *Improvements in screw-gill boxes for preparing wool and other fibrous substances.* Dated June 27, 1867.

This invention relates to retarding the drop of the fallers in screw-gilt boxes; also, to combining the said retarding apparatus with the dabbing brush (when such is used), whereby both may be operated simultaneously, and the one balance the other.—Patent abandoned.

1878 C. J. POWNALL. *Improvements in the means of communicating intelligence between parts of railway trains.* Dated June 27, 1867.

The inventor places a fast pulley on the guard's carriage, and a loose pulley on the carriage nearest the engine, or on the engine or tender. An elastic band is passed round these pulleys, whereby the motion of the one pulley is transmitted to the other, such band extending along the intervening carriages above the doors thereof, so as to be within reach of the passenger; or pulls may be attached to the band, and extend within reach of the passengers. An alarm, a bell, or acoustic signal is placed on or in the carriages which carry the aforesaid pulleys. In each carriage is a case containing a number of tickets bearing the number or indication of the carriage; some tickets are blank, and others bear inscriptions of such intelligence as would ordinarily have to be communicated. Clamps or hooks are provided for connecting the tickets with, or suspending them upon, the band. When a passenger desires to communicate with the guard, he calls his attention by drawing down the lower part of the band, thereby sounding his alarm.—Patent abandoned.

1879 W. R. LAKE. *An improved self-detaching coupling for railway carriages.* (A communication.) Dated June 27, 1867.

This invention relates to a coupling, the connecting pins of which are hinged to their supporting rods, which at the same time may be made to support the buffers. These rods are free to slide back and forth in guides, and they are held in position by springs, and the coupling pins have shoulders which catch under lips or slots so that the coupling pins will remain in an upright position, unless exposed to a lateral strain, and, consequently, the shackle bar is retained, and the carriages are kept from getting uncoupled as long as all the carriages remain on the track. But if one of the carriages runs off the track, whereby the coupling pins forming its connection with the succeeding carriage are subjected to a lateral strain, one or both of the coupling pins turn down, and the carriages become detached.—Patent completed.

1880 W. R. LAKE. *Improvements in metal ties or bands for securing bales of cotton or other substance.* (A communication.) Dated June 27, 1867.

Here a buckle is formed with an obliquely projecting central rib furnished on the outer edge with teeth or notches to hold one end of the hoop or band which is inserted through an opening in one bar of the buckle frame, the other end of the hoop being folded over a solid crossbar on the opposite side of the frame. The back or inner edge of the toothed rib is curved, to give greater strength to the buckle, and the open bar is formed with a shoulder to prevent the lateral displacement of the hoop.—Patent completed.

1881 J. R. COOPER. *Improvements in breech-loading fire-arms.* Dated June 27, 1867.

The patentee claims affixing the needle carrier or striker of the gun to an independent sliding block at the rear of the plug or closer, the block being provided with a projecting plate, whereby the needle or striker is cocked on the unfastening of the plug or closer, the block and plate, and parts immediately concerned in their action, being constructed and arranged as described. Secondly, combining or arranging the parts of a safety bolt for breech-loading firearms, as described.—Patent completed.

1882 W. DAVIS. *Improvements in the method of fastening the overlapping parts of envelopes.* Dated June 27, 1867.

The inventor provides each of the overlapping parts with one or more semicircular tongues projecting beyond the edge of the overlap. These tongues are partially severed by being cut through on each side to about one-fourth of their diameter, and in a line with the edge of the overlap. In the opposite or underlap of the envelope a transverse slit is cut of the length of the uncovered portion of the tongue, through which the tongue is passed, the severed portions being previously folded over towards each other. The folded parts being now opened out to their original form, the two laps are securely locked or dovetailed together.—Patent abandoned.

1883 L. B. ELLIOT. *An improved delivery to a reaping or mowing machine.* Dated June 28, 1867.

By this invention the inconvenience arising from the corn or grass which has been cut being spread over the uncut corn or grass adjacent to the course traversed by the machine upon the delivery platform being tilted, is avoided. This is effected by placing a board extending from one extremity of the finger bar in a diagonal direction across a portion of the delivery platform, such board being jointed at the upper part to a suitable support, the lower edge resting on the delivery platform, and being free to move therewith as the latter is raised or lowered by the attendant, in the ordinary manner. As the corn or grass accumulates upon the platform it is directed towards the side thereof opposite to that on which the board is placed, and from which the corn or grass can be delivered by the attendant.—Patent abandoned.

1884 W. MARSHALL. *Improvements in the construction and production of bedsteads, couches, or sofas, and other similar articles.* Dated June 28, 1867.

Here the laths form a surface in which the centre stands so much above the sides of the bedstead, couch, sofa, &c., that, when the weight of a person rests thereon, the surface of the article will become level, or nearly level, consequent upon the depression of the laths which support the weight of the person.—Patent completed.

1885 J. H. VITON. *An improved method of adjusting paper linings to the interior of casks, cases, and packages of various descriptions.* Dated June 28, 1867.

This invention is not described apart from the drawings.—Patent abandoned.

1886 C. O. HEYL. *An improved method of and apparatus for making sulphuret of carbon.* Dated June 28, 1867.

This invention is not described apart from the drawings.—Patent completed.

1887 C. O. HEYL. *An improved method of and apparatus for extracting fatty matters from, and for scouring wool and other fibrous substances and textile fabrics, by the use of sulphuret of carbon, and for regaining the sulphuret used in such operation.* Dated June 28, 1867.

The inventor places the wool, &c., in closed vessels with or without steam jackets, and introduces the sulphuret of carbon from below; the sulphuret will pass up through the wool and issue near the top of the tank, whence it will pass through distilling apparatuses and return to its original receptacle. When the extraction is completed, he introduces a stream of hot water into the tank near the top, and so causes the volume of sulphuret with which the substance remains charged to fall to the bottom, and pass out of the tank to its original vessel. He then removes the wool, &c., and rinses it.—Patent abandoned.

1888 J. C. SELLARS. *Improvements in the utilization of a certain waste material obtained in the manufacture of hydro-carbon liquids.* Dated June 28, 1867.

This invention relates to the utilization of the pitchy or coke-like residue left in stills or vessels from petroleum, paraffin, &c., after the commercial hydrocarbons have been distilled over, and consists in manufacturing therefrom a substitute for plumbago, which the inventor denominates "artificial plumbago." He takes this residue and subjects it to heat in a retort, either with or without access of air, for a longer or shorter period, so as to drive off all the volatizable portions, &c. After this treatment the material is ready for use.—Patent abandoned.

1889 E. J. HUGHES. *Improvements in blankets used in machines for printing textile fabrics, and in the mode of joining together the ends of double-woven fabrics.* (A communication.) Dated June 28, 1867.

This invention relates, first, to the textile qualities of the fabrics used for the blanket, and to the finish of the same. The fabric consists of a single web of woven material, composed of a number of sets of stout but fine warps, generally of cotton, and a corresponding number of overlaying shoots of filling threads, of about the same fineness, and so closely interwoven as to produce about the same texture upon the surface as that of the generality of printing cloths or printing goods, and about the same thickness as the ordinary woollen blanket. After the blanket is woven it is subjected to a calendering process between heated rollers to remove all elasticity in the direction of its length, and sufficiently in regard to its thickness as to reduce the interwoven mass of threads to a merely compressible body that is not dependant upon the displacement of the threads of which it is composed, but upon the compressibility of the material thus fabricated, the material itself being intimately wrought together in one homogeneous mass or fabric. The invention consists, secondly, in cutting away one-half of the thickness of the warp and filling threads to about two inches of the two ends to be united, and from opposite sides of the two ends relatively one with the other, so that an equal thickness with the main part of the fabric will be produced by lapping the two half thicknesses of both ends one upon the other; the half thicknesses so produced present a ribbed or corrugated surface across the web, and when the ribs of one surface are closely fitted into and interlocked with the spaces between the ribs of the opposite surface, and then permanently fixed closely together, a means is afforded for resisting the strain lengthwise of the blanket that would tend to separate the two parts.—Patent abandoned.

1890 A. M. CLARK. *Improvements in presses for stamping or endorsing.* (A communication.) Dated June 28, 1867.

This invention is not described apart from the drawings.—Patent abandoned.

1891 G. K. GEYELIN. *Improvements in folding wire netting* Dated June 28, 1867.

To rings placed at convenient distances the inventor fastens a certain number of wires of given lengths by means of loops or hooks, so as to form a square, triangle, lozenge, or other figure, by which means the whole can be folded close together for movable poultry, sheep, and other fencings.—Patent abandoned.

1892 C. BROWN. *Improvements in actuating motive power engines, and in the apparatus or means employed therefor.* Dated June 28, 1867.

This invention is based upon a former patent, dated 28th February, 1867 (No. 558), and has for its object the application of atmospheric air, heated whilst under compression for driving motive power engines. The atmospheric air is compressed into a receiver or vessel, and when compressed it is heated by steam or otherwise. The increased expansibility of the air obtained from the elevation of its temperature constitutes the motive force, whilst the original compression at a normal temperature is a constant force in the receiver.—Patent completed.

1893 H. A. LYMAN. *Improvements in the construction of ladies' skirts.* (A communication.) Dated June 28, 1867.

These skirts will readily admit of being cleaned at or near the bottom edge. The skirt consists of an ordinary skeleton or other skirt extending from the waist downwards, some two-thirds, more or less, of the full length required for the complete skirt, to which is attached as a continuation a cloth skirt made with tucks or guides for steel hoops, which are intended to be withdrawn to allow of this lower part of the skirt being detached to be washed. The ends of the hoops are fitted, the one with a tubular slotted socket and the other with a cylindrical plug carrying a bayonet joint pin for attaching their ends together when the hoops are inserted in the skirt.—Patent abandoned.

1894 J. G. TONGUE. *An improvement in adjustable wrenches.* (A communication.) Dated June 28, 1867.

This invention relates to that description of wrenches for screwing up bolts or nuts, &c., in which a permanent jaw from the main bar is used in connection with a sliding jaw made adjustable by a milled head-screw, and consists, in combination with a ribbed or feathered construction of the main bar and swell or shoulder where it forms a back edge junction with the permanent jaw, of a peculiar recessed construction of the sliding jaw, whereby, while without adding materially to weight, increased strength

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and stability are given to the wrench where it is usually liable to rupture, and the sliding and permanent jaws may be brought into the closest requisite position relatively to each other.—Patent completed.

1895 J. and T. ANDERSON. *An improvement in the harness of Jacquard engines.* Dated June 28, 1867.

This invention has reference to what is known as the "cumber board" in Jacquard engine harness. When the "set" is varied, a fresh cumber board is requisite with perforations of suitable pitch. To diminish this inconvenience is the object of this invention. In place of the ordinary cumber board the inventors use two boards, the one placed in the ordinary position, and the other a short distance above it, and they make such boards with a rectangular aperture in lieu of the perforations, and use adjustable strips which are passed transversely through the boards, and placed at such distances apart as may be requisite. They are thus enabled to alter the sets within a considerable range without displacing or removing the cumber boards, and have much convenience from the arrangement.—Patent abandoned,

1896 J. HOLROYD and W. FIELDHOUSE. *An improvement in twisting or doubling machinery for producing a certain species of yarn.* Dated June 28, 1867.

The object here is to produce twisted yarn of an uneven or irregular twist, such irregularities occurring at stated intervals. The patentees drive the lower roller of the twisting or doubling frame by what may be termed partial gearing, that is, by a wheel only partially toothed, the object of this being to cause the front lower roller to be stationary at certain periods, the flyers revolving at their accustomed speed, and the yarn which is being wrapped round that issued from the front rollers, and which is passed independently over the upper front rollers, being twisted more closely on what may be termed the internal thread during such temporary stoppage of the lower rollers, and producing a slack and a tight twist.—Patent completed.

1897 C. O. HEYL. *An improved method of and apparatus for extracting oil or fatty matter from cotton or woollen waste, and analogous substances, by means of sulphuret of carbon.* Dated June 29, 1867.

This invention cannot be satisfactorily described without drawings.—Patent abandoned.

1898 P. ZAROUBINE. *An improved sucking and forcing hydro-pneumatic pump with no piston.* Dated June 29, 1867.

The principle of this pump is the application of the properties of compressed and rarefied air for raising water without the aid of a piston, the degree of atmospheric pressure or expansion necessary for the purpose not depending on the variations of height to which it is desired to raise the liquid, which may be lifted from any depth.—Patent completed.

1899 P. SMITH. *Improvements in corking, stopping, and securing the contents of champagne and other bottles.* (A communication.) Dated June 29, 1867.

This invention consists, first, of a cap or cork cover of india-rubber, &c., placed over the cork and between it and the securing media for compensating for any porosity of the cork. Second, of a ring or collar of india-rubber, &c., passed over the cork and round the neck of the bottle, and under the cork cover; or this ring may be passed over the cork and rest upon the mouth of the bottle, to prevent any of the contents from escaping between the cork and the bottle. Third, of a metallic or other cap passed over the head of the cork, and enclosing the same, so that the lower edge of the cap either rests upon the bottle mouth, or presses upon the stopping ring, or encloses the bottle mouth and compresses the stopping ring between the interior of the cap and the exterior of the neck of the bottle; the cap being of metal hermetically seals the cork. Fourth, in the mode of securing the cap to the neck of the bottle.—Patent completed.

1900 A. M. FELL. *Improvements in purifying or preservative compounds to be applied to the fleeces or skins of sheep and other animals.* Dated June 29, 1867.

This invention consists in combining mineral oil obtained from coal, shale, or crude petroleum, and from which acids and alkaloids have been removed, with a saponaceous compound consisting of resin, palm oil, cod oil, soda ley, and potash ley, and with napthaline.—Patent abandoned.

1901 A. M. FELL. *Improvements in batching or treating jute.* Dated June 29, 1867.

This invention consists, principally, in the employment in the "batching" process of the mineral oil prepared by well-known processes from crude petroleum, or from the crude oil obtained from coal or shale by distillation at a low red heat, such crude oil being repeatedly treated with strong sulphuric acid, and with alkali, to remove alkaloids and acids, and being washed and distilled.—Patent abandoned.

1902 A. HODGE. *Improvements in adjustable appliances for fixing door handles.* Dated June 29, 1867.

This invention consists in adapting an internally screwed collar to screw upon the screwed edges of the square or equivalently-shaped spindle, such collar holding the handle by a flange or rim turned over a head or flange on the neck of the handle, and being prevented from unscrewing from friction against the door or shield by an interposed disc loose on the spindle, but fitted so as not to turn thereon.—Patent completed.

1903 H. J. COX. *Improvements in the manufacture of carriage bodies, and which said improvements are also applicable to the manufacture of pleasure and other boats, and other like purposes.* Dated June 29, 1867.

This invention consists in moulding carriage bodies, boats, and various other articles of coarse paper pulp, or pulp made and reduced from strong coarse fibrous material, using suitable adhesive or gelatin as material with the mould in a heated or cold state.—Patent abandoned.

1904 S., R., and W. TEBLOCK. *Improvements in breech-loading firearms.* Dated June 29, 1867.

This invention relates, first, to the small pin called the "striker," which, upon being struck by the hammer, explodes the cap of the central-fire cartridge, and consists in forming it with an enlarged head at its lower end, forming a double or single inclined plane or planes. A portion of the inclined plane or planes projects beyond the breech or back end, a spring being placed round the pin, and made to act in a downward direction, so as to prevent the end of the striker next the hammer from projecting over the level of the surrounding surface, except when the gun is loaded. When the pin is used in lock-tast guns, the inclined plane on the head need only be on the upper side thereof, so as to act whilst the breech is being closed after placing the cartridge in the barrel. In guns not on this principle the inclined plane on both sides is requisite in order to prevent the cartridge being held by the pin. This principle, when applied to the Snider gun, is accompanied by a further improvement, which constitutes the second part of this invention. By this improvement the gun is put on half cock at the same time that the cartridge is withdrawn. The invention comprises other features which we cannot give space to here.—Patent completed.

1905 W. H. RICHARDSON. *A certain improved mode of manufacturing iron and steel.* Dated June 29, 1867.

The patentee claims, first, the process of remelting pig iron and afterwards finishing it in a stationary revolving or reciprocating puddling, balling, or other furnace as an improved cast iron or crude steel, in contradistinction to taking the iron direct in the melted state from the blast furnace, and then converting it into improved cast iron or crude steel. Second, the process of manufacturing steel, as described, by remelting the pig iron in any of the furnaces set forth, in place of taking the iron direct from the blast furnace in a melted state, and then converting it into steel. Third, the application of the tubular rabble or stirring rod, or their equivalent, for injecting blast into molten cast iron in a revolving, reciprocating, or movable furnace, to enable the carrying out of the production therein of improved malleable iron, cast iron, or steel, in the manner described.—Patent completed.

1906 A. STEWART. *Improvements in textile fabrics, and in the apparatus or means employed for effecting the same.* Dated June 29, 1867.

This invention has for its object the production of certain figured appearances upon that class of goods known as fancy dress cloths, and it consists in a mode of printing some of the warp threads only.—Patent completed.

1907 J. J. LANE. *Improved machinery for making tapers.* Dated June 29 1867.

This invention relates, first, to machinery for coating cotton strands with wax or a composition for the manufacture of tapers; and, second, to the cutting up of the coated strands into lengths suitable for forming matches. We cannot here quote the details of the invention.—Patent abandoned.

1908 C. C. DUBRULLE. *Improvements in miners' lamps.* Dated June 29, 1867.

The principle of this lamp is that it cannot be opened without lowering the cotton or wick, and extinguishing the lamp if it had been lighted. For additional security the inventor provides the lamp with a second fastening, which prevents the removal of the wire gauze unless the fastening is opened by a particular key.—Patent abandoned.

1909 J. CONLONG. *Improvements in expanding and constructing combs or swaiths for warping, beaming, dressing, and other frames, and in machinery or apparatus connected therewith.* Dated June 29, 1867.

The object here is to obviate the defects of that class of expanding and contracting combs in which the dents are actuated by spiral or other springs, and are contracted or expanded by elongating or compressing such springs, and one part of the invention consists in substituting for those springs differential right and left-handed screws, acting independently on each dent by pins fitted into the dents, and fitting loosely in the threads, so that when the screws are turned a positive motion is conveyed to each dent separately; and another part of the invention consists in improved mechanism for cutting such differential screws.—Patent abandoned.

1910 C. PETIT. *Improvements in lamps for burning petroleum, shale, and other mineral oils.* Dated June 29, 1867.

This invention consists in forming the burners of lamps with their air chambers and passages much larger than those in general use, in order to burn not only shale and boghead oils, but also the lighter mineral oils, such as the oils of petroleum and others of a similar nature.—Patent completed.

1911 E. SEPHTON. *Improvements in the construction or arrangement of blocks, so called workmen's dwellings.* Dated June 29, 1867.

Provisional protection has not been granted for this invention.

1912 E. SIMMONS. *Improvements in the construction of screw propellers.* Dated June 29, 1867.

Provisional protection has not been granted for this invention.

1913 C. E. BROOMAN. *Improved means of applying and fixing metals on fabrics, feathers, artificial flowers, and other articles.* (A communication.) Dated June 29, 1867.

This invention consists, chiefly, in the use of a particular glutinous preparation for holding the gold, silver, &c., on the surface of the lace or other article. This preparation has two components or elements, viz., a solid material in powder, which is a mineral salt, by preference a salt of zinc (blanc de zinc), and a liquid substance which is a mixture of oil and varnish.—Patent abandoned.

1914 G. REES. *An improved method of treating glass in order to produce tablets and other articles.* Dated June 29, 1867.

Here the inventor takes glass in a state of powder, either dry or as a paste, and mixes the same, or not, with metallic or mineral oxides to produce various colours. He places this glass, either in the mixed state or not, in a mould having a design in or on its surface, or plain—if a plain surface is required—and after having filled the cavities, or covered the surface, if plain, he makes a backing to the required thickness of the same material (glass mixed or not); he then covers the material with a suitable cover, which may have indentations or projections upon it, and he presses these parts of the mould together with sufficient pressure to conglomerate the material between them. The material can then be removed from the mould and vitrified in a kiln.—Patent abandoned.

1915 J. G. N. ALLEYNE. *Improvements in clocks.* Dated July 1, 1867.

The patentee claims, first, the application to clocks of a combined pin wheel and gravity escapement arranged and operating substantially as described with reference to the drawings. Second, constructing the cams and ratchet wheels for clocks with the working surfaces formed of chilled cast iron, as described.—Patent completed.

1916 J. CHAUDRON. *Improvements in boring or sinking wells, and in apparatus and tools employed for that purpose.* Dated July 1, 1867.

This invention has for its object the sinking of deep wells through aqueous upper strata without having to pump the water out of the boring during the progress of the work, the apparatus employed being so arranged as to effect the complete isolation of the aqueous strata, thus enabling the work to be carried on through any depth of such strata.—Patent completed.

1917 F. T. HUBERT and H. D. G. TRUSCOTT. *Improvements in the construction of general electric telegraphic machines, and the mode of working them.* Dated July 1, 1867.

This invention relates to a former patent, dated June 28, 1866 (No. 1,725), and consists in combination with the mechanism of the indicator or dial therein described of the apparatus, hereinafter described, for printing either on a cylindrical or flat surface. The apparatus in its combined form consists of the mechanism connected with the dial—that for moving the cylindrical or flat surface as required to receive the printing, and that for bringing the same in contact with the printing wheel as required. The mechanism connected with the dial is or may be contained in a case at the upper part of the combined apparatus, and consists of the barrel, the rollers for inking the types, the printing wheel with types on it, such wheel being mounted as required at the back of the revolving dial indicator, and working through an opening which communicates with the apparatus below it; also the electro-magnets and springs, the electric commutators, levers, buttons, and handles required. The case underneath the above contains a movable cylinder covered with paper suitably arranged for printing, mounted so as to be capable of revolving and on its axis, and also of being moved horizontally to give the requisite spaces between the lines of the printing; and further, of being moved from the apparatus when required. The cylinder is turned by means of either one or two electric magnets with a lever escapement. After the cylinder has completed one revolution, it is moved horizontally through the space required by a lever escapement acting upon mechanism adapted for the purpose; the cylinder is raised and brought in contact with the type on the edge of the printing wheel, as required for each impression, by means of a set of multiplying levers which are actuated by the electro-magnets in the lower compartment of the apparatus. The cylinder is mounted at the two ends, so as to be capable of removal when the paper is covered with printing. The apparatus above described may be used either as a single electric indicator, or as an electric printing telegraph. The dial indicator with its apparatus is connected when required with the printing apparatus by means of an electric commutator at the lower part of the dial case.—Patent completed.

1918 F. T. POLLARD. *An improved bench dog or bench hook.* Dated July 1, 1867.

This invention is not described apart from the drawings.—Patent completed.

1919 P. IRONSIDE. *Improvements in the construction of Venetian blinds or shutters.* Dated July 1, 1867.

Here a vertical rod is laid in a groove, and each lath carries an arm which, besides passing through the vertical rod, rests in bearings formed in the sides of the groove. The vertical rod has a slot at its central part for each lath, and each lath receives a disc, eccentric, or plate, and through which each arm of each lath passes; pins also pass through the projecting points of each disc or eccentric; therefore, the arm of each lath is tied, as it were, in two places to the vertical rod; thus when motion is communicated to the vertical rod, whether causing it to rise or fall, so the discs turn the arms of the laths and alter the position thereof, as desired.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated December 16, 1867.

3589 J. Stanfield, Betchworth, Surrey. Improvements in the means of and apparatus for obtaining and applying hydrogen gas to the furnaces of steam engines, boilers, and kilns for the manufacture of bricks and lime.

Dated December 21, 1867.

3635 C. G. Wilson, Regent's Park, civil engineer. Improvements in machinery for pressing cotton and other substances, the said machinery being adaptable for locomotion on railways or on common roads.

Dated January 1, 1868.

7 A. M. Clark, Chancery-lane. Improvements in breech-loading ordnance. (A communication.)

Dated January 3, 1868.

24 C. Long, Knightsbridge. A new or improved mode and apparatus for eliminating a portion of the azote in furnaces and fireplaces, and for utilizing the oxygen and hydrogen of water as facilitators of combustion, and as fuel, or as reducers, and in some cases as decarburators. (A communication.)

Dated January 4, 1868.

29 W. W Morley, Wooburn. Printing of paper bags while in the process of making by Shaw's patent, or other bag machines, or for printing paper from the reel.

Dated January 8, 1868.

73 W. H. Bailey, Salford, brass founder, and J. W. Lowther, Manchester, manufacturer. Improvements in lubricating tallow cups.

Dated January 9, 1868.

87 S. G. Archibald, Edinburgh. An improved mode of preparing tablets, paper, and other surfaces for receiving writing.

89 R. Winder, Farningham, engineer. A new folding machine for folding sheep, and in making temporary enclosures in place of hurdles, nettings, and other plans.

Dated January 11, 1868.

110 W. D. Young, Edinburgh, iron and wire fence manufacturer. Improvements in wedging and fastening fences and other similar structures.

Dated January 13, 1868.

119 C. A. Watkins, Greek-street, Soho-square, brush manufacturer. Improvements in the manufacture of ties for painting and other brushes.

Dated January 14, 1868.

120 T. Wood, Liverpool. Improvements in the construction of railway carriages, and in the method of coupling the same, as also in the method of, and apparatus for, signalling between passengers, guards, and engine drivers of trains, and officials and others at stations and other places.

122 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the treatment of woven fabrics for improving the appearance thereof. (A communication.)

Dated January 15, 1868.

126 T. Sagar, machine maker, and T. Richmond, manufacturer, Burnley, Lancashire. Improvements in looms for weaving.

127 A. B. Boyer, Rue St. Lazare, Paris, doctor of medi-

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cine. Improvements in the construction of aerial cradles.

128 F. and I. Alekan, jewellers, Boulevard Sebastopol, Paris. Improvements in studs for shirt fronts and other similar purposes.

129 W. E. Gedge, Wellington-street, Strand. The substitution of thin flexible and movable blades or cutters of sheet steel in lieu of rigid blades or cutters in planing machines, and machines cutting and shaping wood by means of rotating tools, and an arrangement which permits their use on tool holders or cutter stocks with curved, helicoidal, conical, and other surfaces. (A communication.)

130 L. M. Becker, Guildhall Chambers, Basinghall-street, City, telegraph engineer. Improvements in the mode of laying, supporting, and maintaining the wires used for electric telegraph and other purposes, parts of which improvements are applicable to other purposes.

131 G. Nimmo, Jersey City, New Jersey. An improved composition for furnace linings, fire bricks, pots, crucibles, and other articles.

132 J. Lang, Paisley, Renfrew. Improvements relating to the printing of music.

133 D. Hodgson, farmer, and J. Dodd, engineer, Swaton, Yorkshire. Improvements in machinery for cutting grass and corn.

134 J. Hudson, machine maker, and C. Catlow, overlooker, Burnley, Lancashire. Improvements in looms for weaving.

137 J. Parker, Glasgow, manufacturer. Improvements in textile fabrics.

138 J. Kidd, St. Paul's Wharf, London, engineer. Improvements in obtaining artificial light, and in apparatus employed therein.

139 J. Head, Newport Rolling Mills, near Middlesborough, engineer. Improvements in furnaces for puddling, boiling, melting, or heating iron or steel.

140 W. Wilkins and W. G. Pollard, hosiery manufacturers, Leicester. Improvements in the manufacture of knitted reversible gaiters and bootakins for children, and in mitts and armlets for ladies, gentlemen, or children.

Dated January 16, 1868.

141 T. Travis and W. H. Prince, silk spinners, and J. Tomlinson, machine maker, Rochdale. Improvements in machinery for clearing and smoothing yarn and thread.

142 J. Eggleton, Old Town, Clapham. Improvements in the manufacture of bellows regulators for waterclosets.

143 J. J. Ashworth, Manchester, manufacturer. Improvements in looms.

144 J. Tolson and J. Boothroyd, Dalton, Yorkshire. Improvements in mule spinning machinery.

145 R. Schneider, Manchester. Certain improvements in the manufacture of piled fabrics.

146 C. E. Brooman, patent agent, Fleet-street, City. Improvements in gas-heating and cooking apparatus. (A communication.)

147 H. B. and A. Mullord, manufacturing stationers, Hoxton. An improved material for the manufacture or ornamentation of bonnets and other articles.

148 J. Wood, East Wemyss, Fifeshire. Improvements in windows.

149 J. A. Jones, Middlesborough, engineer. Improvements in the manufacture of iron and steel.

150 W. Betts, Wharf-road, City-road, capsule manufacturer. A new manufacture of a material to be used in the production of capsules, and for other purposes where thin flexible metallic sheets are employed.

151 J. G. Rollins, Old Swan-lane, City. Improvements in baskets for containing fruit and other goods. (A communication.)

152 T. Nash, Great Dover-street, Surrey. Improvements in stoves and fireplaces.

153 G. E. Reading, Birmingham, manufacturer. Improved busk fasteners.

154 C. D. Abel, Southampton-buildings, Chancery-lane. A new or improved system of movable switches, tongues, or rails for the crossings and intersections of the permanent way of railways. (A communication.)

155 F. Postill, Nelson-street, Scarborough, brick manufacturer. Improvements in kilns for burning bricks, earthenware, and other ceramic articles.

156 W. E. Newton, Chancery-lane. Improved machinery for shaping, grinding, sharpening, and polishing sword blades and handles, scabbards, gun barrels, and other arms. (A communication.)

Dated January 17, 1868.

158 R. Heathfield, Birmingham, manufacturer. Improvements in machinery for the manufacture of nails and tacks. (A communication.)

159 J. Moorhouse, Wakefield, worsted spinner. Improvements in that class of machinery known as cone drawing, employed in drawing or preparing wool.

160 H. C. Lobnitz and A. Buquet, engineers, Renfrew. Improvements in apparatus for propelling ships or other vessels.

161 S. and E. Burrows, Dukinfield, Chester. Improvements in the method of employing waste steam and the water arising from the condensation thereof, and in apparatus connected therewith.

162 J. Hosking, jun., Gateshead-on-Tyne, engineer. Improvements in the cutting heads of instruments used in drilling, boring, tunnelling, or otherwise penetrating rock, stone, or other hard material.

163 J. Young, Stewarton, Ayrshire. Improvements in washing, and in the apparatus or means employed therefor.

164 H. Aitken, Falkirk. Improvements in treating iron ores or iron stones for the purpose of effecting economy in the obtainment of iron and other products therefrom.

165 J. Crossley, Halifax, carpet manufacturer. Improvements in washing printed and parti-coloured yarns.

166 J. M. Napiers, York-road, Lambeth. Improvements in apparatus for cutting and dressing metals, woods, and other materials, and in the tools to be used in combination therewith.

167 D. A. Fyfe, Edinburgh. An improved mode of manufacturing paper pulp from wood and other fibrous materials.

168 N. H. Rolfe, Hull, merchant. Improvements in machinery for cutting laths.

169 W. R. Lake, Southampton-buildings, Chancery-lane. An improved mode of treating wood-veneer, and forming therefrom sheets or cards for various purposes. (A communication.)

170 G. S. Fisher, Southampton-buildings, Chancery-lane. An improved implement for cutting hay, straw, and other like substances.

171 J. Winter, jun., Wardour-street, Soho. Improved apparatus for filling glass bottles and jars with soups, jellies, and fruits, for the purpose of preserving them, the said apparatus being also applicable for filling bottles with sauces, wines, spirits, beer, liquors, and other still and effervescing beverages, also machinery in combination with the above apparatus for corking or stoppering such said bottles and jars.

Dated January 18, 1868.

172 J. Millward, Cuzon Chambers, Paradise-street, Birmingham, civil engineer. Improvements in the means and apparatus or machinery for propelling ships or vessels. (A communication.)

173 T. B. Kay, engineer, and F. Hamilton, foreman, Bolton-le-Moors. Certain improvements in carding engines to be employed for carding cotton and other fibrous materials.

175 B. T. Moore, Elm Lodge, Spring-grove, Isleworth, Middlesex, civil engineer. A new or improved apparatus for protecting water pipes from injury by frost.

178 H. Kershaw, Laister Dyke, near Bradford, worsted spinner. Improvements in means or apparatus employed in spinning worsted and other fibres.

181 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in ribbon looms. (A communication.)

182 A. Bochkoltz, Vienna, civil engineer. An improved mechanical arrangement to be employed in connection with self-acting valves.

183 B. J. Heywood, Loraine-road, Holloway. Improvements in the manufacture of pencil cases.

184 J. Davidson, Woolwich. Improved machinery for manufacturing bullets.

185 W. E. Newton, Chancery-lane. Improvements in ovens or kilns for firing or baking porcelain and various kinds of earthenware or pottery. (A communication.)

186 J. Carr, Crescent, Clapham, and C. Lucop, Drummond-road, Surrey, manager. Improvements in the manufacture of meat and other biscuits.

187 G. S. Fisher, Southampton-buildings, Chancery-lane. Improvements in links or couplings for harness and other purposes.

188 F. J. Baynes, Holloway-terrace, Holloway-road, Islington. Improvements in kitchen ranges, which improvements are also applicable to other cooking stoves.

189 D. Timmins, Stourport, engineer. Improvements in motive power engines.

190 G. Gopsill, Birmingham, jeweller. Improvements in sleeve links and fastenings for articles of jewellery, and for other like purposes.

Dated January 20, 1868.

194 M. Robinson, Accrington, Lancashire, machinist. Improvements in the manufacture of expanding and contracting combs or reeds.

196 J. Woodley, Send, Surrey. Improvements in apparatus for communicating or signalling in railway trains.

200 J. H. Johnson, Lincoln's Inn-fields. Improvements in ships for containing oils or burning fluids, also in raising such oils or burning fluids, and supplying the same as fuel to the furnaces of steam ships, parts of which improvements are applicable to the ballasting of ships with water. (A communication.)

202 A. V. Newton, Chancery-lane. Improvements in sewing machines, parts of which are applicable to other purposes. (A communication.)

Dated January 21, 1868.

204 J. F. Spencer, Sunderland, engineer. Improvements in steam boilers.

206 C. W. Brown, Gloucester Villas, Upper Lewisham-road, New Cross. Improvements in the construction of truncheons used by police and other constables and persons.

208 C. R. Havell, Reading, Berkshire, artist. Improvements in water heating apparatus.

210 L. N. Le Gras, Wardour-street, Soho, civil engineer. Improvements in churns.

212 W. J. Coleman, St. Mary-at-Hill. Improved apparatus to be employed in the manufacture of beer and wine finings.

214 J. H. Johnson, Lincoln's Inn-fields. Improvements in apparatus for indicating the relative positions and movements of certain of the heavenly bodies. (A communication.)

216 W. Davis, Gainford, Durham. Improvements in the method of fastening bags made of paper or other material, for the conveyance by post, or otherwise, of samples of grain, seed, textile fabrics, and other articles.

218 H. Brinsmead, Ipswich, machinist. Improvements in thrashing machines.

220 A. B. Brown, Vauxhall Iron Works, Wandsworth-road, engineer. Improvements in actuating the valves of engines worked by steam or other fluid.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," February 4, 1868.

2438 G. Haseltine. Iron and steel. (A communication.)
2668 A. Aitchison and H. J. Grantham. Carburetted gas.
2675 J. Griffin and F. Green. Envelopes.
2687 W. Winter. Sewing machines.
2688 G. Batcheldor. Trough waterclosets.
2690 J. H. Brown. Paper.
2692 T. H. Williams. Gas burners.
2703 A. Rooker. Taps.
2706 J. and J. Kirk, jun. Lace.
2713 J., B., and R. Wood. Steam engines.
2714 A. Morrall. Fish hooks.
2715 J. Jameson. Paper.
2716 G. Wilkinson. Pumps.
2719 J. Jameson. Indication of value on cheques.
2724 J. E. H. Andrew. Looms for weaving.
2728 A. M. Clark. Hat blocking machine. (A communication.)
2731 L. de la Peyrouse. Treatment of paraffin. (A communication.)
2732 F. Branscombe. Apparatus employed in drilling.
2733 J. and J. A. Huggett. Horse nails.
2736 H. A. Bonneville. Treating skins. (A communication.)
2744 M. Hamer. India-rubber tubing.
2750 I. Dimock. Apparatus for boiling eggs.
2751 W. J. and W. Hill. Securing watch chains to vests.
2752 J. Donald. Burning oil in furnaces.
2767 W. and S. Smith. Back rollers.
2779 W. R. Lake. Sewing boots and shoes. (Acommunication.)
2787 G. Townsend. Machine needles.
2800 R. Hattersley. Distributing printer's type.
2807 A. Bradburn and S. T. Marsh. Jointed rules.
2835 A. Danilecki. Electric baths. (A communication.)
2841 J. Speight. Spinning worsted.
2851 G. Twigg. Corkscrews.
2867 H. B. Barlow. Sewing machines. (A communication.)
2935 J. J. Holden. Polishing boots.
3065 E. Donner. Clearing skins.
3068 W. R. Lake. Cap for furniture springs. (A communication.)
3129 H. A. Bonneville. Preserving pasty matters. (A communication.)
3359 E. Belknap. Treatment of the solution of malt.
3381 E. H. Bentall. Nuts and bolts.
3424 J. Hadley. Drying corn.
3448 J. Newton. Lubricating parts of doffing knife apparatus.
3590 W. A. Gilbee. Raising water. (A communication.)
3632 J. Hadley. Cleaning grain.
3714 H. Bessemer. Treatment of cast iron.
19 E. J. and W. A. Kruss. Camera.
33 W. H. Atkinson. Cleansing casks.
69 S. Goldstein. Vest.
99 H. Cochrane. Making moulds for castings.
140 W. Wilkins and W. G. Pollard. Knitted reversible gaiters.
145 R. Schneider. Piled fabrics.
149 J. A. Jones. Iron and steel.
165 J. Crossley. Washing printed yarns.
184 J. Davidson. Bullets.
186 J. Carr. Meat biscuits.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed January 31, 1868.

2236 J. H. Johnson
2241 T. Allan
2242 J. G. Tongue
2244 J. and T. Elce
2245 C. D. Abel
2248 J. Russell
2249 A. Budenberg
2254 W. W. Hughes
2255 W. Wilson
2264 J. Heaton
2265 W. Prangley
2285 A. M. Clark
2291 T. J. Baker
2303 A. M. Clark
2325 H. M. Mellor
2369 J. W. Dixon and W. Buttery.
2508 G. A. Buchholz
2542 B. W. Ewer
2552 J. Marsden
2842 R. Smith
2860 W. H. May and P. Graham
2871 J. B. P. A. Thierry
3277 W. Anderson

Sealed February 4, 1868.

2259 W. J. Pughsley
2260 A. C. Bamlett
2262 J. G. Tongue
2267 T. Whittaker and M. Rourke
2270 T. Luthringer
2271 E. J. W. Parnacott
2276 C. M'Dermott
2278 F. C. Marshall and H. Stewart
2280 M. Hamer
2281 T. S. Cressey and J. Webb
2286 C. Benson and J. Barker
2297 C. Hohgrefe
2299 H. B. Barlow
2302 G. Hodgson
2304 G. Warsop
2307 F. H. Holmes
2329 J. Badger
2336 C. Holliday
2339 W. Betts
2340 W. Betts
2360 J. W. Dudley
2459 H. J. Simlick
2579 W. E. Newton
2972 W. Gray
3091 W. E. de Bourran
3093 J. Orr
3319 W. Boulton
3410 J. Fitter

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

210 T. Steel
244 J. H. Johnson
249 V. Burq
261 W. Teall and A. Naylor
281 J. and W. M'Naught
286 J. Hughes
292 C. Lungley
294 J. Ball
310 J. A. Phillips
319 R. M. Alloway
322 J. Booth
332 C. Beard

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

230 W. Winstanley, J. Kelly, W. Payne, and J. Formby
246 E. Smith
263 J. Chatterton
249 H. Phillips and J. Bannehr
275 H. Bessemer
430 J. J. Miller

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending February 1, 1867.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
1275	0 4	1754	0 6	1790	0 6	1833	0 4	1852	0 4	1877	0 4
1356	0 4	1756	0 10	1793	0 8	1835	0 4	1854	0 4	1878	0 4
1566	1 4	1759	0 8	1797	0 10	1838	0 4	1855	0 4	1879	0 8
1675	0 8	1762	0 8	1798	3 4	1840	0 4	1856	0 4	1881	1 2
1704	2 4	1763	0 8	1800	0 8	1841	0 4	1857	0 4	1883	0 4
1706	0 8	1764	0 8	1804	0 10	1842	0 4	1858	0 8	1887	0 4
1718	1 4	1765	0 6	1805	0 10	1843	0 4	1859	0 4	1888	0 4
1720	0 8	1766	0 8	1810	0 8	1844	0 4	1861	0 4	1891	0 4
1723	0 10	1768	0 10	1821	1 2	1845	0 4	1862	0 4	1892	0 4
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1733	0 8	1771	0 10	1824	1 0	1847	0 8	1869	0 4	1895	0 4
1736	3 6	1772	2 4	1826	0 8	1848	0 4	1872	0 4	1896	0 4
1742	0 10	1774	0 10	1828	0 8	1849	0 10	1873	0 4	1905	0 4
1750	0 10	1786	0 10	1832	0 6	1850	0 4	1876	0 4	1961	0 4
1751	0 6	1788	1 0								

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, FEBRUARY 14, 1868.

RECENT GUNNERY EXPERIMENTS AT SHOEBURYNESS.

SOME interesting experiments of a varied character were carried out at Shoeburyness at the close of last week. The first portion related to an improvement which has been made in the Dyer fuze, by Mr. Pettman, of the fuze department, Woolwich Arsenal. This Dyer fuze, which is also known by the name of the "C" percussion fuze, is extensively used in the service, a large quantity being always kept in store. They, however, possess a serious defect, which constantly shows itself in practice—they are liable to premature action. The fuze as originally constructed consists of a case with a solid head, in the centre of which is fixed a needle. Below it a cylindrical pellet is suspended by wire pins, having detonating composition at the top, and a chamber with mealed powder at the bottom. The case is closed by a plug, which screws in, leaving a space about the tenth of an inch between it and the pellet. When the gun is fired, the suspending pins are sheared, and the defect is, that the pellet falls frequently with such force against the bottom of the case, that it rebounds, striking the needle, and exploding the shell in the muzzle of the gun. Some time since Sir William Armstrong proposed to remedy this tendency by placing a leaden ring in the bottom of the pellet, which formed a cushion, and prevented rebound. Experiments were made with these improved fuzes, and the results were perfectly successful. But then the expense of this alteration is stated to be very considerable, as it necessitates the return of all the fuzes to the factory. Mr. Pettman has met the difficulty by placing a thin lead cup between the pellet and the bottom of the case. When the gun is fired the pellet falls upon this cup, flattening it down to a disc, and thus completely preventing rebound.

The advantage of this plan over that of Sir William Armstrong is that it does not involve the return of the fuzes to the arsenal, as the lead cup can be applied by simply opening the case and dropping it in. The alteration is, therefore, inexpensive, the cups costing only about five shillings per thousand, whilst they can be applied at any station. In the trials with the fuze thus improved, 50 were fired from a 12-pounder breech-loader field gun in loaded segment shells, plugged to burst on graze over water at 1,000 yards. The results of these were that forty-one burst on graze, three after graze, whilst six did not burst at all. Fifty more fuzes were then fired from a 9-pounder breech-loading gun in shells similar to those used for the first fifty. Six of these were fired over water, four of them bursting on graze, and two were blind. The remaining forty-four rounds were then fired to graze on sand at the same range. Of these shells thirty burst on graze, two after graze, and twelve did not burst. Eleven of the shells which did not burst were recovered from the range, and an examination of the fuzes showed that there were very good reasons for their not acting. In five the detonating composition was found to be defective, the needle having pierced the brass disc; in four the wires were not sheared; and in the other two instances the fuzes had acted, but were too feeble to pierce the cover over the burster. These experiments have therefore practically demonstrated the fact that Mr. Pettman has, by a very simple arrangement, satisfactorily overcome the liability of the Dyer fuze to premature explosion.

The second part of the experiments consisted of the testing of a trough in place of a tube for firing 9-pounder war rockets of the pattern known as Hale's. These 9-pounder rockets were formerly called 6-pounders, but the weight being nearer the first quantity their defining name has been changed. They are 16in. long, and have a diameter of 2·5in., outside measurement, their average weight being 8lb. 6oz. Formerly the cases were made of drawn tubing, which was liable to split, but now cases are made of sheet iron, riveted and brazed, with three corrugations pressed into it to secure the composition from giving way during flight. The Hale rockets have no stick, but rotate with a spin like a rifle bolt, through the action of the gas issuing from three perforations in the rear upon a small tail-piece or screw. These rockets made very creditable straight low tracks, thus redeeming the character of this missile, which has always been regarded as a very erratic weapon. It will be remembered that some experiments were made with rockets for the Abyssinian expedition; those we are about to describe were a continuation, and were made with the same class of rockets as are supplied to the expeditionary army. For the Abyssinian service it was found necessary to have tubes of short and small dimensions, such as could be carried by mules, and tubes of about 3in. in diameter were approved of. In the recent experiments a V-shaped trough 3ft. 5in. long, 3in. across, and weighing 16lb., was tried against a tube of like length 3in. in diameter, weighing 13lb. 4oz., with results decidedly in favour of the trough. Each was alternately fixed to the same light iron stand or four-legged horse, 16lb. in weight. A given number of rounds were fired from each under similar conditions, the particular advantages and disadvantages becoming apparent in the practice, which from the trough was most uniform. The tube requires a special friction tube for firing the rocket, whilst with the trough the ordinary service friction tube, as used for cannon, is found sufficient. It is a question, however, whether friction tubes will be found as useful as the old method of lighting the rockets by a port-fire, and for the reason that the tube is liable to rapid fouling, so that if the rocket jammed a burst would follow. Some time since a temporary apparatus was constructed at Shoeburyness, in which the trough was made to form, so to speak, one of the legs of a tripod. It was securely pinned to the ground at one end by a pivot, the two legs at the other end being hinged; the elevation for aim was got by opening or closing the hinged legs, as in the use of scissors. This arrangement appears to possess advantages over the present plan. The trials showed that 10deg. of elevation were as much as was practically useful, the composition having ceased to burn just before the rocket came to earth with the range thus obtained. The trough can be elevated with one end touching the ground, whilst the tube must be elevated some distance above it to permit the insertion of the rocket. The elements of superiority in the trough over the tube system are greater firmness in the stand, and less liability to be overturned in drawing the friction tube.

The results of the experiments will be seen from the following record of the actual practice made from the trough at 5deg. elevation, the right deflection being to windward. The total number of rockets fired was 22, the breeze being strong during the trials:—No. 1 round, range 541yds., direction in line; No. 2, range 546yds., deflection 6yds. right; No. 3, range 512yds., deflection 14yds. left; No. 4, range 60yds., grazed; No. 5, range 964yds., deflection 46yds. left; No. 6, range 260yds., deflection 1yd. right; No. 7, range 471yds., deflection 4yds. left; No. 8, range about 722yds., in water nearly in line; No. 9, range 539yds., deflection 5yds. right; No. 10, range 553yds., deflection 7yds. left. From the trough at 10deg. elevation:—No. 1 round, range 1,242yds., deflection 9yds. left; No. 2, range 570yds., deflection 44yds. left. From the tube at 5deg. elevation:—No. 1 round, range 886yds., deflection 13yds. left; No. 2, range 409yds., deflection 4yds. right; No. 3, range 767yds., deflection 11yds. right; No. 4, range 930yds., deflection 30yds. right; No. 5, range 669yds., deflection 26yds. left; No. 6, range 1,208yds., deflection 36yds. right; No. 7, range 668yds., deflection 4yds. right; No. 8, range 376yds., deflection 29yds. left; No. 9, range 850yds., deflection 69yds. left; No 10, range 181yds., deflection 6yds. left.

THE BATTLE OF THE SAFES.

THE battle of the safes bids fair to become as memorable as the battle of the guns and targets. Nor is it of less importance in its way. Guns and plates are for the protection of our country, safes for the protection of our cash. The one appeals to us as a nation, the other as individuals, and each with equal force. It is, therefore, no matter for wonder that the public should demand, and our manufacturers endeavour to supply, repositories for cash and other valuables, which shall be proof against thieves as well as fire. On the latter head we were tolerably well satisfied, but it remained for the Paris Exhibition to prove to us that we really had a safe which might really be considered as thiefproof. The burglary in Cornhill has not been without its fruits for good as well as for evil—evil as regards the loss sustained by Mr. Walker, but good as having led our safe makers competitively on to the production by one of them of an article which has proved itself worthy of the name of a "safe." The safe contest at the late Paris Exhibition, between Mr. Chatwood, of Bolton, and Mr. Herring, of New York, has been briefly referred to in our columns, but hitherto we have abstained from entering into detail particulars. Now, however, that we have the published report* of Mr. Robert Mallett, C.E., and Mr. Robert F. Fairlie, C.E.—the English members of the committee appointed to superintend the competitive trial of the two safes—upon the subject, we can no longer postpone the consideration of the details of the contest, which, in its results, placed Mr. Chatwood in the honourable position of victor.

From the report before us it appears that during the month of May, 1867, Mr. Silas C. Herring, a safe maker, of New York, affixed on the doors of his banker's safe in the Paris Exhibition a challenge against any other safe then exhibiting. Mr. Chatwood at once took it up, and proposed to test one of his safes, then in the Exhibition, against the one which had been so ostentatiously placarded, providing that burglars' appliances only were to be used. In July the agreement was duly signed by the respective competitors, and from which we quote the following:—"That, whereas the said Silas C. Herring is an exhibitor of safes in the Exposition, at Paris, and had on the 5th day of June, 1867, on one of the safes exhibited by him in Class 65, a certain challenge, setting forth that he the said S. C. Herring was willing to submit the said safe to a test against any other safe then exhibited by any other person." We are at a loss to conceive how language could have been more clear and explicit. And yet in the face of it, on the eve of the committee meeting in August, a month after the signing of the above agreement, Mr. Herring appends a codicil to his former posted challenge on the safe, intimating that "the small inside chest was only to be operated upon during trials," thereby ignoring the challenge safe and the original agreement. From this fact our readers will, no doubt, conclude with ourselves that Mr. Herring had not the implicit confidence in the security of the test safe which his challenge

* Tinsley Brothers, Catherine-street, Strand.

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seemed to imply, and that he was desirous of stealing a march upon his English antagonist. We think the committee ought to have branded such an unwarrantable and clandestine proceeding as it deserved, by at once vetoing it, and doubtless the committee overstepped and exceeded its powers by allowing Mr. Herring to raise any question foreign to the original proposition as to which safe was meant.

The American proclivities of Mr. Hoyle, the secretary and interpreter to the committee, and the fact of the French chairman being entirely ignorant of the English language, made the American interest supreme in the committee, so that the influence of the English engineers was only as two to four; and on no other grounds can we account for the decision, that Mr. Chatwood should, in addition to opening the challenge safe, be compelled also to open the practically useless inside chest (into which a man's hat could be put), which Mr. Herring had adroitly attempted to substitute at the last moment. From the report we gather that Mr. Chatwood's men, when preparing their tools for the attack on Herring's challenge safe, had only provided for the siege such as may be strictly defined *bonâ fide* burglars' tools, and such as are ordinarily used by that fraternity. And, although Mr. Chatwood entered his decided protest against the committee overleaping the bounds of its authority (it being impossible to find this second safe within the agreement), he yet declared that so soon as he had fulfilled the well-defined stipulations of the original agreement, by throwing open the doors of the challenge safe, he would then be prepared to show that the practically useless inner chest embedded therein could be also opened. What shall be said, after this flagrant piece of Yankee smartness, of the committee in granting to Herring's men an advantage over Chatwood's in weight of tools, and this for the unique and simple reason that they declared the impossibility of opening Chatwood's safe unless they were permitted to use such appliances and instruments as are ordinarily required when a steam boiler has to be knocked to pieces, thus stultifying its own unanimously-recorded resolution, passed after critically examining the tools of the Chatwood party, thus, "That both competitors be allowed equal weight of tools." We think the committee were remiss in their duty in not on the instant giving the award to Mr. Chatwood, and handing to him the challenge stakes, instead of dallying with unreasonable demands which it had no authority to grant. It did, however, in the excess of its authority, allow to Herring the use of full-sized ponderous boiler maker's implements, more than double the weight of the tools which had been allowed to Chatwood, and the trials were allowed to proceed with these "dead weights" unjustly, as we think, hung upon Mr. Chatwood and his men. The extra sizes and weight of tools allowed by the committee to Herring's experts, during the operation, produced a result which forcibly reminded everyone present of the noise and clatter always found in a boiler maker's shop when in full operation.

It will, no doubt, be asked how comes it that the committee were so remiss in their duty as to permit such a disparity of tools to be used by the competitors? Does not the original agreement clearly define *bonâ fide* burglars' tools—such as burglars are known to use without being detected in their nefarious practices? Ergo, by what right did the committee permit Herring's operators to use tools nearly thrice as heavy as those used by Chatwood's men—tools, too, unknown in the burglar's nomenclature? The affair being in the hands of the committee, their primary duty was to have seen that the first conditions of the agreement were fully carried out. But, with all the extraneous and undue advantages granted to Mr. Herring, his men failed, and failed utterly, in all their efforts to open the invincible door of the Chatwood safe, and only succeeded in making a hole on one side by a battering ram and other heavy implements—(the total weight of which was above 242lb.)—in 235min. On the other hand, Mr. Chatwood's operators opened the doors of Herring's challenge safe in 29min. with the ordinary burglars' implements—(the weight of which was under 12lb.)—the additional small inner chest in the challenge safe taking 210min. further to open, the tools used being equal to 90lb. weight, making a total, in opening the two, of 239min. in time, and 102lb. weight in tools. We, therefore, come to the inevitable conclusion, from an examination of the proceedings of this great international contest, that Mr. Chatwood is really and truly the winner of the wager. We regret to find that, owing to the tampering with the chairman by the American members, and the secretary of the committee, the English engineers were compelled to retire on August 20 (the chairman having also resigned, in writing, at the same time), before any award had been made, or even discussed. Had a verdict been given according to the terms of the agreement, Mr. Chatwood must have been declared the winner, and would have had the satisfaction of distributing among the charities of London, Paris, and Washington, the £600 deposited by Mr. Herring, which, in addition to the £600 deposited by himself, the French stakeholder still retains in the imperial treasury of France. In conclusion, we would remind our readers that several years ago we prognosticated that "Mr. Chatwood's would rank as the foremost safe of its time." This prediction was signally fulfilled at Paris last year.

THE FORCE OF IMPACT.

THAT all moving loads or weights act with a certain amount of impactive or concussive force is now well established. Their action, so far as resulting from vertical descent, was never doubted, but the solution of the question was not equally apparent when the motion took place in a horizontal plane. This may arise from the fact that the effect in the latter instance is not so immediate a sequence of the cause as in the former. The one may be called direct, and the other indirect impact. Pile-driving presents one of the most familiar, and, at the same time, one of the fittest, illustrations of the force of direct impact. Although rules have been given for calculating the effect of the blow from a ram of a known weight falling through a certain height, yet they are practically of little value. This is due to the circumstance that the resistance is in reality an unknown quantity. It is never constant, and has to be assumed for each particular case. Nothing is more common in driving piles, than to find that one will go down nearly twice as fast as another placed only a few feet from it. When a discrepancy so considerable is found within an area so contracted, it is readily perceptible how erroneous any calculation must be which is based upon the assumption that the same description of substratum will invariably present a uniform resistance in different localities. The particular impactive force to which we at present intend calling attention, is that resulting from the motion of a weight in a horizontal plane, as its effects are not so obvious, although their occurrence is quite an every-day affair.

With the introduction of railways arose the necessity of bridges possessing greater spans, and correspondingly greater dimensions, than had been previously imagined. The difficulty experienced by engineers was very great in overcoming the fanciful fears and ominous anticipations of those who regarded the passage of a train as sudden death to any bridge of a large span. It must not be supposed that these ideas were entertained solely by unprofessional and ignorant persons. On the contrary, many first-rate mathematicians and others well skilled in the art of construction shared them, and persisted in the notion with a blind but rigid belief. At present we have no means of estimating the actual effect of the transit of a heavy train at a high velocity over a bridge. It is true that we can provide for the safety of the structure. We can assume the dynamical load to be represented by so many static pounds or tons, resting at different moments of its passage upon various portions of the supporting girders, and from these data deduce the strains upon the flanges and web, and allow, if necessary, an extra margin or proportion of material to resist any contingency which could not well be included in the theoretical investigations. Notwithstanding the sufficiency and accuracy of these calculations, we fail to obtain any value for the force, or that undefined impulse with which the moving load attacks, as it were, the structure. That it is compounded of the weight, and the velocity with which that weight moves, there is little doubt. The cause is known, but the actual manner in which it exercises its functions is completely unknown. It was this very uncertainty that occasioned the alarm when it was proposed to take a train across the Menai Straits, since it was assumed that the danger would augment enormously in the ratio of the span. Let us consider how far these suppositions were correct. In the first place, it is manifest that the resistance to a blow is in direct proportion to the weight of the object receiving it. The ordinary hammer and anvil are illustrations. The dynamical force, or, in this instance, the train, may be regarded as inflicting during its passage a rapid succession of violent blows upon the bridge, which resists them in the ratio of its own weight to that of the train. This circumstance was taken advantage of in rather a peculiar manner in the early days of railway bridges, an extra quantity of ballast being piled upon them to make them heavy. However effective in an anti-impactive sense this method might have been, the economy of the proceeding is undoubtedly open to question, but bearing in mind the excessive margin of strength allowed in the majority of the early girders, the additional load did not probably demand any especial increase of sectional area for itself.

Assuming, as is theoretically correct, that the resistance of a beam to the impactive action of a dynamical force is directly proportional to its weight, without any reference to its dimensions, the relation between a dynamical and a static force appears somewhat parodoxical. If we take two beams having exactly the same sectional area but different lengths, and make L = the length of the longer and L' that of the shorter, then their breaking weights under a static load will be as $\frac{L'}{L}$. But the same beams, when subjected to the action of a dynamical load, would have their breaking weight as $\frac{L}{L'}$. In the one instance, the shorter beam is the stronger; in the other, the longer. Either the weight or the velocity is constant in the above example, but one quantity may be varied. As a corroboration of the truth of the opinion entertained respecting the efficacy of increasing the dead weight of bridges, by the addition of an extra amount of ballast, the experiments of Mr. Hodgkinson may be quoted. That gentleman selected a number of cast-iron bars, having a sectional area of 9 square inches, and a length between bearings of 13¼ft. After breaking a certain number of them, and taking the mean of the results, he found that the height necessary to accomplish their fracture with a given weight was 2¼ft. In the second series of experiments the bars were uniformly loaded with weights, and the height necessary for the given weight to fall through, to break them at the

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centre increased, as those weights were increased. When the bars were loaded with half their statical breaking weight, the height necessary for the given weight to fall through in order to break them was 5ft., or precisely double what was required when the bars were free from any load except their own weight. It must be borne in mind that the capabilities of the material with respect to deflection, have a great influence over its ultimate powers of resisting impact. A distinction must be drawn between the conditions of the examples we have alluded to, and those in which the material of which the beam or girder is composed, is presumed to become changed, with respect to its molecular constitution. This latter state may be brough about by the effect of long-continued impact. a subject which has been treated of by Mr, Fairbairn in the last series of his excellent work "Useful Information for Engineers." It is to be remarked in the experiments of Mr. Hodgkinson, that the greatest fall was required to produce fracture in the bars, before the static weights reached a proportion so high as that of one-half the breaking weight, so that there is evidently a maximum weight for each beam, to resist a given amount of impact. The determination of this ratio for girders and beams intended for railway bridges would not be without much practical interest and value. All these experiments, however, are only reliable up to a certain point. We do not consider that either in those instances we have adduced, or in the experiments carried out by Mr. Fairbairn and others, that the conditions accurately represent the action of the transit of a heavy train over a bridge. They are probably as close an approximation as can be obtained to the actual state of affairs, and must, after all, be viewed more in a theoretical and precautionary light. than in one which admits of a rigorously practical solution to the question.

NEW APPLICATION OF ELECTROTYPING.

WE understand that an ingenious American has invented a new kind of light summer hat, which will be introduced to the public in the next summer. The hat is to be made of manilla paper pulp. The advantages claimed for these hats are that they are exceedingly light, but nevertheless are waterproof. They are elastic, and will not be so liable to break as straw hats are. These hats are made to imitate straw-plait. The mode of manufacture is as follows:—Straw hats are made, by the ordinary process, of the various sizes and patterns required. These hats are then sized so as to be perfectly protected from the action of alkalies and acids. They are then blackleaded, and then copper wires are passed round them in various directions as electric conductors. The models thus prepared are then put into a bath of sulphate of copper, and a suitable battery attached: a one-cell Daniel's battery is sufficient, or even a one-cell Wolaston. When the deposit has attained about the hundredth of an inch, the wires that were wound round the model are detached in case they should have interfered with the deposit on the model. A connection is attached to the deposit in a suitable place, and the model is again immersed in the bath. When the deposit has attained a sufficient thickness to resist the pressure that has to be applied to it in moulding the hats, it is taken out of the bath, washed and dried, and the straw is then burnt out of the copper mould. The mould is then trimmed and put into a suitable frame, and it is ready for the moulding of the hats. The manilla pulp being prepared, it is pressed into the moulds. After being allowed to dry, the hat shrinks, and will easily leave the mould; it is then ready for sizing, waterproofing, and coloring according to the taste of the maker or the demand of the market. This is apparently a very simple and efficient manner of making hats, and it can be equally well applied to caps and bonnets, and will reduce the cost of these articles considerably, the material being cheap, and the process of manufacture simple and rapid after the moulds are made. There is one thing, however, which we would suggest to the inventor. In the electrolytic portion of his process we would recommend bronze powder instead of black-lead to produce a conducting surface on the mould. This could be applied before his insulating size is perfectly dry. If a beeswax size be used then the bronze powder could be applied at any time after the size is put on. Upon this bronze conducting surface the copper spreads much more rapidly than on blacklead. Electro-stereotypers find it much more effective and rapid; consequently, blacklead in electro-stereotyping has all but gone out of use. We think this new application of paper for coverings for the head will prove a great boon to the public, giving a durable and cheap article of dress. If we go on extending the use of paper as we have been doing we shall soon rival the Japanese in the use of that article, and we do not think that even they have reached the limits of its usefulness.

STEAM LIFEBOAT CUTTERS.

IN the steam launches which are now being supplied to our navy, the engine and boiler are not fixtures, but have to be hoisted out of the boat before it can be taken on board ship. In like manner, in getting the launch out of the ship, the boat is hoisted out first, and the engine and boiler are afterwards lowered into her. A considerable period must therefore elapse between the hoisting the launch out of the ship and the time of her steaming away. This defect, which, in some cases might prove of serious moment, is overcome in a very clever way in the steam lifeboat cutters which have been designed by Mr. J. S. White, of East Cowes, and which are being adopted by our naval authorities. The way in which Mr. White obviates the loss of time that now occurs between the services of a boat being called into sudden requisition and her leaving the ship under steam, is very simple—he makes the engine and boiler a fixture. These boats also possess other good qualities peculiarly their own. For instance, Mr. White claims for them a perfect unsinkableness, even when filled to the gunwale with water, and a double crew on board, an impossibility of capsizing them under any circumstances, as well as the constant readiness for active service, already referred to, in retaining their engines and boiler on board, even when slung up at a ship's davits. On a recent occasion, one of these cutters was tried over the measured mile in Stokes Bay, when she made a mean speed of 7 knots. This result is certainly exceptional when we consider that the boat is only 28ft. in length, and is driven by a little single cylinder engine of 3-horse power. It renders them eminently fitted for despatch boats. To test the qualities other than those of speed, which they are stated to possess, a subsequent trial was made with the steam cutter No. 3—the same vessel that gave the above good results under steam. The special object was to determine the practicability of hoisting up and lowering a boat loaded with engine and boiler, the latter filled with water, and a supply of coal on board for the furnace. The port poop davits of the "Duke of Wellington," screw three-decker, were appointed for the trial, so that as great a height as possible from a ship's davits was secured. With boiler filled, fire laid, bunker filled with coal, and the man attending the hooks and blocks of the falls on board, the total weight of the boat when suspended on the falls was about three tons. The falls were manned on the ship's poop by the ordinary number of men, and on the signal being given the cutter was run up to the davits and secured there under three minutes. The boat thus suspended was then carefully examined, but no sign of deflection was detected, thus clearly proving that she was quite capable of carrying her weights under these conditions with safety. The next step was to light the fire under the boiler, and soon afterwards the signal was given to lower the boat for service. In 2min. 3sec. from the time of the signal being given the boat was in the water and leaving the ship under a full head of steam. This result cannot be considered otherwise than as most satisfactory, and, in conjunction with the high speed these little craft attain, reflects great credit on Mr. White, their designer and constructor.

TRANSPARENT SOAP.

FANCY soaps form a large family, of which there are many varieties. One of these is transparent soap, the manufacture of which is extensively carried on in France and other continental countries. For the manufacture of this soap a large quantity of rectified spirits is required. Our own fancy soap manufacturers, however, are prevented from entering upon this branch of the trade owing to the restrictive measures imposed by the Board of Customs and the Inland Revenue department. As the duty on the rectified spirit is very high, and as this peculiar kind of soap cannot be made without it, no operations whatever can be undertaken, since it is impossible to compete with the continental maker, who has his spirits free of duty. To remedy the difficulty, it has been proposed to prepare the soap in a free manufactory until it is in the stage necessary for the introduction of the spirits, and then remove it into a bonded warehouse, where, under the supervision of the revenue officers, the spirits could be added, and the manufacture completed. Such an arrangement appears simple, and as it is merely that which prevails in the preparation of perfumed spirits and the manufacture of liquors, in the London and St. Katherine's Docks, we do not see why the authorities should not extend these provisions to soap. But it seems that the Boards in question are very hard things to deal with, as the trade has not yet succeeded in making any impression upon them, although they have been hammering at them for years. Notwithstanding that repeated applications have been sent in during the last six years to the Boards of Customs and Inland Revenue, the Board of Trade, the Lords of the Treasury, and the Chancellor of the Exchequer, nothing has been done. All admit the importance of the manufacture, but the ground on which the desired facility is refused is said to be that if they grant the privilege to one they must grant it to all; it is, therefore, better to manufacture this soap abroad. This is all very well in its way, and we will even assume these representations to be correct. But surely it is possible for the authorities to devise some means of meeting the point. There must be a woful lack of brains somewhere, which is really driving a valuable branch of business from this country. In the interest of our manufactures, we trust that some common sense will be shown in the matter, and that measures will be devised to enable our soap makers to carry on this special branch of trade.

ELECTRICITY AND TELEGRAPHY.

A NEW feature in telegraphy has just been introduced into France; it is now possible to exchange telegrams between any point in the European system of telegraphs and vessels at sea, by the aid of the semaphoric stations on the coast of France and Algiers. The commercial code of signals adopted by every nation is used for the exchange of signals between the station and the ship; telegrams addressed and sent by post to

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the French semaphore stations with the requisite quantity of telegraph stamps will be signalled to a ship at sea instructed to call off the point in question.

The "Telegraphic Journal" of New York, established some time back in opposition to the "Telegrapher," has ceased to exist.

New lines are being erected in the Brazils, and in a short time we may expect to have Bahia, Pernambuco, and other important commercial places in telegraphic communication with Rio de Janeiro.

A convention has been signed by the Chilian Government with a telegraph company, who undertake to place all the Pacific republics in communication with Cuba, and, consequently, with the United States and Europe.

M. Miergues has modified the battery which we lately noticed. The whole was contained in a glass vase; he now does away with the vase, and substitutes for the zinc an amalgamated zinc cell, at the bottom of which is a disc of india-rubber.

In some experiments lately performed by M. Leroux, relative to the spontaneous re-establishment of the voltaic arc after an extinction of a short period, he found that for a certain time the current might be interrupted without destroying the arc; this time he estimates at 1-25th of a second. Writing on this subject, M. Wartmann remarks that he has observed this phenomenon since 1852, and has made use of it in some researches in the electric light; he finds that for 1-20th of a second the current can be interrupted.

The great difference between the sizes and gauge of various wires, as supplied by manufacturers for telegraph purposes, has been matter of note for some time past. The present wire gauge, generally called the Birmingham, is of an arbitrary nature, and appears to follow no particular rule, being given by different people in widely different diameters. Mr. Latimer Clark is now taking this question up, with the view to the appointment of a committee by the British Association, so that a gauge may be decided upon and generally adopted as the standard gauge. Mr. Clark suggests No. 16 wire, at the assumed diameter of 65-1000th of an inch, as a standard, and from that works the proposed size of the various wires, by constant increments of 25 per cent. in weight, and of constant decrements of 20 per cent. in weight. It is a peculiar fact that the curve-plotted from this gauge very nearly coincides with the Birmingham wire gauge of Mr. Holtzapffel, which is looked upon as the best authority. It is to be regretted that so much diversity should exist, interfering so materially in many ways; and we trust that this question will be thoroughly gone into, and the best and most uniform gauge adopted.

Mr. Rudall, of the London, Chatham, and Dover Railway, has lately introduced an improvement in the modified form of Daniell's battery (commonly known as the sulphate battery), generally in use in our railway system. The old form used to consist (this form is still much in use) of a trough divided by partitions, and subdivided by a porous plate let in. Several arrangements were tried and adopted for doing away with this partition, in order to occupy less space. Amongst these may be mentioned that known as the Silvertonn battery, consisting of loose porcelain double cells in the wooden trough, the copper being formed as a rectangular cell, in order to contain the necessary sulphate. The front of this cell was perforated all over with round equidistant holes, and at the back was attached a piece of leather closing over these holes, and acting as the porous diaphragm; in Rudall's modification the form of the copper cell is maintained, but the leather and the front face of copper are replaced by a porous plate which is let in and secured. The advantage of this battery is that the porous plate acts better, and the battery is cleaner; the absence of the copper face prevents the large amount of deposition that usually, in spite of the well varnished surface, took place. The present modification is found to answer well as a good practical battery for railway or other telegraphic work.

In order to render common equally serviceable with pure zinc, amalgamation with mercury is usually resorted to, as well as to decrease the local action. In Bunsen's batteries, where a stronger acid solution has to be used, great difficulty has always been experienced in keeping the zinc element well amalgamated, so as to reduce as much as possible the great expenditure of the metal. Several plans with this object have been tried, but generally have, for one or more objections, been put on one side. A very simple remedy has lately been tried by M. Demance, who simply places in the zinc cell several drops of mercury. The amalgamation is at once renewed. From the results of experiments made by him with cells whose zincs have been reamalgamated in this manner, he finds that the current obtained is of a remarkable constancy, and that the exterior disengagement of hydrogen is very feeble. In addition to this, after numerous experiments, he is satisfied that the intensity of the current is manifestly superior to that of a battery of the same number of elements under ordinary conditions. It is only under the influence of a current that this reamalgamation will take place. The mercury being in excess the zinc always remains bright, local secondary actions are removed, and when the zinc is withdrawn from the cell the absence is noted of the froth, generally due from impurities in the metal, which usually soils the surface.

DEATH OF SIR DAVID BREWSTER.

ANOTHER long and patient toiler in the paths of science has just gone to his last rest. Sir David Brewster, whose name has been prominently before the scientific world for many years past, died on the evening of Monday last, at the ripe age of eighty-seven. "Full of years and honours" are words easily spoken, but not so easily realized. Never were they more appropriately applied than to the deceased philosopher, whose whole life was a practical and beautiful comment upon unwearying progressive scientific research, discovery and application. He was originally destined for the Church, but choosing rather to follow the bent of his own inclinations he entered upon scientific studies and pursuits. His first active step in this direction was to accept the editorship of the "Edinburgh Encyclopædia," a work to which he made a number of important and interesting scientific contributions, and which he did not complete till 1830. He had already devoted himself principally to the science of optics, in which he was destined to attain so distinguished a reputation, and honours had poured thickly upon him. In the year 1807 he was made LL.D. of Aberdeen University; Oxford conferred on him the degree of D.C.L. and Cambridge that of A.M. Next year Dr. Brewster was elected a member of the Royal Society of Edinburgh, of which he subsequently filled the offices of secretary, vice-president, and president—holding the latter office at his death.

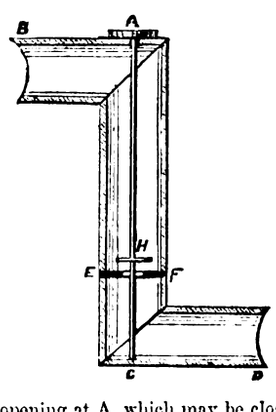
In 1815, Dr. Brewster received the Copley medal of the Royal Society for his discovery of the law of the polarization of light by reflection, and soon after was admitted a fellow of that body. In 1816 the Institute of France adjudged to him half of the prize of 3,000f., awarded for the most important discoveries made in Europe, in any branch of science, during the two preceding years. In 1819 Dr. Brewster received from the Royal Society the Rumford gold and silver medals, the Royal gold and silver medals, for his discoveries on the polarization of light, and from the Royal Society of Edinburgh the Keith prize twice, for his discovery of two new fluids in minerals and his analysis of solar light. It would be an almost endless task to enumerate all Sir David Brewster's discoveries and inventions, or to give a list of all the honours which were conferred upon him during a long life of unceasing activity. Without him our lighthouses would not have been what they now are, nor should we have had the perfect stereoscope we possess. The list of Sir David Brewster's contributions to scientific and general literature is a very long one, and includes our own pages, to which, some years since, he contributed a series of articles on his favourite subjects. In all parts of the world his merits have been fully recognised by learned bodies, whilst sovereigns have conferred upon him signal distinctions and decorations. To Sir David was due the establishment of the British Association, which grew out of a scientific meeting convened by him at York, in 1831. At the last meeting of this association it was remarked with regret that his health was not what it formerly was; in fact, he had to be removed from the hall on one occasion. Latterly his health had been failing, and at last nature gave way, and he sank to rest, leaving behind him a name which his survivors in science may envy and emulate.

PHOTOGRAPHY.

THE OXY-HYDROGEN LIGHT—OPERA-GLASS CAMERAS —DEVELOPING DRY PLATES.

OXYGEN is now largely used in the production of the lime light for photographic enlarging, and the manufacture of this gas may long be carried on with perfect safety but at last result in an explosion dangerous to life and limb. This arises from the use of an impure sample of black oxide of manganese, containing combustible matter, so that when chlorate of potash is added, and heat is applied to the retort, an explosion is the result. Safety from such accidents may be secured by heating the black oxide of manganese to dull redness in a crucible before using it in the manufacture of oxygen from chlorate of potash. In this roasting operation care must be taken that soot or carbon does not fall into the crucible, or that may result in an explosion. After preparing a quantity of oxygen, it is best to wash out the retort, and to throw the washings on a filter, which will collect the black oxide of manganese. This oxide is not changed by the process of making oxygen, and after having once been used for the purpose, of course it may be employed again with perfect security.

Last night (Thursday), Mr. John Traill Taylor, brought his method of securing safety from explosion during the use of the oxy-hydrogen light under the notice of the South London Photographic Society. He places a valve in each pipe leading to the two gas reservoirs, and these valves continue open whilst the light is being properly managed, but directly the operator, through any mistake, produces unequal pressure on the gas reservoirs, the gas is stopped on its way into the reservoir of its neighbour, closes the valve, and communication is cut off. Mr. Taylor described several valves which he had tried, that shown in accompanying cut being perhaps the most simple of the whole. B A C D is a bent piece of brass pipe



with an opening at A, which may be closed by the milled head therein represented. A C is a smooth wire down the centre of the pipe, with a light flat piece of ivory H free to move up and down there upon. E F represent the section of a flat brass ring in the pipe, and forming the opening to the valve. A piece of india-rubber tubing connects the end B with the right tap or taps of the lantern, whilst similar tubing, from the other end D, communicates with the gas reservoir. Hence, the gas-

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when flowing in its proper direction from D to B lifts up the piece of ivory, as shown in the cut, and passes uninterruptedly, but if from any mistake the gas is pressed in the opposite direction, the valve closes, and the tube is sealed. Mr. Taylor says that this light valve has no tendency to cause a fluttering of the flame, which burns as steadily as ever, whilst the operator is secured from the danger of an explosion either by accident, carelessness, or design.

Mr. Taylor also says, "With respect to the cost, and quantity of oxygen obtained from chlorate of potash, if this salt be pure, and the operation conducted with extreme care, the quantity of oxygen which should be obtained from a pound of the chlorate, mixed with a quarter of a pound of oxide of manganese, is five cubic feet; but, from various circumstances, all that is really obtained is from 4ft. to 4½ft. As a bag containing this quantity will, with proper management, serve for supplying a lime light for an entertainment or exhibition of pictures, lasting a sufficient time to almost weary an audience of average appreciation, the cost of the 'raw material' for an evening's oxygen will be from one to two shillings, according to locality, for chlorate of potash varies very much in price, from 10d. per pound, when bought in large quantities, to more than double that sum."

Safety from explosions in the manufacture of oxygen may further be secured by having a metal retort made with a long vertical neck, and, instead of screwing on the "head-piece" in the usual manner, fix it to the top of the neck of the retort by means of 2in. of broad india-rubber tubing. Thus, the top of the retort will act as a safety valve, and be blown off when, as is sometimes the case, the gas is given off suddenly in large volumes.

The chief difficulty in the way of taking outdoor views consists in the cumbrous nature of the apparatus, even when dry plates are used. Hence, much attention has been drawn of late to the necessity for a little "opera glass" stereoscopic camera, to take pictures only about 2in. in diameter. The lenses must give sharp definition, so that the little pictures will bear enlarging when printed on collodion by the process of Mr. Johnson, as already described in these columns. The tourist will thus be troubled with the carriage of very little apparatus, and the "walking stick" legs desirable for such a camera will not be an inconvenience. Apparatus of this description is much wanted, and it is to be hoped that the demand will shortly be met by the introduction of good articles into the market. Small lenses giving a brilliant image upon a small plate being the best for instantaneous photography, it is desirable that all little cameras of the description just mentioned should be furnished with a rapidly acting shutter, which might be fixed either between the lenses of the double combination or immediately in front of the plate.

The tannin process with bromized collodion plates has been proposed for use with this little camera, and such plates are doubtless the best dry ones for the process. Unfortunately, there is some want of certainty with all dry plates, and it is disappointing, after getting home, to develope a bad negative of a scene which may never again be revisited. When the tourist is so situated that he is able conveniently to develope his plates within a few hours after he prepares them, the glycerine process is the simplest and most certain that could be adopted, and will give less trouble than any dry method.

There is considerable liability to produce fogging in the development of dry plates by the alkaline method, but as that practised and published by Mr. Russell Manners Gordon gives perfect security from such mishaps, it is desirable to reproduce it here. He uses three solutions—No. 1 consisting of pyrogallic acid 96 grains, absolute alcohol 1 ounce; No. 2, carbonate of ammonia 96 grains, water 1 ounce; No. 3, bromide of ammonium 8 grains, water 1 ounce. When the picture is to be developed, he first wets the plate with distilled water, and then mixes distilled water 1 ounce, solution No. 1 ten drops, solution No. 3 five drops, which mixture is poured over the plate, on which it is allowed to remain a few seconds only. It is then returned to the developing measure, where five drops of solution No. 2 are added. This mixture, on being again applied to the film, at once brings out the picture, and after a little time, if from under-exposure the image does not develope quickly enough, four or five drops more of solution No. 2 may be added. The plate has then to be washed, and flushed with a little acid pyrogallic solution, to neutralise any remaining traces of alkali, after which the intensifying operations are performed in the usual manner.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

A NEW VOLTAIC BATTERY—CONVERSION OF CARBONIC INTO OXALIC ACID—AN IMPROVED PROCESS FOR SILVERING GLASS.

A NEW voltaic combination of great power was exhibited to some of the learned societies last week. It is the invention of Messrs. De La Rue and Hugo Müller, and has been designed for Mr. Gassiott. The elements consist of small cylinders of pure zinc and chloride of silver. The latter is cast upon a thin silver wire which forms the conductor. The exciting liquid is merely a dilute solution of common salt. In the battery shown the cylinders were only 3in. long, and about the size of goose-quills, arranged in two ounce phials cut down to two-thirds of their length, but a series of ten such couples decomposed water with great rapidity. By the chemical action taking place in the cell the chloride of silver is reduced and chloride of zinc formed. The action proceeds so long as any chloride remains, for the reduced silver adheres to the wire as a spongy mass, which allows the liquid to permeate to any unreduced chloride. The first cost of such a battery will be considerable, but as the only loss will be a little zinc, it will be very economical in working. Mr. Gassiott, it was said, is having a battery of 1,000 pairs constructed, of which, no doubt, the scientific world will in good time hear and see much.

Many chemists have tried to effect the direct conversion of carbonic into oxalic acid, and it was announced at the last meeting of the Chemical Society that one had succeeded in the attempt. A communication from Professor Kolbe stated that a German chemist, whose name we did not catch, had accomplished the object, by passing a stream of moist carbonic acid over metallic sodium distributed through sand, and heated to the boiling point of mercury. After some time, oxalate of soda was found among the sand. It had been noticed before that potassium amalgam absorbed carbonic acid and formed oxalic acid.

The celebrated chemist Liebig offers the fine example of a man who can, at times, descend from the loftiest flights of philosophical speculation to administer either to the wants of mankind by the preparation of an extract of meat, or to their vanities, by showing how mirrors may be easily and cheaply made. His last directions for the silvering of glass we borrow from the "Annalen der Chemie und Physik" and the "Philosophical Magazine." There is nothing new in the process, except the introduction of a small amount of copper, which has, however, important advantages. Without the copper the deposit of silver is apt to show speckles and pinholes, which are completely avoided in the process now described. The directions for preparing the various solutions are rather complicated, but we will endeavour to give them in a short space. First of all, a solution must be made of one part of fused nitrate of silver in ten parts of distilled water. Then a solution of 242 grammes (say half a pound) of sulphate of ammonia in water, made up to 1,200 cubic centimetres (two pints two ounces). Then a solution of caustic soda, free from chloride of sodium, of about the specific gravity 1·05. A silvering solution, designated A, is then composed as follows:—

Take 100 volumes of the ammonia solution
140 „ nitrate of silver solution.
750 „ soda solution.

The sulphate of ammonia solution must be poured gradually on the silver solution, and the soda also added by degrees. This mixture must stand three days to deposit, and then the clear liquor can either be decanted or drawn off with a siphon.

A reducing liquid (*a*) is now to be prepared by dissolving 50 grammes of white sugar candy in sufficient water to make a thin syrup, to which is added 3·1 grammes of tartaric acid. This mixture must be boiled for an hour, and then diluted to 500 cubic centimetres (0·88 pint). A solution (*b*) is made by dissolving 2·857 grammes of tartrate of copper in 500 cubic centimetres (0·88 pint) of water.

The reducing mixture B is made by mixing one volume of the sugar solution (*a*) with one volume of the copper solution (*b*), and eight volumes of water.

We now come to the actual silvering mixture. This is composed of:—

50 volumes of solution A
10 „ „ B
250 to 300 „ „ distilled water.

Solution A must be mixed with the water in a separate vessel; the solution B may be added in the bath. The reduction and deposit of the silver takes place best at a temperature from 70deg. to 85deg. Fah. The quantity of silver deposited Liebig states will be about a quarter of an ounce avoirdupois on the square metre, that is 1·2 square yard. Thus the manufacture of mirrors by this process will be very economical.

THE ANEMOMETER AND THE RECENT GALES.

THE recent storm at Liverpool was of probably unprecedented severity; it has certainly not been equalled during the present generation. The anemometer, or wind register, at the Bidston observatory, was erected in June, 1851, with a scale extending to 45lbs. on the square foot, which was then deemed to be ample for any contingency. This, says the "Liverpool Albion," answered very well until December, 1863, when, during a storm of great severity, the registering pencil was sent by three gusts to the extreme limit of the scale, 45lbs. to the square foot. Accordingly, when the new observatory was erected, the anemometer sheet was made to register 60lbs. to the square foot, and it was not deemed possible that any gale could visit these latitudes whose strength would exceed that limit. Thirty-six pounds to the square foot is set down in the charts as a "violent hurricane," so that those who framed the scale were quite justified in that opinion. Indeed, 60lbs. seemed to be an unnecessarily extended limit. The wind first began to increase perceptibly in strength about 9 a.m. on the 30th, but it did not assume a serious form until the evening of the 31st, when it rapidly increased in violence until, at half-past eleven at night, the anemometer registered one gust at a pressure of 51lbs. to the foot. At this time the wind was blowing from the west north-west, accompanied by rain, which continued through the greater part of the night. About 8 a.m. on Saturday the wind moderated, and the weather cleared, but soon afterwards the wind, veering slightly to the north-west, again increased in force, until between eleven and two o'clock the registering pencil was continuously sent far beyond the limit of 60lbs.; and Mr. Hartnup calculates, from the force with which the pencil was driven, that the pressure at several periods could not have been less than from 70 to 80lb. to the square foot. This is a tremendous pressure, so far in excess of anything hitherto recorded that it is questionable whether any part of the earth, even the West Indies, is often visited by a wind-force of greater severity. At about 3 p.m. the wind gradually subsided, and by sunset blew only a moderate gale. The barometer registered at midnight on the 29th 30deg. 31min. and from that time it continued to fall steadily until noon on Saturday, when it stood at 29deg. From this time it again rose, and at 2.30 p.m. stood at 29deg. 13min. During the great and disastrous hurricane of January 7th, 1839, the most severe on record, the barometer went down to 28deg., but unfortunately, so far as we have been able to learn, there is no record of the strength of the wind. It is not probable, however, that it even reached the excessive pressure of Saturday. Considering the tremendous force of the storm, it is remarkable that the disasters in the town and district were few, and of a slight character.

CRYSTAL PALACE.

WE recently noticed the partial restoration of the tropical end of the Crystal Palace, and it is with pleasure that we are now able to announce that the newly built end having been completed, will be thrown open to the public to-morrow (Saturday). The erection has been undertaken by the Hamilton Windsor Iron Works Company (Liverpool), under the direction of Mr. Edwin Clark. The finishing of this portion of the Palace has afforded the opportunity of locating the show of British and foreign birds there. Moderately heated, the tropical department of the Palace forms an unequalled place for such an exhibition. There will be an unusually large show, including specimens of all our native favourites, every variety of canaries, parrots, and parrakeets of every description and plumage, cockatoos, hybrids, albinos, &c., &c. As a novelty, the Monti fountain basin will be stocked with a large number of exceedingly rare water fowls. There will also be an interesting collection of pigeons of every sort. The birds will be judged this afternoon, and the show will be open at ten o'clock to-morrow morning, a concert being given as usual at three o'clock. The exhibition will be continued next week from Monday to Friday.

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THE ACCELERATOR GUN.

BY MR. A. S. LYMAN.

FIG. 1.

FIG. 2

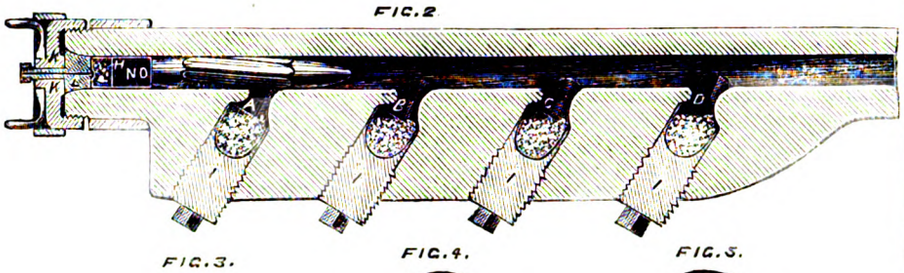


FIG. 3.

FIG. 4.

FIG. 5.

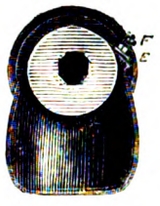


FIG. 7.

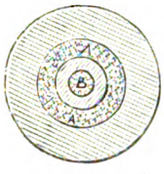
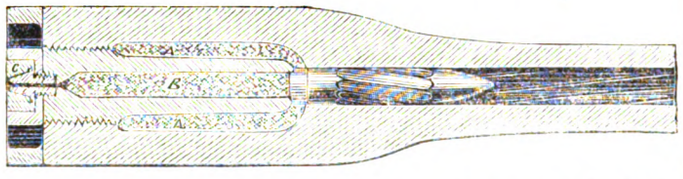


FIG. 6



THE ACCELERATOR GUN.

SOME months since we briefly referred to a gun on the accelerator principle, which has been brought out in America, and which had successfully stood some searching practical trials. This gun is the invention of Mr. A. S. Lyman, of New York, who has recently patented it in England. In this gun, in addition to the charge of powder supplied in the ordinary manner there are additional charge chambers, the charges of which act upon the projectile in succession after the initial charge has been exploded, whereby the motion of the projectile is accelerated. Mr. Lyman has designed two of these guns, the first arrangement being represented in figs. 1 to 5 of the annexed engravings. Fig. 1 is a top view, and fig. 2 a vertical longitudinal section of the gun. Fig. 3 is a cross section through one of the accelerators or additional charge chambers. Fig. 4 is a rear view, and fig. 5 a front view. The arrangement consists in forming in the body of the gun below and in a line with the bore several, say four, accelerating chambers A B C D, which are charged through openings leading from the upper part of the gun; these openings, after the charges have been inserted, are closed by screw valves E. The valve stem projects up through the screw and has a cap nut F on its end to keep out water. It is arranged so that when the screw has made half a turn in being withdrawn, it strikes the cap F and lifts the valve from its seat without revolving it, whereby friction is avoided; a copper cup G prevents windage.

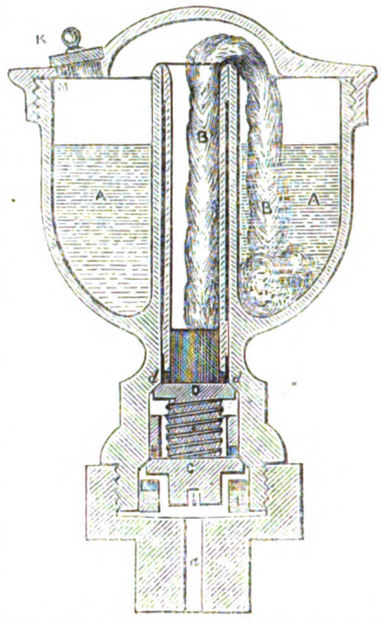
When the gun is fired the projectile is driven by the initial charge at H, which is comparatively small, past the first accelerator A, and the resistance of the shot causes the fire to set back down into and ignite the powder in this accelerator. This raises the pressure perhaps half as high as it was raised by the small initial charge H before the inertia of the projectile was overcome. The action of each of the other accelerators B C D is the same. The quantity of powder considered necessary for these accelerator guns for a projectile of (say) 280lb., is as follows:—For the initial charge, 3½lb. of mammoth powder; for the first accelerator A, 20lb. of mammoth powder; for the second accelerator B, 20lb. of No. 7 powder; for the third accelerator C, 25lb. of cannon powder; and for the fourth accelerator D, 25lb. of quick and strong powder. The accelerator plugs I should be of soft cast steel fitting closely in and protecting the cast iron from the fire of the powder.

In constructing the breech of guns, when provided with accelerating chambers according to this arrangement, Mr. Lyman has a cap K screwing on the outside of the breech, as in the Whitworth gun, but in front of this cap is a taper plug L, with its stem projecting back through the cap, and with a nut M on its rear end so as to have about half an inch play in order that when the breech is opened the cap K will make half a turn before it strikes this nut M, and lift the plug L from its seat without necessarily revolving it at the same time; friction and the power required to open the breech are thus greatly lessened. N is the sabot, which is made of a case of copper or sheet brass, filled with sheets of pasteboard. Where the back end of the projectile is tapered an iron plate O is placed in the front of the sabot to prevent the pasteboard being driven forward around the projectile. The second arrangement is represented in longitudinal section in fig. 6 and in cross section in fig. 7. It consists in constructing an additional charge chamber A at the breech and outside the bore of the gun. When the initial charge at B is fired, a wad C in front of this charge, which closes the communication between the two charge chambers A and B, is forced forward, starts the shot, and allows the fire to set back and ignite the accelerating charge A. This arrangement applies to muzzle-loaders, and the loading must be effected while the gun is in a vertical position, or nearly so; while loading, the powder, after filling the ordinary charge chamber B, runs over into the accelerating chamber A. The amount of powder in the chamber A should be about seven times that in the chamber B. We are expecting a report of the trials of this gun from America, which we shall publish as soon as we receive it.

SCHLŒSSER'S LUBRICATOR.

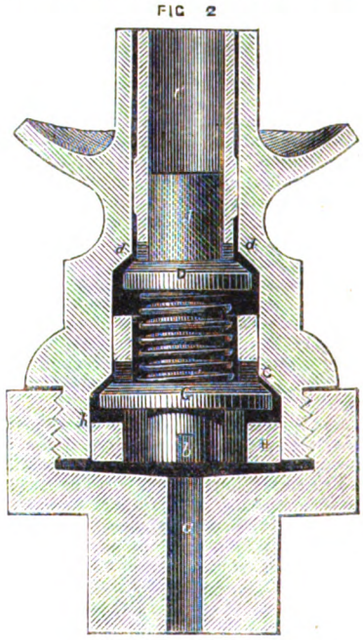
IT is well known that steam alone, and the water practically resulting from its condensation, very efficiently lubricate ordinary cylinder pistons and slide valves—especially when those parts are not very heavy, as with locomotive work, for instance. The construction of Shlœsser's self-acting lubricator is based upon the principle of furnishing no grease at all to the cylinder and valve chest as long as the engine is working under steam, but of instantly lubricating the parts as soon as the piston and valve are working dry, through their own momentum or otherwise. This lubricator, a German invention, has already been introduced on a large number of the lines in that country. It was shown in the patent locomotive of Herr Krauss at the Paris Exhibition, and in the Prussian machinery section. We believe it is being introduced into England by the London agents for the Bochum Steel Company, Messrs. Heintzmann and Rochussen. The external appearance of this lubricator is that of an ordinary cylinder oil cup, having a small opening X in its corner for the introduction of oil. Should tallow be used the cover must necessarily be taken off. The lubricant is conveyed from the annular chamber containing it into the central tube C by means of a wick. In order to prevent the chance passage of any grit, the bottom

FIG 1



of this tube is fitted with a thimble of wire gauze. Below this tube are two valves D and G, opening from above. Fig. 1 shows the position of these valves when the cylinder is under steam; fig. 2 is an enlarged view of the valve when open. Valve D is kept closed up against its slot by means of a spiral spring when the engine is standing still, so that no oil can escape; and when the engine is working under steam this action is evidently reinforced by means of the pressure of the steam on its bottom. But as soon as steam is shut off, and the engine

FIG 2



works empty, the strong exhaust in the empty cylinder or valve chest overcomes the spiral spring. The valve then descends and affords an annular opening, through which the oil escapes out of the cup. This takes place as long as the partial vacuum in the parts makes itself felt, but as soon as the engine stops, or steam is let on, the valve again closes. The amount of lubrication can be regulated in different ways, either by increasing or diminishing the threads of the wick, by varying the stroke of the valve by screwing up or down the nut on its threaded spindle *e*, or by varying the number of the openings *d*, *d*. The function of the second valve G, below the first D, is comparatively unim-

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portant. It is for preventing the inlet of the water of condensation into the working parts of the apparatus. This valve rests on a ring H, made with grooves H H, for the escape of the grease, and having at its foot another groove intended for the same purpose. The descent of this valve can also be regulated by adjusting the ring H. A saving of as much as two-thirds of the usual quantity of grease is claimed for this lubricator as the result of the trials on the Nassau line of railway.

INSTITUTION OF CIVIL ENGINEERS.

AT a meeting of the Institution of Civil Engineers, held February 4, 1868, C. H. Gregory, Esq., President, in the chair. The paper read was on Floods in the Nerbudda Valley: with remarks on Monsoon Floods in India generally, by Mr. A. C. Howden, Assoc. Inst. C.E.

This valley was described as being bounded on the north by the Vindhya and on the south by the Sautpoora ranges of mountains, and as consisting principally of black cotton soil, which was renowned for its fertility. The drainage of the valley supplied nearly the whole volume of the waters of the Nerbudda river, which traversed it in a direction nearly due east and west. The river took its rise in the Vindhya Mountains, at an elevation of 3,500ft. above the sea; its fall to Jubbulpore, 190 miles distant, was 10ft. per mile, and thence to the Gulf of Cambay, the fall might be estimated at about 2ft. per mile, the total length of the river being 800 miles. The width at its source was only 1 yard, while a little above its confluence with the Towah, 360 miles down stream, it was 900 yards, and at its mouth upwards of 1 mile. In an ordinary monsoon the level of the water rose between 30ft. and 40ft., but it had been known to rise nearly 60ft., when it overflowed the banks. Midway between the river and the Sautpoora Mountains, this valley for a length of about 270 miles was traversed by the north-eastern extension of the Great Indian Peninsula Railway, which crossed all the tributaries falling into the river on its southern bank; and it was the floods to which these feeders were liable that formed the subject of the present paper.

The floods of this region were divisible into two classes, according as they affected the plains, or the rivers. With regard to the former, it was remarked that the greater part of the Nerbudda Valley traversed by the railway was almost a level plain; and that although the average rainfall in the district, 46in., or 11½in. for each of the four monsoon months from June to September, could easily be provided for by the natural watercourses, yet that as much as 10.50in. fell in eighteen hours, in August, 1864, causing sudden and disastrous floods. It was observed that, in constructing a railway across plains of this description, great attention should be paid to the rainfall of the district, and ample provision should be made for carrying off the maximum amount speedily, without allowing it to dam up; as few embankments (especially those formed of black soil) could withstand the immense pressure then brought upon them, although the period of danger might not exceed twelve hours during the year, and should an opening once be formed, the scour was such that the embankment speedily melted away.

The principal rivers crossed by the railway in the Nerbudda Valley from Bhere to Bagra, a distance of 100 miles, were the Towah, Gungal, Matchock, Karlee Matchock, and the Suktha or Chota Towah, besides the Sconce Jamnee, Hurda, and other nullahs. The greatest flood known for ten or fourteen years, or according to native report, for thirty years, occurred in 1864, when, on the 15th of August, the river Towah rose 47ft. in a few hours; and it was estimated that the velocity at the surface was 16.58ft. per second, the fall 4.25ft. per mile, and the discharge 976,629 cubic feet per minute. It had been asserted that the flood of 1864 was an unusual one, but that of 1865 was of a similar character; while the flood of 1866 exceeded its predecessors, both in force and magnitude. The next important river was the Gungal, the highest known flood in which took place on the 22nd of July, 1864, when with a fall of 3ft. per mile, the mean velocity from calculation being 166.14in. per second, the discharge amounted to 732,123 cubic feet per minute. Two subsequent floods occurred in this river on the 8th and the 29th of August, 1866, and then, the fall being as before 3ft. per mile, the mean velocities were found to be from observation 153.68 and 110.22in. per second respectively, the relative discharges being 477,820 and 109,494 cubic feet per second. Some idea of the force of the current in Indian rivers on such occasions may be gathered from the fact, that in a comparatively small river, 30ft. plate-girders had been carried 7 miles down stream; while, in 1866, masses of masonry weighing 1,600 tons and 1,000 tons had been washed away from two of the piers of the Towah Viaduct, without a single stone being recovered.

In conclusion, the author expressed the opinion that, in bridging rivers of the description referred to, in the first place, wide spans were indispensable; for the current was so swift, and the rise of water so rapid, after a heavy fall of rain, that any contraction of the waterway caused a dangerous scour and backing up. Secondly, he thought that next in importance to having as few piers as possible, was the necessity of giving them the greatest strength, by building them of solid block in course, set in cement. Thirdly, that the face of the cutwater of piers should always be tool-dressed to reduce the friction, the "bush" frequently left on forming an obstruction. And, fourthly, that when rubble backing was used, care should be taken in suspending work, to finish off below high-water level with a bed of solid block in course, as otherwise the water would penetrate the work, and speedily blow up the pier.

SOUTH OF ENGLAND LITERARY AND PHILOSOPHICAL SOCIETY.

THE annual soirée of the above Society was held on Friday evening last, February 7, at the Hartley Institution, Southampton, by permission of the Hartley council. The Society has been in existence for several years, and was formed to meet the generally-expressed want of an association which should serve to bring together occasionally and to promote the co-operation of those in the town of Southampton and the surrounding neighbourhood who are occupied in the pursuit or interested in the progress of literature and science. The Society was formerly presided over by the late Lord Palmerston, and has now for its president the Hon. W. Cowper, M.P., and the soirée just held was rendered more attractive by the presence, for the first time, of the right hon. gentleman, who on this occasion delivered an interesting address. The Hartley Institution is a place eminently suited for conversazioni and soirées, the number of large rooms it possesses enabling the exhibition and classification of the various objects easy to accomplish and most convenient for show. In the reading-room were shown a collection of microscopes, spectroscopes, zoetropes, and other optical instruments; models of Jerusalem and the Pyramids, exhibited by Colonel Sir H. James; new invention for saving life in case of fire, by Messrs. Strugnell and Shepperd; a very good collection of antiquities and other objects of interest, by Mr. S. Sharp, of Northampton, &c. In the library were exhibited a large collection of objects of ethnological interest, by Mr. E. T. Stevens, of Salisbury, &c; and in the upper rooms the following objects of interest were exhibited:—Smoke rings and spectroscope, by Dr. Bond; gigantic soap bubbles, various forms of instruments for registering variations of temperature; and the spygmograph, an instrument for indicating on paper the beats of the pulse and the motions of the heart, confirming what is learnt by palpitation, Dr. Langstaff; and a collection of electrical and philosophical instruments, by Mr. W. H. Preece.

It was in these upper rooms that the principal objects of interest appeared to be located, to judge by the constant state of crowding; in one room was to be seen a large collection of telegraphic apparatus for ordinary speaking and for railway signalling, and other purposes. In the next room Mr. Preece's large ebonite plate electrical machine appeared to be the principal source of amusement and instruction; the apparatus connected with this machine for exemplifying experiments in frictional electricity were remarkable alike for the excellence of their workmanship and for their number: in fact, a collection that privately has rarely been equalled. Amongst other objects of particular interest, to which attention was constantly called by the loud reports of the fuzes, was Siemens' dynamo-electric apparatus for blasting purposes; the facility with which fuzes could be exploded at apparently any distance, by the simple exertion of muscular force in turning a handle, was truly astonishing. In the same room was also Ansell's firedamp indicator; a description of this has appeared so often that we cannot mention more here than that it formed, on account of its novelty in Southampton, an object of great interest. These two last apparatus were, by kind permission of the inventors, exhibited by Mr. G. E. Preece. The large theatre was frequently visited to hear an excellent selection of vocal and instrumental music; and shortly before ten o'clock the balcony and the body of the hall were well filled to listen to an address from the president of the Institution, who was introduced by the Mayor in an appropriate speech.

The Right Hon. W. Cowper said, as president, he was very glad upon this the first opportunity he had had of attending their annual conversazione, to congratulate the members of the Society upon the prosperity of the undertaking. One of the characteristics of the present day was the great achievements which were made by combinations or associations; and they found even in philosophical and literary pursuits they required a combination, a concourse of persons of similar tastes, who, by being united, were enabled to make progress which otherwise they would not be able to succeed in doing. The addition of social intercourse to the pursuit of science seemed to him a discovery quite worthy of note. This Society was not a society only for recreation, but they desired, he was sure, to promote utility as far as they could, and to look beyond their own sphere and see what useful things the Society could accomplish. During the short time that he was permitted to address them, he rather wished to improve the occasion by considering what was possible to be done in this great city by the means which were always existing in it to assist in the solution of some of those great questions respecting the education of the working classes, and which now deserved and received so much public attention. Since the great question of the Reform Bill had been settled, he considered the question which most urgently pressed for solution was the question of improvement in the education of the people; and the employment of scientific education in all places of tuition was a question which had now to be dealt with. But perhaps the special requirement to which their attention should be most directed was the mode by which technical education could be given to the artizans of this country. By technical education they understood the teaching of those elementary principles of science which were involved in the ordinary process of skilled labour—the application of science to the work which was carried on in the various manufactories. It was not necessary that he should speak of the modes in which science should be taught in upper schools, but he might mention that a very interesting experiment was about to be tried in the establishment of a college for young ladies, which was to be formed upon the principles of the Oxford and Cambridge Universities. But with regard to the technical education which was about to be given to the artizans of the country, they found that the importance of it was not fully recognized, and that the means were still very deficient. He thought there could be no doubt at all that a scientific training was just the sort of training which would be advantageous to working men. When we looked abroad and saw what the rest of the world was doing in this direction, we should soon find that if we stood still we should be left far in the rear. Now the governments of the most enlightened countries of Europe had been devoting great attention, and granting considerable sums of money, for the diffusion of technical education among the working classes. In France there were 25,000 evening classes, with about 600,000 pupils, and in those classes facilities were afforded for bringing to the artizan that scientific training which he needed. The English artizans, as shown from the Paris Exhibition, no longer held the same relative position in regard to Prussia, Switzerland, Austria, and France, that they did on former occasions. Now, how did we stand in England? Certainly the Committee of Privy Council on Education had exerted itself to extend the teaching of science, and we had at the present moment about 200 science schools, with some 10,000 pupils who passed examnations, but really those schools were not what they were called—they were merely elementary schools, with a little smattering of science in them. It seemed to him that Southampton was just the place where they ought to see a science school flourishing and successful. Those large engineering establishments which existed in the town must provide a number of youths, to whom it would be of incalculable importance to acquire such a knowledge as would assist them in their trade. They had in that scientific department of the Government, presided over by the officer who was so distinguished in the scientific

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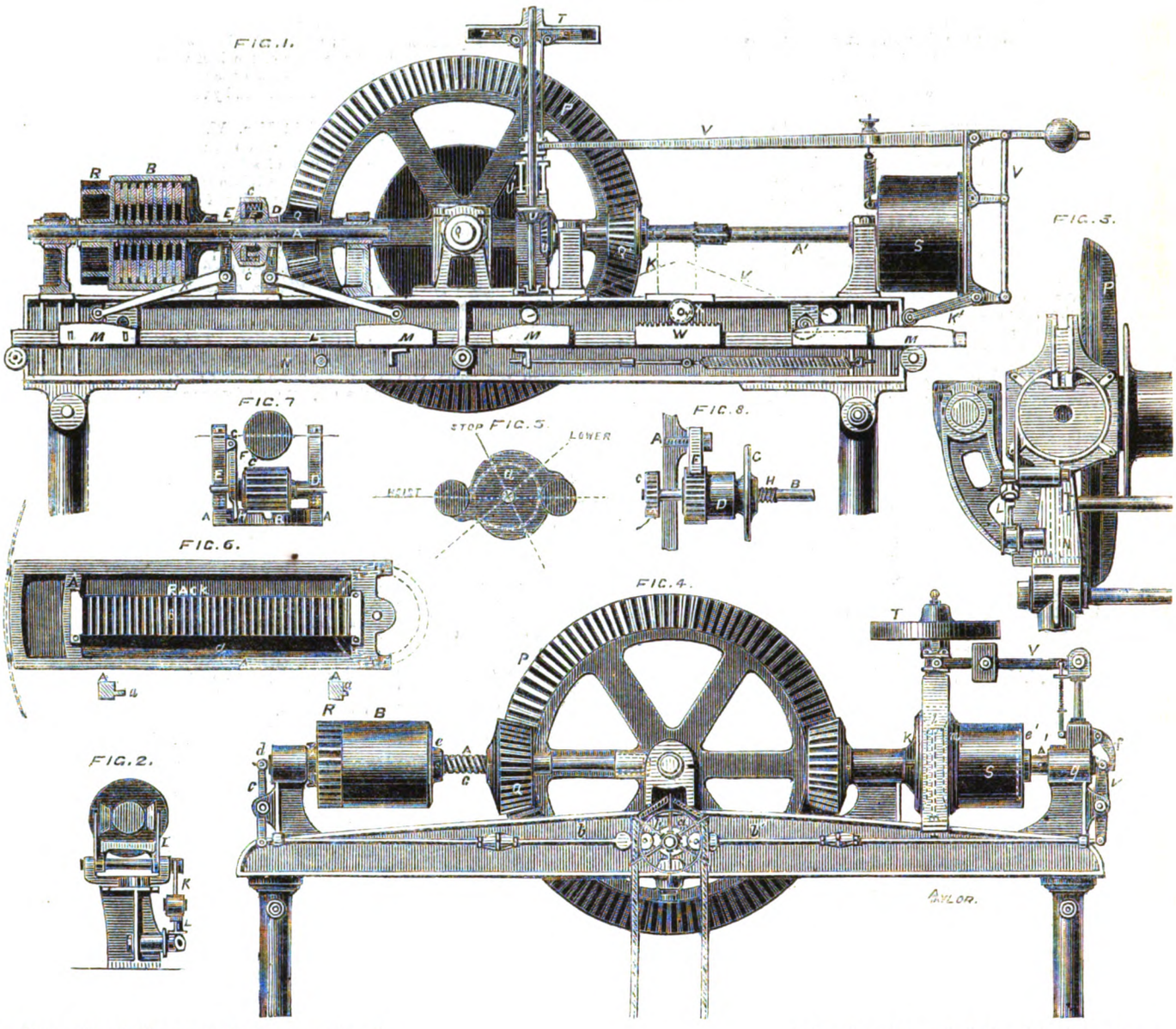
FRICTION COUPLING BRAKE.

BY MR. T. A. WESTON.



world as well as in his own profession, a number of persons to whom a scientific education would be most useful. They had in the Hartley Institution class rooms, a laboratory, a library, and a museum —much that was wanted; and the able, zealous, and enthusiastic principal, Dr. Bond, with his coadjutors, had already established engineering classes, in which such technical education as he had referred to might be given. The Hartley Council had shown their readiness to do what was possible in this direction by being, he believed, the first public body in the country who had taken advantage of what had been done by the Committee of Council on Education with regard to artizans' science exhibitions. There was, he was sure, in the town a number of gentlemen who would be happy to co-operate and do what was necessary in establishing a really efficient science school in connection with the Hartley Institution. He should be glad to see some committee formed, some association of persons who were interested in the matter, and then he had no fear of any lack of pupils. He hoped, therefore, that Southampton, so distinguished for its commercial activity and enterprize, and in many other respects, might also have linked to its reputation a science school added to the few already in existence in other parts of the country.

A vote of thanks was accorded to the right hon. gentleman on the motion of Colonel Sir H. James, seconded by Dr. Langstaff. A similar compliment was also paid to the Mayor for presiding, on the proposition of Dr. Bond, seconded by the Right Hon. W. Cowper. the latter complimenting the town upon having so excellent a chief magistrate.

FRICTION COUPLING BRAKE.

THE friction coupling brake invented by Mr. T. A. Weston, of Birmingham, is so well known to our readers, that it is not necessary for us to do more than refer to it in introducing Mr. Weston's most recent applications of that useful invention. In the present instance the invention is applied to hoisting machinery, gun carriages, &c., and consists of arrangements for applying and withdrawing the pressure requisite for operating the coupling brake. Fig. 1 in our engraving represents a front elevation of a power hoist with Mr. Weston's improvements applied; figs. 2 and 3 are end elevations of the same. Upon the shaft A, fig. 1, carrying the coupling brake B is placed a short hollow cylinder C, having a central boss D capable of turning freely on the shaft A. The lid or cover E of this cylinder is also provided with a central boss F so as to turn freely upon the shaft A with the cylinder C, and it is forced outwards from the cylinder by springs G contained therein. The central boss of the lid or cover is extended along the shaft and made to press by the intervention of the keys F^1 upon the discs H of the coupling brake B when required to effect the coupling action of the discs. When the springs exert their force upon the coupling brake the spring box C may revolve with the shaft, but when the coupling pressure is withdrawn by the spring box and its cover being mutually compressed together the spring box is brought to rest with and by the parts employed to compress it.

Upon each side of the spring box is a forked bell-crank lever I by which the spring box C may be compressed or released as the arms K of the bell-crank levers are elevated or depressed by the longitudinal motion of a sliding bar L, which is provided with inclines M for that purpose. N is a casting or girder carrying one end of the barrel shaft O of the hoist, the other end of the shaft being also supported. On the shaft O a bevel wheel P is placed next the girder N; upon each side of the bevel wheel P, and gearing therewith is a bevel pinion Q Q^1 with shafts A A^1 lying parallel to the girder N, bearings being formed for the same. To each coupling brake B are attached pinions R, which gear into corresponding spur wheels fixed upon one common driving shaft for the purpose of effecting the hoisting and lowering motions accordingly as one or other of the pinions is coupled with its shaft A or A^1. The pinion shaft A^1 is extended towards one end of the girder into a stationary brake box S fixed to the girder N, and to which is applied the speed governor T. The governor weights T^1 revolve horizontally, deriving their motion from light bevel wheels U upon the shafts A^1 U^1. The governor weights act by the levers V upon the stationary brake box S, and arrest any excess of speed in the act of lowering. The governor brake S is also acted upon by a lever K^1 to arrest the lowering motion at any point. The sliding bar L extends the whole length of the girder, and is in contact with the arms K of all the bell-crank levers of the coupling brakes as well as the lever K^1 of the governor brake, and lifts or drops them by suitably arranged projections on inclines M on the said bar. The projection M upon the sliding bar may be adjustable so that the hoisting, lowering, and the stop motions may follow each other in a convenient manner. The stop motion is obtained by pressure upon the stationary brake box effected by the incline M^1 and lever K^1. The sliding motion of the bar I may be effected by a toothed rack W attached thereto and gearing with the pinion X carried on the spindle Y of a sprocket wheel. The hoist is operated by the parts described, to which motion is conveniently imparted for the purpose by means of an endless rope and sprocket wheel attached to and carried by the pinion shaft X.

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HOT BLAST STOVE AT THE THORNABY WORKS.

BY MR. WHITWELL.

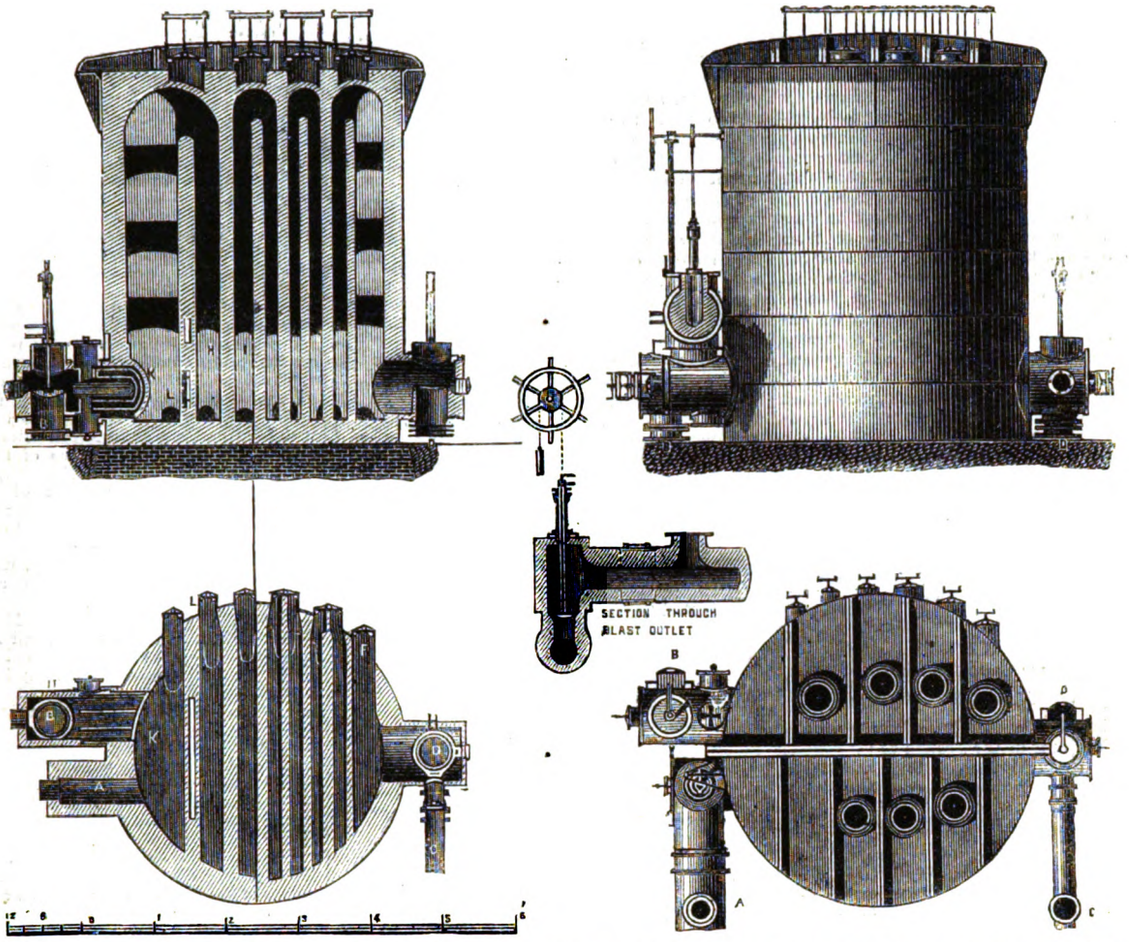

Fig. 4 represents a side view of another arrangement of hoist Mr. Weston has also brought out. A is a hollow shaft carrying a coupling B and a pinion Q gearing into the bevel wheel P to transmit a hoisting motion to the hoisting barrel by the action of the spring G upon the coupling B, the wheel R of which is geared to a wheel upon the driving shaft, as described with reference to fig. 1. This coupling pressure is removed in lowering by the cam *a* (shown in detail, fig. 5), acting upon the rod *b* and levers *c* through the pushing rod *d* within the hollow shaft A, the rod *d* forcing backwards the disc *e* of the coupling and relieving the latter from the pressure of the spring when the shaft A may turn in the contrary direction in which it is carried by the descending load. The lowering motion is suitably retarded by the governor T exerting its force upon the brake S through the intervention of the levers V, crank *f*, and pushing rod *g* which forces inwards the disc *e* upon the discs of the brake S. Upon the shaft A^1 is fixed a bevel wheel *k*, which by the pinion *l* transmits motion to the governor T and to the brake drum S by the pinion *l* also gearing with the wheel cast on the drum S; by this means the drum S and the discs connected thereto are rotated in a reverse direction to the other series of discs carried upon the shaft A^1, which contrary motion in the discs adds to their brake action. To stop the hoist wholly the cam *a* has a projection to act upon the rod *b*, lever U, and pushing rod *g*; the hoist is thus conveniently operated by the sprocket wheel *h* and rope *i* carried by the shaft Y, upon which is fixed the cam *a*.

Fig. 6 is a plan of the slide of a gun carriage to which Mr. Weston's invention is applied; fig. 7 is a transverse section of the same, together with that of the gun carriage thereon. A is the framework of the slide, one side of which has an inclined rib or rail *a*. B is a rack secured to the frame A, into which rack the compressor or disc brake C gears by spur teeth formed on its outside. D is a shaft carrying the brake C, and is supported in the sides E of the gun carriage; this shaft may be locked to or released from the sides of the carriage by any suitable means. F is a forked lever, the forks embracing the shaft D and vibrating between lugs G upon the carriage side; the tail H of this lever bears upon and traverses the inclined edge of the rib or rail *a*. As the carriage is driven by the recoil of the gun backward along the slide the lever E is gradually carried inwards against the brake or compressor C as the tail H traverses the inclined rib or rail *a*; during this backward motion of the carriage the shaft D is locked to the carriage sides E; the brake discs thereon are therefore stationary, whilst the discs attached to the drum C receive motion from the rack B. As the pressure is thus gradually increased upon the brake C an increasing resistance is thereby afforded to the recoil of the gun carriage.

Fig. 8 represents this invention as applied for controlling the lowering motion of an ordinary crane. A is the framing of the crane supporting the shaft B; C is a pinion keyed thereon and gearing into the spur wheel of the winding barrel; D is the brake box having a ratchet wheel E formed thereon on which the pall F acts. G is a hand wheel screwed to fit the screw H formed on the shaft B for the purpose of coupling the discs of the brake D; the pinion C turns in the direction shown by the arrow when lowering. Lowering is effected by unscrewing the hand wheel upon the screw thread H of the shaft B, which is again restored to its original position and again coupled with the brake box D by the lowering motion of the shaft.

We should add that this invention has had numerous practical applications, all of which are giving every satisfaction. For instance, the brake has been applied to numerous windlasses in the Royal Navy, the authorities having highly approved of it, and ordered its adoption. Then, again, there are eighteen hoists on this principle which are at work at the London Road Station, Manchester, of the Manchester, Sheffield, and Lincolnshire Railway. These are 90f.t lifts, and are for general warehouse purposes. With regard to the application of the principle to gun carriages, we will only now observe that it has been so applied and successfully worked. We hope shortly to place the details of this application before our readers, together with the results of some practical trials which have lately been made.

HOT BLAST STOVE AT THE THORNABY IRONWORKS.

THE annexed engraving illustrates a novel form of hot blast stove which has been used for some time at the Thornaby Ironworks, Stockton-on-Tees. In the Cleveland district, where economy in working is studied as much, or perhaps more, than in most other iron producing districts, it has been found that with an increase of every 100deg. in the temperature of the blast above 750deg., a saving of about 1 cwt. of coke on the ton of iron made has been effected. Hence, in order to produce pig iron as economically as possible, it has become necessary to provide a very large and expensive plant of heating stoves. Mr. Whitwell's hot blast stove contains no cast-iron pipes, but is constructed of firebrick, ganister, or other refractory material—enclosed in cast iron—which is capable of enduring the greatest heat that can be obtained from the combustion of the blast furnace gas, and hence all wear and tear of cast-iron stove pipies is saved, whilst a temperature of blast is obtained which would be probably unattainable under any circumstances in any stove constructed with cast-iron pipes. In working this apparatus two similar stoves are used, which by preference are of a circular form, and whilst the blast is being heated in the one the other is being heated by the blast furnace gas, which is introduced at the gas inlet B; the air necessary to effect combustion being introduced through the Argand burner K also at the air inlet L; in this instance the air is heated to a high temperature before meeting the gas, and thus induces a most intense combustion.

The gases ascend and descend the walls of the stove, passing under the central longitudinal wall in their course to the chimney, as at H and I; the products of combustion, after imparting their heat to the brickwork, pass off to the chimney at D. When a sufficient temperature has been obtained the process is reversed, the blast is introduced into the stove just heated, and issues therefrom at a temperature nearly equal to that already communicated to the brickwork by the burning gas, passing, in fact, over the self-same surfaces over which the gas has already travelled. The cold blast is introduced at C at that end of the stove whence the products of combustion have previously been passing at a low temperature to the chimney, by which means the blast is gradually heated, so that when it reaches that part of the stove which is red hot, it has attained to nearly the same temperature, and issues from the stove as above mentioned at a red heat. A distinguishing feature of these stoves, however, is that they may be cleaned from the dust deposited on the

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heating surfaces by the gas, without being cooled down, and without it being necessary to enter them: for this purpose doors or valves E, protected by brickwork are placed at the top and at the sides of the stoves, and by opening those at the top the dust can be scraped from the heating surfaces and removed by the bottom valves F, without any loss of time. Hence it is not necessary to purify the gas before using it. The valves are so arranged as to allow sufficient air to be admitted to burn the gas perfectly, by which means the gas is consumed with great economy; for, whereas in cast-iron pipe stoves the gas issues from the chimney at a heat of nearly 2,000deg., in these stoves the products of combustion pass into the chimney at a temperature of from 500deg. to 700deg., the difference being absorbed by the heating surfaces, and returned to the blast furnace in the heated blast. The construction of this stove will be readily understood from our engravings. The principle on which the apparatus acts is not new, but the details and general arrangements are novel and constitute features of much excellence. The "Engineer," from which paper we obtain our information, states that a pair of these stoves are now working at the Thornaby Ironworks, Stockton-on-Tees. They are cleaned every two months, and this is accomplished in four hours and a-half, whilst red hot, by means of wire brushes and rakes. The ordinary stoves require thirty-six hours to cool, clean, and get up heats again, thus producing irregularity in the working of the furnaces. The patentee has arranged with Messrs. Siemens and Cowper for the use of their patents in this hot blast stove.

THE EMPEROR NAPOLEON III. ON THE VOLTAIC PILE.

It is certainly not generally known that the present Emperor of the French is the author of a very able essay on the voltaic pile. It will be found published in the "Comptes Rendus" for 1843, vol. xvi., pp. 1180—1. At the time of its publication it had great merit, and even now will be found to possess much interest. We give it here all the more willingly as the paper in question is not to be found in the Emperor's collected works. The essay came before the Academy of Sciences in the form of a letter to Arago, dated the 23rd of April, 1843, from the Fortress of Ham, where he was then imprisoned for his attempt at Boulogne. The academicians observe in a note that "though Prince Napoleon was preceded by M. Becquerel in the construction of a pile composed of elements consisting of only one metal, yet they feel they ought to publish the letter," adding that "the clearness of the reasoning and of the results will justify our determination in the eyes of everyone."

The Prince's essay is as follows:—The source of galvanic electricity has been attributed by Volta to the contact of two dissimilar metals. Davy partook of this opinion, but other men of science, and amongst them the illustrious Faraday, have expressed the opinion that the chemical decomposition of the metals was the only cause of the electricity. Adopting this last hypothesis I have reasoned as follows:—As in the pile there is never more than one of the two metals that is oxidized, if the electricity is only due to the chemical action, the second metal ought to play in this connection but a secondary part. What is this part? It is, I think, that of attracting and conducting the electricity developed by the first in a manner analogous to that going on in the ordinary electric machine. As a fact, in the latter the electricity disengaged by the friction traverses an imperfect conducting medium, which is the air, and is attracted and conducted by a perfect conductor, which is the metal. In the pile the electricity produced by the oxidation of any given metal traverses an imperfect conducting medium, which is the liquid, and is gathered up and transmitted by a perfect conductor, which is the adjacent metal.

This idea appeared so clear and simple to me that I sought for a means of proving its exactness by experiment, and I further reasoned as follows:—If it be true that one of the two metals employed in the pile only serves as a conductor, it can be replaced by metal identical with that being oxidized, provided that it be plunged into a liquid that, while permitting the passage of the electricity, does not attack that metal. Experiment confirmed my previsions. I constructed two couples, according to the principle of the constant piles of Daniell, but with one metal. I immersed a copper cylinder into a liquid consisting of water and nitric acid, the whole being contained in a porous earthenware tube. This tube was surrounded with another copper cylinder immersed in water acidulated with sulphuric acid, a mixture that does not attack copper. Having formed the communications in the usual way, I decomposed with this pile of two couples some dissolved iodide of potassium, and having placed at the extremities of the piles two copper plates dipping into a solution of the sulphate of the same metal, I gathered at the pile communicating with the copper attached a deposit of copper.

I made a second experiment with zinc alone. I poured into a porous tube a mixture of water and sulphuric acid, and I surrounded this tube with another cylinder of zinc, immersed in pure tepid water, with two similar couples. I equally decomposed iodide of potassium, and I obtained, by taking the necessary precautions, a deposit of copper at the pile in connection with the zinc attached as previously. Finally, I reversed the usual order of the metals, and placed the copper into the centre of a vessel plunging into water and nitric acid, and I surrounded the porous tube with a zinc cylinder immersed in pure water. I thus obtained a rather strong pile. I should have wished to have been able to measure with care the different strengths of the electric currents produced, but it was impossible for me to do this for want of a galvanometer. My efforts to construct one did not succeed, as the magnetized needles were always deviated by the attraction of the iron bars surrounding my windows. Nevertheless, from the experiments I was able to make, it seemed to me demonstrated:—

1. That in the pile the cause of the electricity is purely chemical, as two metals are not necessary to produce a current.

2. That the metal which is not oxidized only serves to transmit the electricity.

3. That each metal is positive or negative (anode or cathode) to itself or to others, according to the nature of the liquid into which it is plunged.

METAL FOR FRASER GUNS.

We last week briefly noticed the circumstance that Colonel Campbell had received permission to utilize some of the old cast-iron guns of small calibre for the manufacture of Fraser guns. This is a very satisfactory arrangement, inasmuch as it disposes of an immense stock of ordnance materials which have been accumulating for the past twenty or thirty years in Woolwich Arsenal, and with which the open spaces fronting the stores and factories are now encumbered. It appears that about 2,000 tons weight of the smaller calibres are now being transferred to the Royal Gun Factories to be worked up by the Bessemer process into malleable blocks and coils for the above purpose. There are also other guns to be utilized in this way; in fact it has been ascertained that the waste stock of old material will supply the factories for twelve or fourteen years, independently of the large number of guns conceded to Major Palliser for the purpose of conversion on his principle. Colonel Campbell, through whose suggestion the War Department has sanctioned the introduction of the system, is so well satisfied with the results hitherto obtained by the initiatory trials, that the number of puddling furnaces is to be increased from three to five, and a number of efficient puddlers have been added to the establishment. Besides the old guns, Colonel Campbell intends using up the whole of the refuse, such as the old carronades of the time of George I., and the useless spherical and broken shot and shell amassed in various parts of the Arsenal. With five furnaces it is stated that ten tons of malleable iron of very superior quality will be produced daily at the rate, including all expenses, of about £8 per ton. We can but regard this as a step in the right direction, and a sensible method of dealing with what has hitherto been deemed waste.

"BESSEMERISING" AND THE NITRATE STEEL PROCESS.

Just as the Messrs. Moses, the great trouser-makers, have long been known to keep their own poet, so have the Messrs. Bessemer, the great steel makers, long been known to keep their own leading article writer. And in both these cases, and with the same prosaic end in view, the result has been the publication of a great mass of poetical prose and prosaic poetry. Now reflection will show the impartial observer that Mr. Bessemer's investing in what some might deem a luxury was a particularly natural step on his part. Upon the whole, we consider it probable that a few of the many investments Mr. Bessemer has made during his career have been more promising. It is now many years ago that Mr. Bessemer discovered the great use of puffing——air into materials softened by heat, or soft by nature. By an obvious train of thought Mr. Bessemer looks upon the public as a multitude of pigs, simply boiling to be converted into Christian Bessemer metal. We break no confidence, therefore, when we state as a fact, of which many are already aware, that Mr. Bessemer has long ago purchased, set up, and started, a very powerful blowing or puffing engine, embodying all the latest Yankee dodges—in fact, we believe the choicest production of an American maker. And with all the energy of its remarkable country does this remarkable engine work. It does occasionally throw about a good deal of dirty grease—possibly due to too much lubrication—and its tenter has also to be very careful in handling it. But, upon the whole, it yields a very high percentage of puffing duty, and may be looked upon as the most powerful Bessemer Blowing Engine ever erected on a bed plate. Such are the results of the march of intellect and of the applications of science and invention to the wants of the age. At a less advanced period in the world's history Mr. Bessemer might have been contented with blowing his own trumpet. But, no. With a true appreciation of the value of the division of labour and of the utilization of power, he applies a blowing engine to the trumpet of fame. Or, to drop the metaphor, Mr. Bessemer no doubt considers, like the poet, with regard to the end "of all fame—'tis but to fill a certain portion of uncertain paper." And, accordingly, it is filled with accounts of the Bessemer process, and Bessemer metal, and Bessemer rails, and Bessemer ingots, and Bessemer converters, and Mr. Bessemer's school-days, and Bessemer plate, and Bessemer rails again, again, and so on, *ad infinitum*.

But if the Bessemer Blowing Engine works "sweet" in effecting, or in attempting to effect, Bessemer conversions, its action is not pleasant with regard to other processes of steel making. A fortnight ago we were so foolhardy as to venture guardedly to express some hopefulness as to the future of a certain process for making steel and refining iron for puddling purposes by the use of nitrate of soda. The Bessemer Blowing Engine was down upon us at once. Apart from a playful little splashing about of grease, no doubt greatly due to the extremely rapid reciprocations of its brass details, and apart also from some more or less ingenious little "conversions" of our words (easily detected by anyone caring to take the trouble) Bessemer Blowing Engine's objections resolve themselves into:—1. That nitrate of soda, if used for making steel and refining iron, would be very costly. 2. That the limited supply of nitrates ought to have shown us "the immediate probability of a rise in the market value of soda, if wanted in such enormous masses as the iron trade of the Cleveland district would demand."

1. But in the first place, we must remind the Bessemer Blowing Engine that, in observing that, as "a ton of nitrate costs £10," 8 per cent. being required, the outlay of 16s. per ton of pig iron "for the nitrate alone," would show "the immediate probability of a rise in the market value of soda;" it forgets its *protege's*—or its protector's (?)—as to this question we are as puzzled as in telling the head from the tail of a hairy terrier—average charges of £2 10s. per ton for royalty alone. Assuming Mr. Hargreave's ultimate success, Mr. Hargreaves would be able to use iron costing 16s. to 20s. per ton less than anything that Mr. Bessemer can use, and possibly obtain—certainly with less cost of plant and labour—a larger yield and a better quality of steel.

2. As to the supply of the nitrate of soda being "limited," the fact is that the supply is practically exhaustless. One single South American source of supply has been estimated by Bollaert, in his work on Peru, as amounting to more than sixty-three millions of tons. The mode in which it is manufactured and conveyed to the Peruvian coast for shipment is still of the rudest description, and a greater demand would no doubt be attended with a diminished price. A proof of this is to be found in the fact that though the demand for it was never greater than at present, its price was never lower. It is extensively used as a manure and in the manufacture of nitric and sulphuric acids, in the latter of which manufactures alone 14,000 tons annually are consumed. The last annual Board of Trade returns of imports extend down to the year 1866; those for 1867 will only be published within a month. Taking the year 1866, therefore, we find that more than 48,000 tons of nitrate of soda were imported into Britain during that year. In spite, therefore, of the Bessemer Blowing Engine, the supply may be considered as being practically exhaustless as the iron and coal of this country; and if Mr. Hargreaves can as easily overcome his practical difficulties as we have met the Bessemer Blowing Engine's airy objections, Mr. Hargreaves will yet be a very wealthy man.—"The Engineer."

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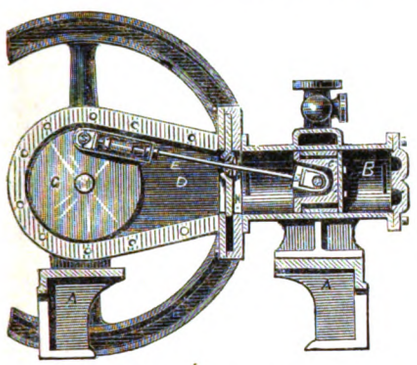
BAILEY'S STEAM ENGINE.

THE essential requisites in a steam engine in order to excel in the present advanced stage of its improvement, are lightness, strength, compactness, and simplicity, so that it can be easily transported, occupy but little space, be readily put up and operated by engineers of ordinary capacity and limited experience. The working parts should be few and durable, and protected from the injurious effects of dust and dirt. In the engine herewith represented the elements above mentioned seem to be combined in an eminent degree. The crank of this engine, with its connecting rod, &c., is enclosed in a steam-tight head, so arranged as to form an extension from one end of the cylinder in which the piston works, and to this piston the connecting rod is directly pivoted and the opposite end actuating the fly-wheel. To close the communication between the cylinder and the hollow head, a transverse slide is fitted with a rocking block through which the connecting rod passes, the combined action of which provides for the free motion of the connecting rod, and, at the same time, forming a sufficiently steam-tight division between the cylinder and head.

Our engraving shows a vertical section of the working parts of Bailey's engine. Upon the standards A A is secured a cylinder with its attached head, and they support the valves, &c., necessary for the action of the engine. A piston C is fitted to the cylinder, and is made of sufficient length to form in itself a guide in its reciprocating motion. One end of this piston is hollowed out to receive one end of the connecting rod which is pivoted to it, the opposite end of the rod being attached to the wrist pin S of the disc G which is keyed to the shaft of th



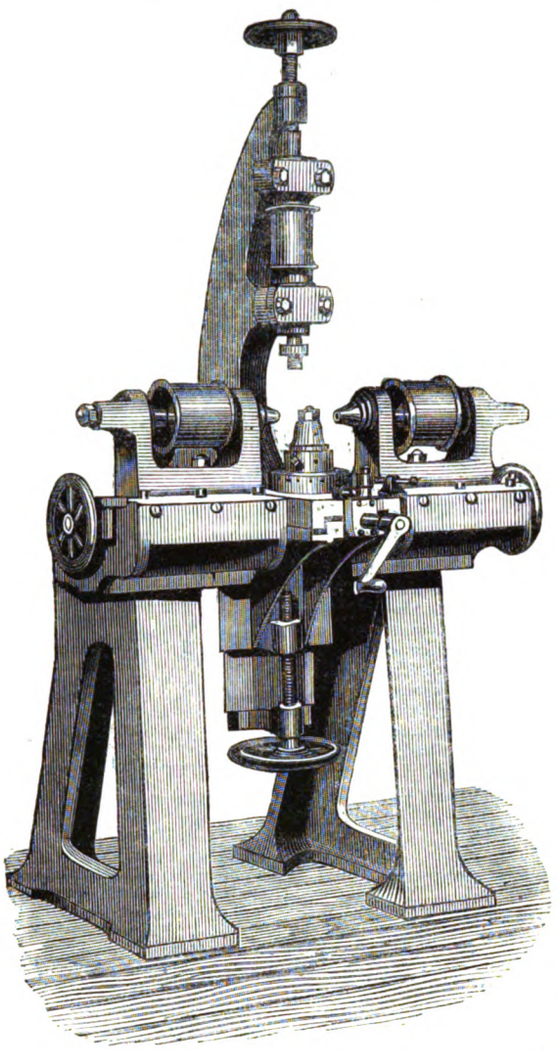
fly-wheel. This disc is enclosed in the extension D of the cylinder, and the form of this extension is such as to correspond to the travel of the connecting rod, E. This arrangement of parts not only dispenses with a piston rod, cross-head &c., but forms a steady-working and compact form of engine, having its crank and connecting rod concealed from view and injury. To close the communication between the forward end of the cylinder B and the head D so as to exclude the steam which would otherwise fill it, and would consequently be exhausted with every stroke of the cylinder, proving a loss, a slide H is fitted in a case, so that a free vertical motion is given to the slide by the motion of the connecting rod. Through a central opening of this slide the connecting rod passes; and to form a steam-tight joint the rod passes through a rocking block I which has a curved form of face to correspond with a similar curvature made in the slide.

By the motion induced by the connecting rod the slide works up and down, and the block works in its seat in an oscillating manner, presenting no impediment to the operation of the rod, and by the combined action of the slide and rocking-block the connecting rod has free passage and play in a sufficient steam-tight manner without the aid of a stuffing box; but inasmuch as the head D forms a steam-tight inclosure, it is by no means necessary that the slide H or the block I be otherwise than a good working fit, and packing may be dispensed with. It will be observed that the steam-tight extension D of the cylinder encloses all the principal working parts, which serves to keep them well lubricated, and prevents the ingress of dust, dirt, or other foreign substances. This makes it especially applicable to the American street cars, and we understand that one is now being introduced into a car in New York. The "American Gaslight Journal," to which paper we are indebted for all particulars, states that this engine was patented in March last year, and is on sale at 42, Day-street, New York, where it appears likely to be in good demand.

THE number of visitors at the South Kensington Museum during the week ending February 8, were:—On Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 10,898; Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,418—total, 12,316. Average of corresponding week in former years, 10,077. Total from the opening of the museum, 7,186,250.

NUT SHAPING MACHINE.

BY MESSRS. KENDALL AND GENT.



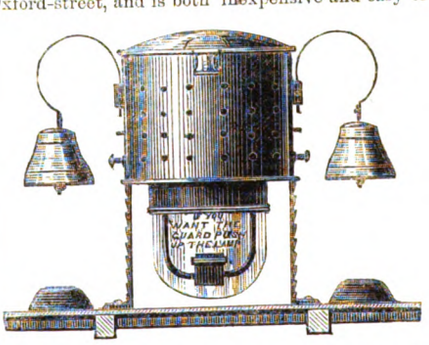
NUT-SHAPING MACHINE.

THE neat little machine illustrated above has been designed for shaping nuts, bolt heads, and other articles having any number of sides. Three varieties of the machine are manufactured—single, double, and treble. That illustrated is a treble machine. The article to be shaped is fixed by a suitable mandril to the sliding table, the position of which is regulated by a hand-wheel and screw. The three cutters are driven by the band-wheels seen to the right and left and at the top of the machine. The heads are severally adjustable, so as to be easily brought to bear and act simultaneously on the object on the mandril. The form of cutter found best to answer the purpose is the flat, or "fly" cutter, modified in various ways as may be necessary. By one run up of the horizontal slide the three faces are finished, the surface left by the cutters being beautifully delicate, the slight ring marks left by the cutters giving a kind of watered surface to the material. The faces are changed for others by turning round the dividing apparatus below the mandril, so that the point of the handle shown may drop into the proper hole in the rim of the indexed dividing wheels; this handle is held in its place by a coiled spring. The various heads of the machine are easily driven, and the machine is usually worked by a youth; the saving in files and workmen's wages over the hand system of finishing is, we understand, great. The use of these machines is rapidly extending, and they have been found especially serviceable to brass workers. We should add that this machine is manufactured by Messrs. Kendall and Gent, of the Victoria Works, Salford.

THE number of visitors at the Patent Office, South Kensington, for the week ending Feb. 8, was 3,923; total number since the opening of the museum free daily (12th May, 1858), 1,243,132.

RAILWAY PASSENGER SIGNAL.

THE growing necessity for a means of communication between the passengers and guards of railway trains, and the probability that Government will shortly take action in the matter, have lately served to stimulate inventors in this direction. A simple apparatus for train signalling has just been brought under our notice, and is shown in the accompaning engraving. It is the invention of Mr. Joseph Offord, of 79, Wells-street, Oxford-street, and is both inexpensive and easy of



application. The ordinary lamp, which already exists in each compartment, is made available with the addition of one or more bells, attached by springs to the protector, as now used with every lamp. By means of two springs and ratchets the lamp rises by anyone gently pushing at the bottom of the glass, and the bells leave the small blocks on which they rest, and ring rapidly until the train is stopped, or the lamp lowered, which can only be done from the roof. The signal needs no attention and is always ready for action, and it cannot be tampered with, without its being discovered who has done so. The spot where atten-

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tion is required is at once seen, either day or night, without additional lights, and unimpeded by curves or lights from the windows. Among other advantages, this signal would be plainly seen at all the stations, and it cannot be prevented from acting. Small engravings, showing its action, could be posted in each carriage. But it is so simple that it cannot get out of order, and anyone can understand it, and it is of universal application. If a guard were in the next carriage to the engine, and always on the lookout, from a raised glass compartment, in any case of danger he would at once see and could act simultaneously with the driver, and no doubt prevent many serious and costly accidents.

THE PATENT CONCRETE STONE IN AUSTRALIA.

ONLY a few months since we drew the attention of our readers to the circumstance that the manufacture of concrete stone, under Mr. Ransome's patent, was being introduced into India. It is with much pleasure we observe, by the Australian papers, that it is now being carried out in Melbourne. A company has been formed for the purpose of producing this material, which is made in the same way as here in England. The process of manufacture is well known to our readers, so that we need only observe that sand and silicate of soda are mixed together, moulded, and afterwards hardened by immersion in a solution of chloride of calcium. A number of the leading architects of Melbourne recently met at the offices of the company in that city, and witnessed the manufacture of the patent stone, and inspected a number of specimens. The results of the experiments were most satisfactory, and showed the perfect adaptability of the stone for building purposes. We are glad to observe the gradual extension of this important manufacture, which is based upon sound scientific principles, and we congratulate Mr. Ransome upon the success which is now resulting from the years of patient labour he has bestowed upon the subject.

THE GOURAMI FISH.

WE call the attention of ourreadors and the public to the offer, by Mr. Henry Lee, F.L.S., of a prize or reward of £20 to the person who shall first take to him, at the office of "Land and Water," four or more living specimens, male and female, of the Mauritius fish Gourami. The Gourami is so highly esteemed as an article of food that its flavour is by some thought even more delicious than that of the salmon or turbot, and it would, without doubt, be a great and useful addition to the food-fish of Great Britain. Even before the year 1830 various attempts were made to introduce it to foreign countries. Some of these were successful, others the contrary; but there is every reason to believe that, by careful attention during transit, the Gourami may, without any great difficulty, be safely brought to England. It is very hardy, and will live for a long time in rather impure water. It is thought that specimens of this fish, about four inches long, are those most likely to bear the voyage well. Dr. Meller, director of the Royal Botanical Gardens, Mauritius, has kindly promised to supply as many as he may think desirable to anyone who will seriously undertake the care of them. We sincerely hope that Mr. Lee's liberal offer may be responded to, and that it may lead to the acclimatization in our waters of a very valuable fish. If our expectations are verified, before this time next year our readers may be able to study the habits of the Gourami in one of Mr. Buckland's tanks at the Horticultural Gardens.

Correspondence.

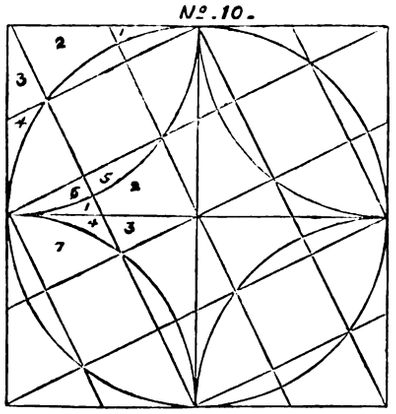
THE SQUARE OF THE CIRCLE, AND THE GREAT PYRAMID OF GIZEH.

LETTER X.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Your correspondents "A. W." and P. H. Van der Weyde, M.D., whose letters appear in your issue of January 31, have in their attitude so completely assumed the well-known weak position in law, "No case, abuse the plaintiff's attorney," that it is almost a work of supererogation to slay them with the weapons which they have placed in my hands. It may be necessary to say that the method adopted by both of them is that process of estimating the length of a circle by polygons interior to and exterior of it. The method is not theirs but was originated by honest old Archimedes, of Syracuse, who never claimed for his rule anything more than an approximation to the length of a circle, nor did he employ the endless decimal method, which is the egregious folly and passion of the present day, and which has been so well handled by your correspondent Mr. Joseph A. Nicholson in his letter No. III., in your issue of January 31. The approximation of Archimedes was diameter 7, circumference 22. My ratio, a ratio founded on the most powerfully complete geometric demonstration (see diagrams in Letter III., of October 18, 1867), that the area of any circle is 4-5ths of its tangent square, its diameter 5, circumference 16. It has been already allowed by nearly all my geometrical friends that the proofs I have adduced in your pages of these values are, if possible, a more indisputably exact quadrature of the whole circle than the quadrature by Hippocrates, of Chios, of his famous lines which I gave in my letter No. VIII. He grasps a portion of the interior of a semicircle having for its diameter the hypotenuse of a right-angled triangle to gauge by it the lines of two semicircles on the two sides of the right angle of the triangle. I, on the contrary, go outside of

No. 10.



and grasp the whole circle upon the hypotenuse of a right-angled triangle, and compare it with the squares on the two sides of the right angle of the triangle which are relatively to one another in the only proportion of which the circle acting upon itself in its square disposition admits (see diagram 6, Letter III.) I am thus, by the unanswerable proposition 47, Book 1 of Euclid, enabled to weigh all these areas relatively to one another in a scale finer even than the hydrostatic balance of Archimedes.

"A. W.," presuming very improperly that I admit approximative mathematical decimal tables to record exact truth, proceeds to found calculations of his own upon them, from which he elicits the following very remarkable result, which, with consummate coolness, he proceeds to put in my mouth, as thus:—"Of course, all the circumscribed polygons of more than fourteen sides have, according to Mr. Harvey, smaller areas than their circles, which is a clear demonstration of the incorrectness of Mr. Harvey's formula." Now, I am not responsible for the improper use here by "A. W." of my name to father his own acts. But I would ask your readers to ascertain for themselves the value of that method, or of the calculations founded on it, which can bring a circumscribed polygon of any number of sides within the circle which it circumscribes.

P. H. Van der Weyde, after misquoting the figures of Mr. James Smith, of Liverpool, and the discussion between him, Professor A. de Morgan, and Sir Rowan Hamilton, from the London "Athenæum," proceeds:—"Mr. Harvey goes further than any of them; the circumference of his circle being 3 and 1-5th diameters, lays outside the circumscribed polygon of sixteen sides." To which of these infallible dogmatists of a so-called infallible decimal theory, which has the extraordinary property of making straight lines tangential of and drawn outside of a circle come within that circle, are we to award the palm of immortality, he of fourteen sides or he of sixteen? Truly, the end is worse than the beginning. If the words "absurd," &c., are to be used, to whom, pray, shall we apply them? I leave the judgment with your readers.

As the truth of my theorem on the square of the circle, explained in your pages in these ten letters, is already so generally admitted as to render its adoption an acknowledged scientific fact merely a work of time, I will terminate with this letter both my lucubrations on it and on the Great Pyramid, because I judge from the letter of Mr. Thomas C. Haines, in your issue of January 31, that these last have not sufficient interest for your readers. In deference, however, to his request that I should do so, I produce diagram No. 10 as self-explanatory evidence of the method by which the 4 spandrils E and the square F G H I (see diagram 7 in my letter No. III., in your issue of October 18, 1867), can be shown to be together equal to two squares of the value of F G H I, and therefore of course equal to one another. The arithmetical digits 1 2 3 4 point out the divisions of one spandril exterior of the circle and brought together within the circle so as to form with a quarter of the central square 5 6 7 one quarter of two whole squares equal to the central square F G H I. I fancy this demonstration (one of many) will reach the apprehension of your readers who have previously believed that in my former demonstrations I assumed that which was indemonstrable. If they had studied Aristotle's "Organon," Book 1, cap. 9, they would not have hesitated to admit the force of my reasoning from quantities common to two descriptions of genus. Aristotle uses it expressly to explain the quadrature of the circle, which he states had been made by Bryso, whose works and whose demonstration of his discovery have not reached our times.

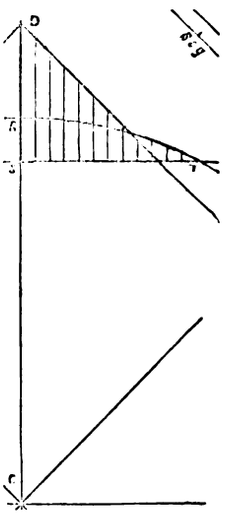
With many thanks for your courtesy in giving place to these geometrical diversions of mine.—I am, Sir, yours, &c., WILLIAM HARVEY.

London, February 7.

LETTER IV.

SIR,—The geometrical proposition which I presented in Letter II., on the 17th ult., had for its object to prove the area of the circle from the given circumference. The object of the present letter is a geometrical proof of the circumference from the given area, and though the proof I have to offer is not so geometrically pure as the previous one, it will, I hope, be exact, and a starting point from which to get at the circumference by working the previous problem backwards.

In my first letter it was shown that the area of parallels depended on the length of line, however placed, the combined length being the measure of the area, though the line might be all on one side and only a point on the other. It is on this principle that I propose to test a square and a circle's equality. Mr. Hayden has justly remarked that an equal circle and square drawn from the same centre will cut off each from each, an equal portion in the form of corner and segment, for the remainder being common of course the whole must be equal. With this view I have placed, for convenience of proof, a segment beneath a corner, divided both by the



same parallel lines, and measured the total length contained in each division separately, and adopted the division at the point where they were equal.

As a proof of the sensitiveness of this arrangement (the true division is a fine space between two nearly touching lines) I have carefully, by lens and screw compass, measured each, and the space between them. The outer line gives a preponderance of segment over corner of 1¼in., the inner line of over 6-8ths in favour of corner over segment, and the space between them a fraction of about 1-24in. to corner, due to curve. Only one-half of the corner and segment is shown in the diagram, but in my measurements I have taken them complete

Let S C be the half diameter of a square.
D C „ half diagonal of ditto.
R C „ the radius of the circle.
D „ the half corner.
and R S T „ the half segment (transposed).

Then the half diagonal D C divided into eleven parts, and one of those parts R S added to S C, the half square will give the radius R C, and the inside edge of that circular line will be the true equivalent to the square. Now, let us refer to my former proposition (January 17), and consider this circle and square as there represented by *o* and *s s s s*; by working that problem backwards we shall arrive at the half circumference of the circle A P, which will be the circumference sought, and establish the rule that the diagonal of a square divided into eleven parts, and one of those parts added to the diameter of the square, will give the diameter of the corresponding circle; on which basis digital calculations may be made, but which I do not intend at present

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to follow. I may here add a corrective to the arbitrary rule given by Mr. W. Hayden for finding the circumference. Mr. H.'s rule is three diameters, and the versed sine or depth of the segment of a fourth of the circle—too little; but three diameters and twice the depth of the segment of which the radius is the chord is too much. The difference between the two, however, is a very close approximation to absolute truth, if not completely so. I am obliged to Mr. Thomas Scutt for the notice he has taken in your last number but one of my previous proposition, and he will excuse me for saying that if he admits it to be correctly "parallelogramized," he admits it to be squared, as there is certainly no difficulty in getting from one to the other, and which was done in the same problem by the XIII. prop. of the VI. Book of Euclid, which gives "the mean proportional line" or square. He says the proportions have been known long ago, which I take his word for, though I never met with them in that form, but I expect every proportion and property of a square and circle is known and has been long ago, but what was wanting was a proof—a clear turning by indisputable geometrical reasoning of a circle into a straight-lined figure, whether triangle, parallelogram, polygon, or what not. This my problem has done, and it was unknown to Euclid; but if I have already been anticipated I shall feel obliged to Mr. Scutt, or any other correspondent, dispelling the illusion of discovery by referring me to any accessible publication where it may be verified. Before closing, I for one beg to protest against the letter of the ex-professor Van der Weyde, who appears to think it sacrilege for any but professors to approach an intricate subjects (often made so by excess of science), and illogically condemns not only Mr. Harvey for being wrong but your other correspondents for putting him right. Mr. Harvey's letters are very interesting, although he still adheres to certain errors (but the world learns as much by errors as truths), and out of them may yet perhaps arise a subject far more practically important than the squaring of the circle, namely, the annotation of our numerals. By the present arrangement of decimals, $\frac{1}{3}$ $\frac{1}{6}$ $\frac{1}{7}$ and $\frac{1}{9}$ and their compounds run off at once into interminable figures; $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{5}$ and $\frac{1}{8}$ are manageable and become finite, but mixed they commence a desperate struggle, like the 35 absurd decimals of Ludolf Van Ceuber.—I am, Sir, yours, &c.,

February 9. JOSEPH A. NICHOLSON.

SIR,—In reply to Mr. Harvey I beg briefly to observe that the "Nautical Almanack," not the "Nautical Magazine," is accepted by naval officers as the production of men of the greatest mathematical attainments. It is accepted, also, under a conviction that the relative positions of the celestial bodies are determined by Kepler's laws of planetary motions; in the computations of which the value of trigonometrical lines are based upon the long accepted ratio of the circle to its diameter.—I am, Sir, yours, &c.,

COMMANDER, R.N.

Pembroke, February 8.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—F. W. P.—H. D. R.—S. S.—W. R.—T. C.—J. H.—A. C.—T. A. W.—W. H.—G. E. P.—T. M.—J. B. T.—J. N.—R. J.—J. N.—E. B. M.—G. W. H.—Messrs. G. K. and Co.—W. H. H.—K. M.—C. E.—J. A. N.—J. T. D.—Messrs. C. M. and Co.—T. A. W.—T. C.—J. B.—F. R. S.—G. H.—M. T. P.—R. B.—C. D. F.—J. R.

Meetings for the Week.

MON.—Royal Institute of British Architects.—George Grove, Esq., on "The Exploration of Jerusalem and the Holy Land," at 8 p.m.

Society of Engineers.—Dr. Cullen on "The Panama Railroad," and on "The Darien Ship Canal," at 7.30 p.m.

TUES.—Royal Institution.—Professor Tyndall on "The Discoveries of Faraday," at 3 p.m.

The Institution of Civil Engineers.—Mr. W. J. M'Alpine, on "The Supporting Power of Piles, and on the Pneumatic Process of Driving Iron Columns, as Practised in America," at 8 p.m.

THURS.—Royal Institution.—Professor Tyndall on "The Discoveries of Faraday," at 3 p.m.

FRI. — Royal Institution. — Rev. M. W. Mayow, on "Macbeth and Hamlet as the Greatest Works of Shakespeare," at 8 p.m.

SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

Naval, Military, and Gunnery Items.

CAPTAIN FREDERICK SIDNEY BOULTON has been elected surveyor of Lloyd's Salvage Association for the port of London, rendered vacant by the death of Captain F. J. Steward.

MR. W. SCAMP, C.E., the late deputy-director of engineering and architectural works to the Admiralty, who has retired with a full-pay superannuation, after a lengthened period of service, transacted his last official business at Somerset House on Wednesday week.

MESSRS. NAPIER AND SONS, of the Clyde, are building for the Dutch Government a steam ram of about 3,000 tons and a turret ship of 2,000 tons. They are intended to be fitted with Skinner's steering apparatus, similar to that successfully tested by her Majesty's ships "Industry" and "Supply," by which one man alone can steer in the most boisterous weather with ease, and free from danger.

THE Belgian Minister of Public Works has concluded a contract with Messrs. Tait and Co., of London, for the establishment of a monthly service of steamers between Antwerp and Rio de Janeiro, Monte Video, and Buenos Ayres, with permission to stop at Lisbon, St. Vincent, Pernambuco, and Bahia. The passage from Ostend to Rio is expected to be effected in twenty-four days, and the first departure from Ostend is to be made on the 16th of March.

THE "Bankers' Gazette" of St. Petersburg announces that in the great arms factory of Toula great activity prevails at this moment. The establisbment has already prepared 15,000 needle-guns, and hopes are entertained that 100,000 will be furnished before the end of the year. These muskets appear to leave nothing to be desired; a soldier can fire seventeen shots a minute if the cartridges are placed on a table beside him, and nine when he has to take them from his cartouche-box.

THE Board of Trade having been requested to state what they deem to be a square-rigged vessel, have given notice to superintendents of mercantile marine offices, and to examiners of candidates for masters' and mates' certificates of competency, that they are advised that full-rigged ships, barques, brigs, and brigantines should be treated and referred to as square-rigged vessels, and that other ships, such as topsail schooners, fore and aft schooners, cutters, sloops, &c., should be treated and referred to as fore and aft rigged vessels.

THE latest advices from Abyssinia state that the lighting of the coast is now complete. The wells, on the American principle, yield a good supply of water, and troops are being rapidly pushed forward into the interior. The native followers are being sent back to India, which must be looked on as favourable, considering that many of these men have done little but eat their dinners since their arrival.

IMPROVEMENTS and alterations in the bakery of the Commissariat Department at Aldershot, now being made, consequent on the introduction of steam for bread-making, necessitated the removal of a chimney shaft 75ft. in height, and which for several years had been in an unsafe condition. The removal of the shaft has just been safely effected under the superintendence of Colonel Laffan, commanding Royal Engineer. A few bricks being taken out, 18oz. of powder in one ounce packets were placed in the spaces, and being fired, the shaft toppled over in beautiful style, and in the direction intended.

THE new T-pier about to be erected in Woolwich Arsenal is ordered to be commenced without further delay. It is intended to facilitate the shipment of the heavy ordnance, and will be fitted with cranes capable of hoisting 30 tons weight. The pier, with its T-platform, will extend 300ft. towards the bed of the Thames, from the wharf fronting the Royal gun factories, and will be 25ft. broad, so as to contain three lines of tramway. The head of the pier will be 100ft. in length, constructed so as to admit of its being lengthened, should an increased demand for shipping space arise. The principal portions of the pier are to be of iron, the cost of which has been estimated at upwards of £20,000. It will be built by contract, under the supervision of the works department of the Royal Engineers.

As speed is really the primary consideration with enarmoured vessels, the subjoined table will show xactly what has been accomplished by the "Danae" in this respect, the first and second trials having been made with the regular trial steam coal, and the third trial with the ordinary quality of coal as supplied for sea service. All were full boiler power trials:—

	Dec. 19, 1867.	Jan. 23, 1868.	Jan. 24· 1868.
Mean speed of the ship, knots	13·172	12·872	12·588
Mean revolutions of engines	94·75	91·96	88·62
Indicated horse power	2088·35	1917·6	1715·29
Steam pressure on piston	26·554	19·448	18·053
Vacuum, mean	26·416	26·08	25·96
Mean draught of water	15ft. 1in. stern, 35in.	15ft. 4in. stern, 22in.	15ft. 3in. stern, 24in.
Trim of ship			

FROM the Clyde it is reported that Messrs. Scott and Co., of Greenock, have contracted with Messrs. Monies, Munro, and Co., to build for them a screw steamer of about 500 tons. The Glasgow and Londonderry Steampacket Company has purchased the paddle steamer "Bridgewater" from the Dublin and Liverpool Steam Navigation Company. The "Bridgewater" was built by Messrs. Caird and Co., Greenock, for Messrs. Burns' Glasgow and Belfast line of steamers; but she afterwards became a blockade runner under the name of the "Old Dominion." On the conclusion of the American war she was purchased by the Dublin and Liverpool Company, and now she has once more changed owners.

Miscellanea.

IN 1865 1,200,000 postage stamps got loose from letters and newspapers in the post offices, and 760,000 in 1866.

MR. HUDSON, of Castleacre, has resigned his seat at the Council of the Royal Agricultural Society, in consequence of his somewhat advanced age. Mr. Hudson is well known as an agriculturist throughout Great Britain.

ABOUT 700,000,000 letters now pass through the post offices in Great Britain and Ireland in the course of a year, and nearly 5,000,000 telegrams pass through the telegraph stations in the United Kingdom during the same period.

THE iron framework of the Universal Exhibition Palace of the Champ de Mars was sold by auction last Saturday for £60,000 to a society of contractors and builders—on which the "Figaro" remarks that the Exhibition has taken more time to disappear than to construct.

IT is computed that the cost of distilling water at Annesley Bay is 2s. a gallon, and the daily needs of the men and animals collected there average 40,000 gallons a day. Therefore, the water supply alone of that station is costing the British taxpayers at the rate of £1,520,000 a year. The "Pall Mall Gazette" calls these the waters of affliction.

IT appears, by the gold-mining records of the colony of Victoria, that twelve selected mines, with an aggregate paid-up capital of £145,382, have paid as profits, in the short period of from seven months to five years, no less a sum than £1,878,907. The history of mining has never before shown such extraordinary results.

AT a recent meeting of the Senatus Academicus of the University of St. Andrew's the degree of Doctor of Laws was conferred on the Rev. Patrick Bell, minister of Carnylie, the inventor of the reaping machine; and also on the Rev. Charles Clouston, minister at Sandwick, author of several works on meteorological science.

BEER has been successfully brewed at Shanghai. This and the arrival of the Celestial Embassy to Europe at the above port show how rapidly China is becoming civilized in the high sense in which we understand the term.

GREAT interest has been manifested in the colony of Melbourne on the subject of preserving superfluous meat, so as to make it an acceptable article in the English market. The problem to be solved is to get good beef and mutton, which at Melbourne are worth only 1½d. per lb., to the millions of English mouths which can get no beef at all. Two modes of preserving the meat have been tried—one in Sydney, and the other in Melbourne—both of which are said to have succeeded.

SIGNOR FUMAGALLI, in some sketches he is publishing in the "Annali di Medicina" of the careers of some distinguished surgeons, mentions, as a very remarkable coincidence, that the two founders of modern Italian surgery, Palletta and Scarpa, were both of humble birth; both remained unmarried, and, becoming very rich, continued to live a life of parsimony; lastly, having become well-nigh blind, in consequence of poring over books, both terminated their famous careers in the same year at the advanced age of eighty-four.

AMONG the numerous tributes paid to the genius and labours of Sir Charles Wheatstone, the Italian Scientific Association of the Forty lately forwarded to him, through the British Legation in Florence, its annual gold medal for the greatest discoveries in physical science, a medal founded by its president,

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Professor Matteucci, and which the society unanimously adjudged to Sir Charles in acknowledgmen of his celebrated and invaluable contributions to the science of electricity.

AT the last meeting of the Society of Engineers, Baldwin Latham, Esq., president, in the chair, twelve candidates for election were balloted for and duly elected. As members:—Messrs. John Rowan, Aylesbury; Hugh McIntosh, Lambeth; William R. Lacey, Wandsworth; Charles Lendey, Royal Small Arms Factory, Enfield; Edward Sacré, Parliament-street; J. Edwin Phillips, Spittlegate Iron Works, Grantham; Christopher Brakell, North Moor Foundry, Oldham. As foreign members: —Lieutenant Constantine Astapoff, Railway Department, St Petersburg. As associates:—Messrs. John C. Mewburn, 166, Fleet-street, and Johnson Vivian Jeffrie, Crossness.

THE village of Carpino, in the Neapolitan province, has been visited by a calamity. A late number of the "Italian" reports that enormous masses of earth and stones, loosened by the melting of the snow, became detached from the mountain, at the foot of which the village stands, and came down like an avalanche, completely burying the parish church, the priest's residence, and two houses adjoining. The inmates, warned of the danger in time, escaped half clad; but, although no lives were lost, these poor people have been reduced to destitution.

THE farmers in Devonshire are complaining of the increase of the ringdove or wood pigeon. These birds visit that country now in large flocks. They feed on beech nuts, acorns, turnip and swede greens, young clovers, cabbage plants, tares, peas, &c. When feeding they have scouts who give notice of danger. They breed often during the year. They commence cooing in March. Many of their early-laid eggs are devoured by jays. They build their nests carelessly, and their young often fall out of them.

ON Thursday week the annual ploughing match of the Bywell Society took place at Nafferton, Northumberland. Upwards of sixty ploughmen competed for the prizes, and as the soil in that neighbourhood is a rich stiff clay, an opportunity was afforded of showing the very highest class of work under the most favourable circumstances. The finest ploughing was of the champion class, in which all the prizes, including a five guinea lever watch, were won with Messrs. Ransome's ploughs. In the boys' class some excellent work was done by the fifteen competitors, considering that they were restricted to the use of 3ft. mould boards, and here again the first prize, a silver watch, was won with one of the same implements.

ON the 16th of October last there was a gale off Labrador, which destroyed 80 vessels, and numerous lives; on the 29th, there was a hurricane at St. Thomas, which destroyed nearly 100 vessels, and nearly 1,000 lives; on the 30th, there was a hurricane at St. Domingo; on the 1st of November, there was one at Hong Kong; on the 2nd, there was one at Calcutta, during which the loss of life and property was very great; on the 3rd, the eruption of Vesuvius commenced; on the 8th, there was a tornado at Matamoras, which did damage to the amount of a million sterling; on the 20th, there was a volcanic eruption in Nicaragua; and on the 20th, there was an earthquake felt at New York, Vermont, and Canada.

MR. GLAISHER reports that the mean temperature of the air in the three winter months ending February, 1867, registered at the Royal Observatory, Greenwich, was 40·6deg., being 1·4 above the average of the preceding 26 years; in the three spring months ending May, 46·7deg., being 0·4 below the average; in the three summer months, ending August, 59·8deg., being 0·8 below the average; in the three autumn months, ending November, 49·2deg., being 1·3 lower than the average; in December, 1867, 37·5deg., being 1·6 lower than the average of 96 years. The highest temperature registered in 1867 in the 56 stations from which Mr. Glaisher has returns was 91·2deg. at Royston, Herts, in August; the lowest was 0·0, at Lampeter, Cardiganshire, and also at Norton-in-Hales, Shropshire, in January, 1867.

A SPEEDY and mighty change in the character of the great Niagara Falls is looked for. It has long been known that beneath the hard limestone shelf over which the vast body of water passes there is a soft stratum of shale. The slow wearing away of the limestone gave a long lease of existence to the falls, but the lease is now threatened with a sudden termination by the certain indications in the currents about 800 yards above the Canadian falls, which, show that the water has got at the sublying shale and is rapidly eating it away. It has even been ascertained that a subterranean stream of water is now pouring into the gulf below the falls, and everything goes to prove that the great limestone shelf known as the "Horseshoe" will soon be completely undermined and destroyed. Two effects are anticipated from this—the conversion of the falls into a rapid thereby rendering the "shooting of Niagara" practicable, and, secondly, the diverting of the entire body of water to the Canadian side, the United States being thus robbed of their share of the mighty cataract by the Britishers.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—1955
BUILDINGS AND BUILDING MATERIALS—1922, 1953, 1990
CHEMISTRY AND PHOTOGRAPHY—1950, 1994
CULTIVATION OF THE SOIL, including agricultural implements and machines—1952, 1991, 1995, 1996, 1997, 2002
ELECTRICAL APPARATUS—None
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—1923, 1925, 1932, 1933, 1975, 1998
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1954, 1957, 1964, 1970
GENERAL MACHINERY—1920, 1921, 1927, 1928, 1935, 1937, 1944, 1946, 1948, 1956, 1968, 1973, 1982, 1992
LIGHTING, HEATING, AND VENTILATING—1931, 1938, 1967, 1986, 2004
METALS, including apparatus for their manufacture—1939, 1980
MISCELLANEOUS—1929, 1930, 1942, 1945, 1947, 1949, 1951, 1960, 1969, 1972, 1977, 1978, 1983, 1985, 1987, 1988, 1989, 2006
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1959, 1976, 1979, 1981
SHIPS AND BOATS, including their fittings—1924, 1943, 1958, 1961, 1963, 1993
STEAM ENGINES—1936, 1940, 1941, 1966, 1974, 1984, 1999, 2000, 2001, 2003
WARFARE—1926, 1934, 1962, 1971

1920 J. R. BURN. *Improvements in presses for cutting paper.* Dated July 2, 1867.

One part of this invention has for its object to do away with the necessity of screwing down the pressing bar of paper cutting presses by hand every time before cutting, by causing the machine to effect this automatically. The inventor attaches the pressing bar to a screw spindle which passes through a tapped boss on a strong lever, the fulcrum of which is supported by the framing, while the end of the lever is connected to a rod which is so actuated by a cam driven by the machine, that the lever, and consequently the pressing bar, is depressed whenever required to nip the paper, and then raised to release the paper. Another part of the invention consists in arranging the gauge against which the paper is set before cutting to turn back on a hinge, so as to allow of the paper being removed from behind the machine after having been cut.—Patent abandoned.

1921 W. DUCK. *Improvements in stoppering bottles, and in the apparatus to be employed therein.* Dated July 2, 1867.

This invention relates to stoppering bottles, whether of glass or metal, or both combined, by means of a glass or porcelain cup or cover, having a female screw therein, which is turned on the male thread on the neck of the bottle to be stoppered.—Patent completed.

1922 W. STEVEN and A. ROBERTSON. *Improvements in brick-making machines.* Dated July 2, 1867.

This invention relates to machines of the kind described in a former patent, dated March 22, 1841 (No. 8897), and one of these improvements consists in dispensing with certain pistons or plungers employed in the machines constructed according to that invention. A cover of metal or wood is placed over each pug mill outlet, and is shaped so as to lead or guide the issuing clay down into the moulds or mould openings in the sliding frame. A second improvement consists in actuating the remaining pistons or plungers by means of weights in combination with levers, which levers have their movements regulated by cams shaped with depressions to allow of the descent of the weights at the proper times, and the inclined sides of which depressions re-elevate them by a positive action. A third improvement consists in introducing a yielding appliance in the driving arrangement, so that when from obstructions in the machine the resistance becomes injuriously increased, the parts will slip, and thereby save the gearing.—Patent abandoned.

1923 J. GREENHALGH. *Improvements in machinery or apparatus for opening and cleaning cotton or other fibrous materials.* Dated July 2, 1867.

This invention relates to machines for opening and cleaning cotton and other fibrous materials known as "willows." The first improvement relates to a new mode of supplying the cotton or other material to the machine. The second consists in apparatus for delivering the cotton or other material (after it is cleaned and opened) from the machine. The third consists in the application of a slide to close the aperture leading to the dust fan.—Patent abandoned.

1924 G. A. F. FOWKE. *Improvements in compositions for preventing the fouling of the bottoms of ships, floating docks, and other similar structures, and in the mode or means of applying the said compositions.* Dated July 2, 1867.

Here the patentee takes the following ingredients, in certain proportions, namely, pitch, resin, plumbago, tallow, and cement. He melts the ingredients. He next prepares a composition of the same ingredients (with the exception of the tallow), and uses it as a second coating over and above the first. He now takes sulphur, plumbago, and cement, in certain proportions, and melts them. He runs this composition into moulds to form plates, rolling it during the process for rendering the plates of sufficient density, and forcing it into the moulds. He makes the edges of these plates bevelled, and coats them with a dressing of both or either of the compositions first described. The composition already spread upon the ship being warmed, and that upon the plates being also warmed, the plates are pressed on to their places on the surface to be coated where they adhere, and the interstices between the plates are filled up at the bevelled edges with the composition last referred to, in a soft state. This he presses in with hot irons, making a perfect joint, and forming one homogeneous surface.—Patent completed.

1925 T. and J. WOOD. *Improvements in machinery for printing hanks of yarns or threads with one or more colours.* Dated July 2, 1867.

The patentee arranges the ribs on the distributing rollers to correspond by means of toothed wheels with certain ribs on the printing rollers for printing one or several colours on hanks of yarns or threads, all as described and illustrated in the drawings.—Patent completed.

1926 A. M. CLARK. *Improvements in breech-loading ordnance.* (A communication.) Dated July 2, 1867.

This invention is not described apart from the drawings —Patent abandoned.

1927 J. STURGEON. *Improvements in machinery employed in getting coal, stone, and other minerals, and in apparatus connected therewith.* Dated July 2, 1867.

The chief object of this invention is to produce a machine capable of performing the principal operations required in tunnelling or making a drift, long wall, cutting or pillar, and stall cutting, or to work at an irregular face of coal of any length. The patentee employs a cutter or cutters actuated by an engine worked by compressed air, which is so arranged that the cutter may have an independent forward motion imparted to it for a certain length without shifting the whole machine bodily from its original situation during the process of cutting.—Patent completed.

1928 A. SCHWARTZ. *Improvements in lubricators for lubricating rotating shafts and other moving surfaces.* Dated July 2, 1867.

Here an oil vessel is employed, which is made of glass, and is of a bottle-like form. Into the mouth of it there is fitted a stopper through which a pipe passes, the interior of which is filled with a group of minute tubes. The inner end of the pipe is covered with a cap, in the centre of which is a small hole. When the apparatus is in use it is inverted and the pipe inserted in a hole bored for it in the bearing, so that it and the small tubes within it rest upon the shaft or surface to be lubricated. In this apparatus the oil does not flow out when it is inverted in consequence of the small diameter of the tubes, and because there is no free admission of air to the upper part of the oil reservoir, but the shaft or moving surface being in contact with the tubes draws the oil from them.—Patent abandoned.

1929 T. YOUNG. *Improvements in buttons or fastenings for dress.* Dated July 2, 1867.

The inventor forms the button in two parts, one of which forms the back and the other the front of the button; the back portion is made like an ordinary suspender or brace button, with three or more holes formed through it, so that it may be attached to a garment by sewing. Through the centre of the back part of the button is another hole in which is cut a screw thread. The front of the button carries at its back a projecting pin or shank with a male screw which can be screwed into the central hole in the back portion of the button which is sewn on to the garment. Thus, when the garment is not being worn, the face of each button upon it may be removed and may be screwed on to other back pieces either loose or sewn on to other garments.—Patent abandoned..

1930 G. GORDON. *Improved means of, and apparatus for, washing and drying moist substances, or drying and burning granular substances, or evaporating liquid substances, and for economizing the waste heat produced in such processes.* Dated July 2, 1867.

The patentee claims the utilization of the waste and unintentionally made steam given off in drying moist and evaporating liquid, solid, or aeriform matters, for saving the heat of such steam. He also claims the washing, drying, or burning of granular substances (as exemplified in the specification in the instance of animal charcoal), and the utilization of the waste steam and heat given off in the processes so described, except so far as the same are repetitions of processes embodied in a patent granted to him in the year 1866 (No. 2571).—Patent completed.

1931 J. SOMERVILLE and R. ELSDON. *Improvements in the treatment of apparatus employed in the manufacture and materials used in the purification of gas.* Dated July 3, 1867.

The patentees claim the use of chalk limestone, or foul gas lime, for removing carbon without injury to the retort, and the obtainment of a useful product thereby, substantially as described.—Patent completed.

1932 J. ELCE and P. WILLIAMS. *Improvements in machinery for spinning and doubling.* Dated July 3, 1867.

The patentees claim, first, the giving a positive traversing motion in either direction, and at any speed, to the endless band supporting or acting on the bobbins of throstle, spinning, and doubling frames, for varying the drag in accordance with the diameter of the bobbin, and the combs of yarn to be spun or doubled; and, secondly, the giving a positive traversing motion to the rod to which the ends of the weighted cords are attached for varying the drag according to the increasing diameter of the bobbin.—Patent completed.

1933 W. R. LAKE. *Improvements in machinery for manufacturing cordage, webbing, and other like articles.* (A communication.) Dated July 3, 1867.

This invention relates to a previous patent, dated May 8, 1866 (No. 1318). To obviate delay and inconvenience, and to reduce the strain on the strands, the inventor employs a hook of peculiar form, around which is loosely fitted a hollow cup or sleeve. The latter is pressed up against its head by a spring, the tension of which is regulated by a screw nut, the strand being conducted from the spool, reel, or bobbin over the edge of the cup down under the hook, and thence up over the opposite edge to the required point. By this construction, when the strand becomes knotted, the edge of the cup against which the strand is drawn is tipped or rocked down to afford room for its entrance between the cup and hook, after which the knot is drawn up between the opposite side of the hook and the edge of the cup, which then yields or rocks downwards, as above described. Second, the invention consists in pivoting to the spindle or latch, which may be adjusted in a line with the spindle, so as to form a continuation of the same, and allow the spool or bobbin to be slipped thereon, and then

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adjusted into its normal position at right angles, or nearly so, to the spindle, thus securely confining the spool or bobbin in place on the latter.—Patent completed.

1934 F. R. AIKMAN. *Improvements in firearms and ordnance for the purpose of instructing soldiers, volunteers, and others, with a short range only, to fire with precision over long ranges, and for obtaining a correct register of each shot.* Dated July 3, 1867.

The patentee claims the arrangement of an outer sectional cylinder and inner barrel, and mode of adjusting the same, as described, for practising long-range firing over a short range only, the outer or false barrel or sectional cylinder used for sighting only being raised or elevated as required, while the inner barrel is proportionately depressed and kept point blank to the target, which target the bullet will strike if the sighting and aiming of the outer or false barrel or cylinder for the long range be correct. He also claims the application of the principle, as described, to ordnance and heavy guns.—Patent completed.

1935 J. M'KIBBIN. *Improvements in appliances for filling into and drawing liquids from casks and other vessels, and for excluding the air from such vessels when empty.* Dated July 3, 1867.

The patentee claims, first, a ring or bushing arranged with an inner rim or flange, and fastened in the manner and for the purposes described. Second, a plug or bung arranged with a perforation and adjusted to a ring or bushing so as to admit the air at pleasure into a vessel, in the manner and for the purposes described. Third, a plug arranged with perforations, a screw thread, and slots adjusted to a fixed coupling ring or bushing, and moved by a tap arranged with a shoulder or screw thread, and spuds or tongues, in the manner and for the purposes described.—Patent completed.

1936 H. and D. DAVY. *Improvements in centrifugal governors, and means of governing steam and other engines.* Dated July 3, 1867.

The patentee claims, first, the application of a curved horn (or horns) from which the pendulums of centrifugal governors may be suspended, as described. Second, constructing the pendulum arms of steel (by preference), as described. Third, constructing the forked or other arms on or between which the pendulums move of a curved form, as described. Fourth, arranging the pendulums so as to obtain the relative positions described. Fifth, the arrangement of quadrant, lever, and catches applied for operating the spindles of throttle valves, as described.—Patent completed.

1937 W. GALLOWAY and G. PLANT. *Improvements in the manufacture of welded tubes, and in apparatus employed for that purpose, which latter are partly applicable to other purposes.* Dated July 3, 1867.

The patentees claim, first, welding conical or tapering tubes by first placing the skelp upon a tapering mandril of a form corresponding with that of the interior of the tube when finished, and then passing the same through a rolling mill, the rolls of which have grooves of a tapering form, and of a circumferential length equal to or greater than the length of the tube. Second, constructing smiths' fires for heating conical or other tubes with two opposite tuyeres, or two opposite rows of tuyeres, arranged and operating as described. Third, arranging in smiths' fires one or more annular pipes having apertures serving as tuyeres, the annular water spaces of which pipes communicate with one or more strong water chambers or steam boilers arranged and operating as set forth.—Patent completed.

1938 D. P. MORISON. *Improvements in miners' safety lamps.* Dated July 3, 1867.

This invention relates, first, to lamps in which the air necessary for combustion is admitted through perforations above the cylinder surrounding the flame. Second, to lamps in which such air is supplied through perforations below the said cylinder, and the improvements are designed to prevent any communication between the flame of the lamp and the surrounding explosive mixture, even when the latter presses against the lamp at a high velocity. In the first case, the inventor employs a cylinder of sheet brass or other metal in lieu of the metallic gauze generally used. In this chimney he places at short intervals discs of wire gauze. The air is admitted at the top of two cylinders of glass or other material surrounding the top through a ring of wire gauze; or it may be admitted at the bottom of the cylinder and pass upwards. Over the top of the two cylinders a protecting shield is placed. In the second case the air is made to pass under the protecting shield of brass or other metal and a series of perforations, then through a ring of wire gauze and another series of perforations before reaching the flame. In this lamp a cylinder of glass is placed entirely surrounding an interior cylinder of wire gauze, and prevents any current from reaching the interior of the lamp.—Patent completed.

1939 T. BORLASE. *Grinding and pulverizing metallic ores and any other substances.* Dated July 3, 1867.

In the first place the work enters the bell mouth of the cones employed in this machine with water (the latter being conveyed to the feeder by a pipe or launder, and the feeder supplying the water, and also the mineral, &c., used in such quantities as may be required), where it is torn up and reduced to a proper size by ribs and grooves cast in the mouth of the mill to pass through or between the plain surfaces of the cones, which are constructed of cast iron fitted closely together, so as to bruise every grain, where it will be kept by regulating the quantity of water that is left in with the work, and confining the work by the adjusting ring at the outer edge of the mill, which is perforated for the purpose, a sufficient time to be brought into a fit state to pass over a separating machine or machines that may be required. The regulating of the work will be by admitting water in greater or less quantities, and by adjusting the perforated ring till the material is made very fine.—Patent completed.

1940 W. S. SCOTT and W. H. STEEL. *Improvements in self-acting escape or relief valves applied to the cylinders of steam engines.* Dated July 3, 1867.

The object here is to obtain the free escape of the condensed steam, and any water that may be carried over into the cylinders from the boiler. This is effected by the fitting of a pipe from each end of the cylinder to a box containing two valves fixed on the same spindle with corresponding valve seats, so that one valve acts upon the other alternately, whereby as one valve is closed by the steam entering one end of the cylinder from the boiler, the other is opened to allow the escape of the water from the exhaust end of the cylinder.—Patent completed.

1941 R. SHAW. *Improvements in motive power engines.* Dated July 3, 1867.

Within a cylinder provided with a valve to regulate the admission of the steam, &c., the inventor places a piston made longer or deeper than those now in use. This piston reciprocates as in ordinary motive power engines. It is fitted with an eccentric and guide or crank within itself. The eccentric or crank is secured on the main shaft which passes transversely through the cylinder and piston, and by these parts the reciprocating motion of the piston is converted into rotary of the main shaft. Bed plate, framing, bearings, connections, and appurtenances requisite in ordinary motive power engines are provided.—Patent abandoned.

1942 J. H. JOHNSON. *Improvements in the mode of preserving butter and substances of a similar nature.* (A communication.) Dated July 3, 1867.

This invention consists in retaining butter, &c., free from contact with the sides of those vessels in which it is enclosed, and surrounding it with purified or distilled water, or with distilled water containing in solution carbonate or bi-carbonate of soda, or other alkali, such as potash, either alone or in conjunction with tartaric acid, or other acid capable of liberating carbonic acid from such alkaline solutions.—Patent abandoned.

1943 H. CLARKE. *Improvements in propelling vessels.* Dated July 3, 1867.

This invention relates to the propulsion of vessels by a rotary sail, that is to say, by a large surface extended to operate on the atmosphere. The axis of the rotary sail is actuated by steam power in the vessel, and is caused to rotate thereby at a rate suitable for the speed to be obtained. The sail in rotating presents its oblique surfaces to the atmosphere, against which they press, and force the vessel onwards.—Patent completed.

1944 D. DAVY. *Improvements in steam and other hammers whereby to effect economy in the use of the steam or other fluid actuating the said hammers.* Dated July 3, 1867.

The patentee claims, first, passing a portion of the steam, &c., which has raised the hammer to the top side of the hammer piston, and passing a portion of the steam, &c., which has acted on the top side of the hammer piston in the descent of the hammer, to the underside of the said piston, in each case before the steam, &c., is admitted into the cylinder at the initial pressure. Second, the several arrangements of valves.—Patent completed.

1945 W. THOMPSON. *Improvements in mouthpieces for cigars and pipes.* Dated July 3, 1867.

The patentee claims, first, providing mouth pieces for cigars and pipes with a chamber containing cotton wool, or its equivalent, through which the smoke has to pass on its way to the mouth. Second, the employment of a case for containing the cotton or other wool, constructed and operating as described.—Patent abandoned..

1946 J. SALMON and G. W. HICK. *Improvements in machines for ruling paper, part of which improvements is also applicable to guiding paper into printing and other machines.* Dated July 3, 1867.

These improvements consist, first, in arranging the machine so that the paper may be ruled on both sides, although it is passed only once through the machine; and, second, in using self-acting mechanism to raise the pins after the paper has passed from underneath them in order to prevent them from inking the aprons.—Patent abandoned.

1947 F. LEONARDT. *A new or improved combined lamp and match box.* (A communication.) Dated July 3, 1867.

This lamp is made of a cylindrical figure, and is fixed in the axis of a tube of larger diameter, the tube being closed at bottom. The annular space between the lamp and the tube forms a box in which the matches are placed.—Patent abandoned.

1948 J. M'ADAMS. *An improvement in machinery for printing from a chain of types.* Dated July 3, 1867.

This invention is not described apart from the drawings.—Patent completed.

1949 W. E. NEWTON. *Improved apparatus for the manufacture of soda water and other aerated liquids.* (A communication.) Dated July 3, 1867.

Here the pump feed and agitator to the condenser are connected together without the application of joints to the latter above the average level of the water therein. The feed and agitator are operated through the base of the condenser, and the discharge of feed pipe passes from the pump into the condenser, and imparts to it a reciprocating action by or with the pump, so that the pressure of gas or liquid in the condenser is made to assist the pump in its discharging or feeding stroke to the condenser by acting upon the exposed end of the discharge pipe or devices connected therewith. In combination with the condenser there is a pump for charging and keeping up the supply to the latter. The constituent parts of this pump are a stationary hollow plunger, and a reciprocating cylinder, with inlet and delivery valves, and an upper reciprocating discharge or feed pipe. The invention further consists in arranging on the end of the discharge pipe which projects into the condenser from below one or other equivalents constructed so as (in the reciprocating action of the pump) to catch and distribute the gas in the water, and to agitate the latter within the condenser, for effecting a thorough mixing of the gas and water.—Patent completed.

1950 A. E. HERRMANN. *An improved lubricating compound.* (A communication.) Dated July 3, 1867.

This invention consists in the production of a lubricating compound formed from lime soap (composed of lime, firm grease, and fine oils) dissoved in fine oils and paraffin oil.—Patent abandoned.

1951 E. M. BROWN. *Improvements in apparatus for carrying umbrellas.* Dated July 3, 1867.

This apparatus consists of an ornamental plate with a chain attached to it. The plate is secured by a band to the waist of the wearer, and the chain has a ring at its lower end through which the lower extremity of the umbrella stick is inserted. To secure the upper end of the umbrella, it is encircled by another short chain, also fixed to the plate, and having a cross bar at its end, which is, to make it fast, passed through another ring near the upper end of the first chain.—Patent completed.

1952 R. HELLARD. *Improvements in reaping and mowing machines.* Dated July 4, 1867.

This invention comprises, first, a drop stay kept down by a spring on the turned or grooved part of the spindle of the bevel wheel by the inside bearing to keep it from springing out of gear in which works the knives. Second, a tilting (table) side delivery platform to swing in its centre, or nearly so, and to be self-acting, or to be worked with the hand or foot. Third, a side delivery platform hung with hinges or hooks and twists or joints to that part or side of the machine against the standing or uncut crop. Fourth, the vane reel formed of iron or steel, thus making the reel vane, shaft ends, and vane reel of metal. Fifth, a lever bolt with and without spring with a claw at the end for throwing the revolving canvas or other revolving platform and octagon or other rollers behind the knives in and out of gear, and which claw bolt is fixed behind the driving wheel on the back part of the frame in a horizontal line pointing towards the end of the aforesaid roller or rollers. Sixth, a revolving roller or rollers between the knife bar and the revolving platform in order to raise the corn, &c., when cutting on to the side delivery, tilting, and other platform. Seventh, the creepers for getting up the down-laid crops, previously patented by the inventor the 11th March, 1859 (No. 626), which are to be made of steel or cast or malleable iron.—Patent abandoned.

1953 T. WELTON. *A new revolving shutter or blind, to be applied either inside or outside of houses or other buildings.* Dated July 4, 1867.

This invention consists in making a shutter or blind of sheet iron or steel, so that each part (described as plates) interlocks with the other and others, and so forms a continuous hinge or hinges, to the front of which may be affixed laths of wood, or metallic bars of the required thickness of any sectional form or width, either as regards the plates, otherwise hinges, or the outside covering (if any) of iron or wood.—Patent abandoned.

1954 J. FERREYT. *A new system of organs, with two, three or four keyboards and separate pedals.* Dated July 4, 1867.

This system of manufacturing organs allows the organist to transpose altogether, or in part, the action on the rows of pipes of which the organ is composed from the first keyboard to the second, and vice versa, as well as to the pedals.—Patent completed.

1955 T. and T. VICARS, and J. SMITH. *Improvements in self-feeding smokeless furnaces.* Dated July 4, 1867.

This invention relates to that class of self-feeding smokeless furnaces, such as Incke's, and Wilson and Smith's, wherein a progressive movement is given to the fuel, and consists, first, of an improvement on that furnace fire-grate for which Messrs. Wilson and Smith obtained a patent, dated September, 1863 (No. 2206). Between the bars described in the specification of that invention the present patentees place other firebars; these latter are moved backwards and forwards a shorter distance than the travel of the former, from which they receive motion, studs and slots being employed for that purpose. Second, of means for supplying fuel to all furnaces in which a progressive movement is given to the fuel resting on the fire-grate. Instead of passing all the fuel from the front through or under the door of the furnace, they supply part or the whole from the top at a greater or lesser distance from the front or back, according to the size of the fire-grate. They place a hopper over or higher than the top of the fire-grate, and lead tubes or enclosed ways therefrom; these terminate directly over the fire-grate. For steam boiler furnaces they carry the tubes or ways through the boiler; screws, &c., are worked on the tubes or ways to propel, measure, and regulate the feed of fuel.—Patent completed.

1956 P. F. TRANCHAT. *Certain improvements in machinery for cutting fraises.* Dated July 4, 1867.

The patentee mounts the circular cutter to be cut on a spindle capable of turning on its axis, and provided with a gauged plate for dividing its circle of rotation in any given number of parts, and over this stationary cutter to be cut, and transversely with its spindle, he places a lever suspended by an universal adjustable joint at one of its extremities, and containing at a short distance therefrom a small working circular cutter adjusted on centres, and rotated over the cutter to be cut; at a distance about five times that of the working cutter from the extremity of the lever he places an adjustable guide plate, on which the lever rests, and which plate is an enlarged representation of the profile of the cutter to be cut; by traversing the said lever over this guide plate, the working cutter is traversed over the stationary cutter, on which one tooth or cut is then made; the stationary cutter is then rotated the required amount for another tooth, and these two successive operations are repeated until the entire circumference of the stationary cutter has been cut.—Patent completed.

1957 A. A. CHAMPION. *Improvements in chronographs or apparatus combined with chronometers and other timekeepers for measuring and indicating short intervals of time.* Dated July 4, 1867.

This invention has for its object the arrangement of mechanism in combination with a chronometer or other timekeeper to act as a "chronograph" instrument for measuring and recording short intervals of time without interfering in any way with the timekeeping quality of the chronometer or timekeeper with which such mechanism or apparatus is combined, and comprises numerous intricate mechanical arrangements which we cannot give space to here.—Patent abandoned.

1958 H. CLARKE. *Improvements in apparatus for propelling vessels.* Dated July 4, 1867.

This invention relates to apparatus for propelling by its action in the atmosphere. The patentee provides what he terms a rotating sail (or sails), being oblique vanes or sections of screws mounted on a horizontal axis; such vanes he constructs of a series of radial arms extending from the axis, so that canvas, &c., when stretched thereon, will present a surface which, when the axis is rotated, will act in the manner of a screw on the air, and so produce an end thrust on the shaft, and, consequently, propel the vessel.—Patent completed.

1959 F. BRADY. *Improvements in apparatus for working railway switches and signals.* Dated July 4, 1867.

Here, when a switch lever is moved to shift a switch, all the signals which must then necessarily be set at danger will be locked in that position. The patentee claims connecting the switch levers with spindles or axes having locking axis upon them acting upon the signal levers or links, or parts connected therewith, as described.—Patent completed.

1960 J. BOLTON. *Improvements in stands or holders for croquet balls and implements.* Dated July 4, 1867.

The stands or holders have a tray, box, or base, and a cover with locks and bolts, and locked flaps, lids, or sides arranged and combined together.—Patent completed.

1961 W. DAY. *Improvements in the mode of applying metal sheathing to iron ships, caissons, and floating docks, and*

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other iron constructions subject to corrosion. Dated July 4, 1867.

The patentee claims the mode described of putting zinc or other electro-positive metal in strips with screws or rivets of iron, zinc, or other suitable metal, upon iron ships' caissons, floating docks, &c., thereby preventing corrosion. —Patent completed.

1962 W. E. NEWTON. *Improvements in breech-loading fire-arms.* (A communication.) Dated July 4, 1867.

This invention consists in the use of a lever and a sliding extractor so combined with a chambered breech-block hinged at one side that the said lever not only serves as a thumb-piece, whereby the breech-block may be turned laterally from the breech receiver to unclose the breech, but may also be used to operate the extractor to expel the empty cartridge shells from the barrel. The invention further consists in an arrangement of such lever with reference to a notch or recess formed in the rear end of the breech receiver, whereby the lever may also be employed to securely lock the breech-block in position to close the breech.—Patent completed.

1963 A. V. NEWTON. *An improved combined ship's propeller and steerer.* (A communication.) Dated July 4, 1867.

This propeller consists of a vertical shaft supported in bearings at a suitable depth in the water. From this shaft proceed two or more tiers of radial arms arranged with their edges horizontal, so as to afford little resistance to the water. The lower arms are made somewhat shorter than the upper, so as to give the complete outline of the propeller the shape of an inverted truncated cone. To the extremities of these arms are hinged rectangular or rhomboidal blades or paddles, the hinges or pivots being placed on their vertical central line. A tubular or sleeve shaft surrounds the upper portion of the main shaft, and is free to turn upon it. This sleeve shaft is connected by gearing with the tiller. In order to enable the blades or paddles to feather as the wheel rotates, there is fitted to the foot of the sleeve shaft an eccentric around which is a strap free to revolve, and to this strap are attached radial eccentric rods or arms having their other extremities pivoted to the steel blades or paddles out of the central line thereof. The upper end of the main shaft (above the sleeve shaft) connects by a crank, &c., with the source of power.—Patent completed.

1964 I. PICK. *Improvements in scarfs and other like articles of wearing apparel.* Dated July 4, 1867.

The inventor manufactures a scarf, or like article, so that it shall also serve as a chest protector. He combines with a piece of material, serving as a covering or protector for the chest, a strap or band which passes round the neck of the wearer, or under the collar, being retained in place by hook, button, or otherwise.—Patent abandoned.

1965 M. HENRY. *Improvements in apparatus for raising and lowering heavy bodies.* (A communication.) Dated July 4, 1876.

The platform, carriage, cradle, or weight to be raised or lowered, travels on an inclined way or inclined side, or portion of the framework. The framework may be constructed in vertical section of the shape of a right angled triangle, whereof the hypothenuse forms the aforesaid inclined way or side. T-iron, or double T-iron, or angle iron, may be used in the construction of the apparatus or its framework. A base plate or sole, which rests on the ground or floor when the apparatus is at work, is raised therefrom when it is to be moved. For this purpose the base plate or sole is attached to eccentric discs or plates in which the ends of the axle of the wheels are mounted eccentrically, and which turn in plates or pieces forming portions of the framework, so that by raising the axle, the base plate or sole will be lifted off the ground by the eccentrics, discs, or plates which are held in position by catches or stops. The arms or supports of the load to be raised may be used as handles or shafts for draft purposes in moving the apparatus. The weight is lifted by a crank handle actuating a worm wheel which drives a grooved pulley combined with a toothed pinion which engages a lifting chain attached to the load.—Patent abandoned.

1966 H. RUDDICK. *Improvements in steam engines.* Dated July 4, 1867.

This invention relates to a new arrangement of the piston, connecting rod, and crank shaft with relation to each other and the cylinder, whereby the power is brought near the work, and the machine made more compact, lighter, and cheaper, and consists in arranging within a cylinder furnished with the usual induction and exhaust valves two single acting pistons, one at each end, and joining them by lateral rods within the cylinder, so that they shall be held apart at a proper distance compared with the length of the cylinder, to allow of the desired stroke. Intermediate between these two pistons the patentee places a crank shaft across the cylinder, and connects the crank pin on this shaft by a connecting rod with one of the piston heads.—Patent completed.

1967 W. R. LAKE. *Improvements in the manufacture of illuminating gas, and in apparatus employed in the said manufacture.* (A communication.) Dated July 4, 1867.

This invention consists, chiefly, in preventing the formation of carbon in the retorts by relieving them from the pressure caused by the scaling of the mouths of the tubes in the hydraulic main.—Patent completed.

1968 E. O. GREENING and J. ATKINSON. *Improvements applicable to washing, wringing, and mangling machines.* Dated July 5, 1867.

The patentee claims, first, the use of a worm and worm wheel for actuating the rollers of washing, wringing, and mangling machines, as described. Second, the use of compound springs formed of metallic washers and rings made of vulcanized india-rubber, for producing the necessary pressure between the rollers of washing, wringing, and mangling machines, as described.—Patent completed.

1969 P. L. F. E. ROUSSEL. *A finger stall intended for writing with a single finger.* Dated July 5, 1867.

This finger stall has at its upper end an appendage slightly inclined to the right, and forming a holder for a pen, and its other end passes over the index or other finger like a sewing thimble.—Patent abandoned.

1970 C. D. ABEL. *An improved elastic strap for garments.* (A communication.) Dated July 5, 1867.

This invention consists in attaching a buckle to each end of a strip of elastic material, by preference a solid piece of vulcanized india-rubber. This contrivance is applied to the strap of the garment by cutting off the buckle, button, hook, or other contrivance attached thereto, and passing the one end of the strap through the one buckle of the elastic strap, and the other end of the strap through the other buckle thereof.—Patent abandoned.

1971 J. M'NAUGHTON. *Improvements in breech-loading firearms, and in cartridges and projectiles, a part of which improvements is also applicable for converting muzzle-loading firearms into breech-loading firearms.* Dated July 5, 1867.

This invention is not described apart from the drawings. —Patent completed.

1972 H. C. CARVER. *Improvements in hoop-iron fastenings for bales.* (A communication.) Dated July 5, 1867.

This invention consists in cutting the hoop iron to the length required to pass round the bale, in doubling up each end, securing one doubled end by a rivet, making a hole and short slot in it, and in riveting a button or stud in the other doubled end which will fit the said hole and slot.—Patent completed.

1973 W. R. LAKE. *Improvements in machinery for manufacturing metal tubes.* (A communication.) Dated July 5, 1867.

This invention relates to mechanism for forming sheet metal tubes or pipes with a lap joint, the object being to so construct and arrange the parts that the successive operations are performed automatically. The material in the form of a plate or long flat strip is fed into the machine at one end, and is thence passed on by a series of feed guide and bending rolls which gradually bend the plate around a stationary cylindrical mandril, so as to bring the opposite edges together, lapping one edge over the other, and bending the edges thus joined down to the cylindrical surface of the mandril, the sheet or strip being finally delivered from the opposite end of the machine in the form of a finished tube.—Patent completed.

1974 W. C. CHURCH. *Improvements in, or applicable to, steam and other motive engines.* Dated July 6, 1867.

First, these improvements relate to the slide valves of engines, and to arrangements for removing the excess of pressure from the back of the valve. The back of the valve is modified in shape, so as to receive a circular cap or ring; the upper side or edge of this cap or ring is made to work against a fixed plate which forms a part of the top or cover of the valve chest, when there is only one valve, but when two valves are arranged back to back the plate is placed between them and acts for both valves. The cap or rings is pressed against the said fixed plate partly or wholly by the steam or other motive power used, and partly by springs abutting against the top of the slide valve and acting against the under side of the cap or ring. The joint or space between the slide valve and its cap or ring is made steam-tight by metallic ring packing, which is pressed upwards against a junk ring secured upon the top of the valve, and outwards circumferentially against the inside of the cap or ring. Thus arranged the cap or ring will move with the valve, and will be pressed at the same time so as to be steam-tight against the said fixed plate, and thus the pressure of the steam or fluid in the valve chest will be prevented from acting upon that part of the back of the valve enclosed by the ring or cap. The fixed plate has a passage formed in it which communicates with the space above the ring or cap, and with the atmosphere, so that if there is any leakage, this can be readily ascertained. A tap may be placed at the outlet of the passage from the fixed plate so that the outlet may be closed if the leakage is excessive until it can be attended to. Second, the improvements relate to the pistons of steam and other motive engines, and consist in arrangements by which the greatest pressure of steam, &c., may be made to act constantly and uniformly, or nearly so, to press out the packing ring or rings.—Patent completed.

1975 F. ANDREW and L. CLARKSON. *Improvements in machinery used for printing woven fabrics, warps, yarns, and paper.* Dated July 6, 1867.

This invention consists in the employment of a bowl covered with vulcanized india-rubber, &c., instead of the lapping and blanket hitherto employed in printing machines, and cleaning the surface of the bowl with a doctor or roller, either with or without water. The material passes between the printing roller or rollers and the bowl, and the impressions are obtained in a very effectual manner.—Patent abandoned.

1976 W. R. GORST. *Improvements in the construction of wheeled vehicles.* Dated July 6, 1867.

This invention consists in so constructing the bodies of wheeled vehicles that the seat space can be doubled by folding or moving forwards or backwards a movable piece called the minor body placed opposite the ordinary seat or seats. This minor body is fitted on a hinge or joint near the floor of the vehicle, is formed with a rigid frame, is provided with seats on its inner surface, and is made sufficiently roomy to serve as an apron or leg protector when only the ordinary seats are required.—Patent completed.

1977 R. TIERNAN. *An improved tobacco pipe.* Dated July 6, 1867.

The principal objects of this invention are:—First, to prevent the essential oil from entering the mouth of the smoker; and, second, to cause the tobacco to burn evenly and economically. The inventor forms the pipe with a passage at the side of the bowl. One end of the passage opens to the bowl at or near the bottom thereof, and the other to the stem at or near the top of such bowl.—Patent abandoned.

1978 T. C. THOMAS. *Improvements in water-closet fittings.* Dated July 6, 1867.

This invention consists in so arranging the fittings that a regulated quantity of water may be discharged for flushing the basin every time the closet is used. This is effected by establishing at some convenient point above the level of the pan a small cistern or chamber with a tumbling trough which is always kept charged with the regulated quantity of water, and is filled from a reservoir above. The tumbling trough is filled from the supply pipe through a ball-cock which only admits a certain quantity; it is mounted on centre pins, so that when required it may be tipped over, in order to discharge the water. It is worked by gearing consisting of bands and pulleys connected to a lever, which may be actuated by a handle in the ordinary manner; or it may be connected to the door of the closet, so that it may be actuated whenever the door is open. The pan is provided with a syphon, and when the lever is pulled up or the door opened the tumbling trough will be pulled over on its axis, and the water will be discharged therefrom and allowed to rush down the exit pipe with considerable force into the pan.—Patent abandoned.

1979 W. E. NEWTON. *A novel system of constructing railways and working trains thereon, in order to enable trains to ascend inclines of steep gradient.* (A communication.) Dated July 6, 1867.

Here motion is communicated from the engine by means of pulleys and bands to all the wheels of a train, which are thereby driven at uniform speed. The driving wheels are all made to bear on a single rail placed in the centre of the road. When the gradient to be ascended is very steep, the wheels should be set at an angle of about 30deg., so that considerable pressure may be exerted, and a more complete adherence caused than if the wheels were placed vertically on the rails.—Patent abandoned.

1980 T. MORGAN. *Improvements in the construction of apparatus and furnaces for puddling iron.* Dated July 6, 1867.

This apparatus for puddling is as follows:—A "rabbel" is fixed upon a column, such column having a bevel wheel at the top thereof, fitting into another bevel wheel which is fixed upon a fly-wheel connected with a crank shaft. The column works through a dome fixed upon the top of the furnace, there being on the top of the column a flange fitting upon the part of the dome on which the column rests, and upon which it is suspended when the rabbel is employed in puddling. The rabbel has a circular motion, and is provided with three projections thereon to dip into and agitate the molten iron. When the rabbel is not required for puddling, or when it has become too hot to perform its work with safety, it is lifted through an opening in the top of the puddling furnace by means of a rack and pinion. When the rabbel has been thus lifted out of the furnace, it can be cooled by dipping it in a cistern, which may be prepared for that purpose. The opening through which the rabbel is admitted to the furnace is closed by a slide both when the rabbel is in the furnace and when it is not in use.—Patent abandoned.

1981 H. B. WOODCOCK. *An improvement in the manufacture of tyres for railway wheels.* Dated July 6, 1867.

This invention consists in the use of converted or cemented bars for the manufacture of railway wheel tyres, whereby the inventor obtains any required degree of hardness suitable for tyres without destroying their malleability.—Patent abandoned.

1982 T. CRADDOCK. *Enabling persons to fly in the air, either alone as the bird flies, or singly, or in parties, in a car or basket.* Dated July 6, 1867.

We cannot here give space to the voluminous details of this invention.—Patent abandoned.

1983 W. HARRIS. *A process of uniting and compressing sawdust, and other small particles of wood, for the purpose of converting the same into charcoal, and utilizing the naphtha, tar, and other residuary products of such conversion.* Dated July 6, 1867.

This invention consists in converting sawdust, shavings, chips, or other small refuse particles of wood, into solid pieces or blocks by mixing the same with certain of the residue extracted from wood during the process of charring in retorts, and afterwards compressing the same in moulds, the said residue causing the particles of wood to unite or adhere to each other. The pieces or blocks thus formed are intended to be subsequently converted into charcoal in retorts.—Patent abandoned.

1984 W. ARCHER. *Improvements in rotary engines and rotary pumps.* Dated July 6, 1867.

The inventor makes the steam chamber of a rotary engine (in which the steam is made to give motion to the piston) of a circular or ring-like figure, that is, of a figure such as would be produced by taking a tube open at both ends and bending it into a circular form, and joining its two ends. This chamber is situated horizontally, and in its centre is a vertical shaft to which rotary motion is to be given. In the steam chamber is a piston capable of travelling round the steam chamber, and the said piston communicates with the shaft described by means of an arm fixed on the shaft, and connected to the piston through a slot or opening in the upper or inner side of the steam chamber. This slot or opening is covered by means of an annular cover which fits thereon, and which is carried round by the motion of the piston. The chamber has a plate or valve which crosses it, and which is capable of being temporarily withdrawn to permit of the passage of the piston. On one side of the plate or valve is an opening at which the steam enters, and on the other side is the exhaust pipe at which the waste steam passes out. When steam is admitted between the plate or valve and piston, the latter is carried forward by the pressure of the steam, and traverses the circular chamber, carrying the cover and arm with it, and giving rotary motion to the shaft on which the arm is fixed. After the piston has travelled along nearly the whole length of the chamber, and has arrived at the other side of the plate or valve, steam is shut off, and the plate or valve is withdrawn to allow the piston to pass it. On the piston passing the exhaust pipe, the steam which has urged it forward escapes by the exhaust pipe. On the piston passing the plate or valve the latter is made again to cross the steam chamber, and steam being again admitted between the plate or valve and the piston the latter is again urged forward. The steam may be worked expansively or cut off when the piston has performed only part of its stroke. The steam chamber is enclosed in a steam-tight box into which steam is admitted from the boiler. The pressure of this steam on the cover of the slot balances that in the chamber, and there is no tendency in the said cover to rise from the slot.—Patent abandoned.

1985 C. TOFT. *Improvements in liquor frames, and other frames for holding bottles and vessels.* Dated July 6, 1867.

The object here is the securing of the bottles in the frame when not in use, and preventing access to the contents thereof. The inventor makes in the base or foot of the frame a series of circular depressions in which the bottoms of the liquor bottles fit; he uses a movable handle, and so constructs it that it serves both to lift the frame by and to secure the liquor bottles in the frame. He makes the handle of three or more radial arms having expanded terminations, the arms springing from the central rod of the handle. The arms are of such a diameter that their expanded free ends are capable of being brought over and pressed upon the stoppers of the liquor bottles in the frame, or being removed therefrom by giving the handle motion in a horizontal plane.—Patent abandoned.

1986 J. C. MAJOR. *Improvements in furnaces for the production of heat by burning tar, petroleum, and other liquid combustibles, and in the mode of conducting the burning of the said combustibles.* Dated July 6, 1867.

In carrying the first part of this invention into effect the patentee arranges in front of the furnace, at, or somewhat in advance of the place where the furnace door is ordi-

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narily situated, a vertical opening in which a series of horizontal plates is fixed, the said plates being more or less inclined from the outside of the furnace downwards towards the inside, so that any liquid poured on the plates at the outer sides will run towards the other sides. The plates may be perforated with a series of small holes, so that liquid may flow or drop through from one plate to that next below it. In this case he arranges the openings in one plate so that they shall not be immediately over those in the plate next below it. The air for the support of combustion enters over and under the said plates, or through the openings, where there are any. In order the more effectually to retain the liquid on the plates, sand or ashes may be strewed or fixed on the plates. The tar or petroleum, &c., is supplied from a reservoir on to one or more of the plates where it is ignited. The burning combustible falls from the plate on which it is delivered to a lower plate, and the whole of the plates speedily become so heated as rapidly to volatilize, and promote the burning of the combustible. The vapour of the inflammable liquid on rising from the heated plates becomes mixed with the air passing over, or under, or through the openings in the plates, and burns with the evolution of great heat and light. In carrying the second part of the invention into effect, he adds a small quantity of water to the tar or petroleum, &c.—Patent completed.

1987 N. THOMPSON. *Improvements in unions or apparatus for connecting together pipes or tubes, and for stopping the ends thereof.* Dated July 6, 1867.

This invention relates to a former patent, dated June 8, 1867 (No. 1694), and consists, firstly, in the use of a ring or collar fixed in the middle of the centre sleeve or tube of the union to act as a stop to the packing, but so as to allow of the free passage of the tubes through such ring. The invention consists, secondly, in the application of a packing composed of a ring or tube of soft metal, the inner surface of which fits the tubes or pipes to be connected together, whilst the outer surface thereof, at one or both ends, is of a conical form, and, in order to compress such packing around the tubes or pipes, he employs rings or tubes which are conical on their inner surfaces, and which are connected to, or acted upon, by a screwed sleeve or tube.—Patent abandoned.

1988 G. SEVERN. *Improvements in refrigerators for cooling worts and other liquids.* Dated July 6, 1867.

Within a vat or tank the inventor arranges tiers of pipes with sufficient space between the tiers and between the ends thereof and the tank for a man to pass for cleaning the vat and pipes when required. The pipes of each tier are connected by return bends formed with openings closed by stoppers opposite each line of horizontal pipe for cleaning them out by introducing a brush or otherwise. The tiers of pipes which come against the ends or sides of the vat or tank he prefers to form with angular surfaces, or semicircular, so that they may be flat against the surface of the vat to facilitate cleaning. The hot wort or liquid to be cooled flows in at the upper part of the vat containing the series of tiers of pipes, and is drawn off at or near the bottom. One or more thermometers may be fixed to the side of the vat, the bulbs passing through into the liquor to indicate the temperature thereof. Into the lower part of each of the series of tiers of pipes a jet or jets of water is or are forced, currents of air being also forced in at or near the same point in order to distribute the water in the form of spray through the series of tiers of pipes, so as to absorb the heat from the hot liquor and conduct it away.—Patent abandoned.

1989 J. WHITFORD. *An improved ice-making apparatus.* Dated July 8, 1867.

Here the inventor constructs an apparatus with one vessel within another, the outer one of a cylindrical or other form, so that motion can be given thereto by rolling it to and fro on a smooth surface. The inner vessel is employed to contain the water to be frozen, and the space between the two vessels to contain the freezing mixtures, or vice versa. By preference he fits lids to the apparatus at both ends, the one opening to the freezing mixture, and the other to the ice.—Patent abandoned.

1990 J. CAPPER. *Improvements in the construction of chimney tops.* Dated July 8, 1867.

According to one modification of this invention the inventor makes that part of a chimney top which is attached to the upper termination of the chimney of a cylindrical form, and surrounding the higher part of it by another cylinder of larger diameter, so that an annular space is left between the two. Both of these cylinders are open at the top; the larger and outer one rises above the termination of the smaller one. A short distance below the larger cylinder, and attached to the smaller one, there is a projecting ring from which pieces rise and are attached to the outer cylinder, so as to leave alternately closed and open spaces. Wind enters at the latter, rises upwards in the annular space, and assists egress of the smoke.—Patent abandoned.

1991 J. G. TONGUE. *Improvements in the mode of training hop and grape vines, and other climbing plants.* (A communication.) Dated July 8, 1867.

The nature of this invention consists, first, in a contrivance for supporting the cords around which the vines twine and climb to the top of the trellis, and for keeping each string or cord in its place, and in training the vines in a horizontal or other direction after they have reached the top. Second, in the manner of constructing and arranging the yoke or wicket to which the cords are secured immediately over the root of the vine, so as to present the least obstacle to the necessary culture of the vine during growth.—Patent abandoned.

1992 I. M. MCGEORGE and A. PAUL. *A new or improved plug cock.* Dated July 8, 1867.

The shell or body of this plug valve resembles that of an ordinary straight or throughway stop-cock, with the exception of the opening, which is generally called the "mouth of the shell;" this mouth, instead of being supplied with a gland and stuffing box, or being entirely filled with the plug, is supplied with a lid or cover containing a stuffing box, through which stuffing box a spindle (called a valve spindle) passes, having a screw upon it by which the plug or valve is opened or shut. The lid may be screwed, bolted, or otherwise fastened to the shell.—Patent completed.

1993 J. JOHNSON, E. SHINN, and G. RAGG. *Improvements in signalling apparatus for general purposes, but which is more particularly applicable for use on board navigable vessels.* Dated July 8, 1867.

We cannot here quote the details of this invention. It will probably be noticed in a future number of this journal. —Patent completed.

1994 DR. J. M. LORRE. *Preparing canvas, linen, and cotton for enlarging and printing purposes by photography.* Dated July 8, 1867.

The inventor prepares linen, cotton, silk, &c., by giving it, first, a solution of two ounces of gelatine dissolved in ten ounces of water; he then treats it in the manner hereinafter described with reference to the canvas. He takes canvas prepared in the ordinary way for photographic purposes, that is by using oxide of zinc or lead, and he uses instruments formed of ivory or wood for spreading the coating upon the canvas. He then adds one and a-half ounces of virgin wax dissolved in essence of lavender to one pint of turpentine. The canvas is prepared with three coatings, and dried spontaneously, and when dry he dissolves sixty grains of iodine of zinc in two pints of distilled water, and with half a potatoe and very finely pounded pumice stone rubs this solution on the canvas and dries it with a soft flannel till the surface becomes brilliant. In carrying this invention into effect he further uses three special solutions, the first for printing out or developing the object on canvas by sunlight; the second, for enlarging by artificial light; and the third for printing by contact in a pressure frame.—Patent abandoned.

1995 J. SHANKS. *Improvements in lawn mowing machines.* Dated July 8, 1867.

This invention consists in constructing the sole plates or bottom blades for lawn mowing machines reversible, that is to say, the sole plates or bottom blades are made with two edges, so that when one edge is worn the plate can be unscrewed and reversed, or turned round, when the new edge will be brought into contact with the cutter.—Patent abandoned.

1996 W. TASKER. *Improvements in thrashing machines.* Dated July 8, 1867.

This invention consists, first, in constructing the straw shakers for thrashing machines of a number of strips of wood or iron, which may be fitted with pins or pegs projecting on one or both sides thereof, such strips being attached to leather or other bands working round pulleys, and receiving motion either from a pulley on the drum shaft, or any other convenient actuating medium. Inside this continuous revolving rake, or elevator, is a board which may be ribbed or corrugated on its upper surface, and which may also be perforated; the pins on the inside of the revolving strips in their transit pass up those corrugations in the boards, and carry with them any short straws or cavings that may have passed between the strips, allowing the corn to run down the board, or through it if it is perforated. The pegs on the outside of the strips elevate the straw from the drum on their return round on the underside of the above board, and when empty pass through slots cut in a board or plate, fixed or movable, placed immediately in front of the drum. Second, in constructing and applying to the rocking bars of straw shakers in thrashing machines a flexible hanging bar to carry the same, in place of the fixed bearing at present employed for that purpose. Third, in strengthening the flexible hanging bars used for carrying the caving boards and other parts of thrashing machines by placing at each side, and at the top thereof, one or more strips of any length, or of any convenient material or thickness.—Patent abandoned.

1997 A. MATHER. *Improved machinery for cleaning grain.* Dated July 8, 1867.

This invention is not described apart from the drawings. Patent completed.

1998 A. TURNER and W. HEMSLEY. *An improved manufacture of elastic woven fabric, applicable to the manufacture of gloves, drawers, and other elastic articles.* Dated July 8, 1867.

The object of this invention is to impart elasticity to the articles manufactured, and the invention consists in weaving the fabric diagonally, that is, causing the weft to pass through the shed and across the warp in a diagonal direction, at about an angle of 45deg.—Patent abandoned.

1999 N. CLAYTON and J. SHUTTLEWORTH. *Improvements in traction engines or road locomotives.* Dated July 8, 1867.

Here, in order to obviate the necessity of gearing together the two carrying and driving wheels on the opposite sides of a traction engine with differential or compensating gear, but to allow, nevertheless, the traction engine to be steered with facility, the driving wheels are actuated separately, each by its own steam cylinder and gear.—Patent abandoned.

2000 M. P. W. BOULTON. *Improvements in engines worked by the combustion of inflammable aeriform fluids, and in apparatus for producing such fluids.* Dated July 8, 1867.

In this apparatus the ignition of an explosive aeriform mixture is used to propel a piston, and thereby compress air or fluid in a chamber, which compressed fluid is employed to produce motive power, and the heated products of combustion are applied to a boiler for the generation of steam, which may be used in the same engine as the compressed fluid. Or the products of combustion may be employed to give out heat for other purposes. The invention relates to a previous patent, dated March 10, 1866 (No. 738).—Patent completed.

2001 N. CLAYTON and J. SHUTTLEWORTH. *Improvements in slide valves suitable for steam engines.* Dated July 8, 1867.

In order to enable the steam to be more conveniently worked expansively by a valve governed by a single eccentric, the parts are formed and arranged in the following manner:—The valve face has in it five parts or openings; the central one is in communication with the outlet passage by which the steam passes to the chimney or condenser, as the case may be. The two ports, which are one on either side of the central port or opening, are in connection with passages leading to the ends of the steam cylinder, and over these three ports a U-valve works, but in such manner as never to uncover either of the ports to the steam. The two remaining ports or openings in the valve face are also in connection with the passages leading to the ends of the steam cylinder. These ports serve only for the admission of the steam to the cylinder; over them a flat valve works which receives its motion directly from the eccentric, so as to uncover one or other of the steam ports as the valve makes the last part of its movement in either direction. In the middle of the flat valve is an opening into which the U-valve is received. The U-valve receive its motion from the outer or flat valve, but this is able to slide for a distance independently of it, so that the U-valve only receives motion as the outer or flat valve approaches the ends of its course. From this arrangement it results that the first action of the compound valve as it commences its movement in either direction is to cut off the steam from entering the cylinder, whilst the exhaust steam from the other end is free to escape, the U-valve remaining stationary until the outer or flat valve pushes it over, so as to reverse its position, and then the flat valve admits steam on the other side of the piston.—Patent completed.

2002 W. ANDREWS. *Improvements in hay-making machines.* Dated July 8, 1867.

The patentee claims, first, the constructing hay making machines so that the rakes may be driven at different speeds in the direction known as back action, as described. Second, the constructing hay making machines with the whole of the gearing in the centre of the machine, whilst the rake head is divided into two parts, as described. Lastly, the mounting the rake head in the spring casting in such manner that it can be turned therein, as described. —Patent completed.

2003 J. M'F. GRAY. *Improvements in marine steam engines.* Dated July 9, 1867.

This invention relates to single-acting screw propeller engines, and consists in the employment of a fly-wheel on a friction centre as means for insuring that such engines work smoothly at an uniform speed. The fly-wheel and friction centre are supported or hung on the crank shaft of the engine, on an intermediate shaft, or on the propeller shaft itself; the friction centre is constructed in any ordinary manner.—Patent abandoned.

2004 J. J. BUCKLEY and C. HOOK. *The manufacture of a gas of superior illuminating and heating powers, together with the necessary appliances for the same being generated.* Dated July 9, 1867.

This invention is not described apart from the drawings. —Patent completed.

2005 W. E. GEDGE. *A regulating level.* (A communication.) Dated July 9, 1867.

This level has the property of showing by means of an adjusting screw, a spring, a dial, and an index, the degrees of inclination of slopes or inclines with precision. It is composed of a fixed plate intended to be laid on the incline. At the end of this plate is fixed the level by a pin, or a hinge, so that it may be made to oscillate to preserve its horizontal position. It will be evident that the more rapid the incline, the greater will be the opening of the angle formed by the level and its plate, and there is, therefore, placed at the end of the level a dial which, acting as a tell-tale, shows the degrees of opening of the level, and gives per contra the difference which exists between the incline on which the level is placed and the horizontal. The head of the adjusting screw is divided, so as to give the fractions of an inch, or other measurement, which will be indicated by an index placed on the level.—Patent abandoned.

2006 G. GABILLON. *A process to prepare and preserve paper and tissues with a solution of perchloride of iron, intended for stopping the bleeding of wounds.* Dated July 9, 1867.

The patentee claims the preparation of paper or tissue of any suitable kind with perchloride of iron, as described, to be used as a very convenient and efficacious hemostatic agent; and he claims, also, the means of preventing the paper or tissue thus prepared from being destroyed by the action of the air, by folding and wrapping it up in a piece of waterproofed taffeta, prepared with an addition of resinous substances, as described.—Patent completed.

2007 W. AVERY. *Improvements in boxes or cases for holding packets of needles, and for other like uses.* Dated July 9, 1867.

The patentee claims making the boxes or cases of sheet metal, and providing them with perforated metallic diaphragms or divisions.—Patent completed.

2008 A. SHANKS. *Certain improvements in machinery for making rivets.* Dated July 9, 1867.

Provisional protection has not been granted for this invention.

PROVISIONAL PROTECTIONS.

Dated October 17, 1867.

2907 W. B. Adam, Woodstock Lodge, Granville Park, Blackheath, engineer. Improvements in locomotive engines, vehicles, and appendages thereto, for better and safer working on railways, tramways, and common roads.

Dated December 21, 1867.

3631 B. Browne, King William-street. Improvements in the construction of camp or folding bedsteads. (A communication.)

Dated January 8, 1868.

82 J. Tucker, Old Lenton, near Nottingham, starch manufacturer. Improvements in dressing fabrics and yarns.

Dated January 15, 1868.

135 W. Ayliffe, Cropthorne, Worcestershire, farmer. Improvements in boats, and in the means of steering the same.

136 J. Williamson, White Lion-court, Cornhill, Lloyd's surveyor. Improvements in bolting or fastening one part of a ship or vessel to another.

Dated January 20, 1868.

191 J. Davies, High Park-road, Smethwick, near Birmingham, mechanical engineer. Improvements in machinery for shaping malleable materials, and in apparatus for constructing the same.

193 W. Firth, Rose Villa, Viewforth, Edinburgh. Improvements in the application of vulcanized or unvulcanized india-rubber in the construction of pumps, enemas, syringes, spray producers, and such like instruments.

195 R. Carling, Manchester, and T. Carling, Bolton, mechanical engineer. Certain improvements in lubricating the interior frictional surfaces of steam or other motive power cylinders.

199 A. M. Clark, Chancery-lane. Improvements in steam boilers. (A communication.)

201 J. Parsons, Birmingham, gun barrel manufacturer. Improvements in certain parts of double-barrel breech-loading firearms.

Dated January 21, 1868.

207 J. L. Davies, St. Ann's square, Manchester. Certain improvements in the method of retaining and securing corks or stoppers in bottles or vessels containing aerated liquids, and in apparatus connected therewith. (A communication.)

215 J. J. Long, Glasgow. Improvements in machinery or apparatus to be used in the manufacture of matches or other similar articles.

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215 J. H. Johnson, Lincoln's Inn-fields. Improvements in furnaces. (A communication.)
219 G. T. Bousfield, Loughborough Park, Brixton. Improvements in liberating the colouring matter of madder and similar vegetable substances, from the ligneous matter or cellulose with which it is combined in the plant. (A communication.)

Dated January 22, 1868.

221 F. L. H. Danchell, Horwich, Lancashire, civil engineer. Improvements in machinery and apparatus for preparing, shaping, and drying peat, and other vegetable and mineral substances.
223 P. Harrower and J. C. Stuart, Glasgow. An improved spray producer, for the production of medicated vapours.
226 W. Thompson and T. Stather, Kingston-upon-Hull, engineers. Improvements in mills for grinding or crushing.
228 S. Bennett, Richmond-road, Dalston. Improvements in means or apparatus to facilitate the drying of grain, seed, brewers' grains, and other matters.
229 E. Tomlinson, Hatton-garden, Holborn-hill. Improvements in means and apparatus for ornamenting, printing, colouring, enamelling, staining, and manufacturing articles from wood and other material.
230 R. Needham, Dukinfield, Chester, engineer. Improvements in the valves of steam engines.
231 T. Goune, Pall Mall, Capt. in the 17th Lancers. An improved canteen.
232 C. S. Barker, Gloucester-road, Regent's Park, organ builder. Improvements in the construction of organs.
233 T. W. Gray, Margaret-street, Limehouse. Improvements in lightning conductors.
234 W. Dennis, Aldermanbury, merchant. Improvements in letter boxes, letter pillars, and such like depositories.
235 T. Cook, Penfold-terrace, Crabtreeshot-road, Peckham. Improved machinery for uniting together materials employed in the manufacture of boots and shoes, saddlery, driving bands, and such like articles as require to be strongly united together.

Dated January 23, 1868.

236 T. Rowley, Manchester, traveller. Improvements applicable to the soles and heels of boots, shoes, clogs, and other coverings for the feet.
237 W. Oram, Salford, hydraulic engineer. Improvements in apparatus to be employed for heating buildings, and for other heating purposes.
238 D. Y. Stewart, Glasgow, ironfounder. Improvements in the manufacture of cast-iron pipes and similar articles, and in the moulds and arrangement of apparatus connected therewith.
239 H. Hodge, Southport, ironmonger. Improvements in gas stoves for heating purposes.
240 G. Kirk, ironfounder, and W. Murray, spinner, Huddersfield. Improvements in self-acting mules and billies for spinning and doubling wool or other fibrous substances.
241 J. C. Sanders, Birmingham. Improvements in door, shutter, and bell knobs and furniture.
242 W. Bottomley, Bramley, near Leeds, machinist. Improvements in milling machinery.
244 H. J. Dickinson, North-mews, Henry-street, Gray's Inn-road, billiard table manufacturer. Improvements in tables adapted to be employed for playing billiards or other games with balls, and also for dining or other uses.
245 H. M. Ragland, Fish-street-hill, City. Improvements in tanning hides and skins. (A communication.)
246 G. Allibon, Worcestershire, engineer, and A. Manbre, Baker-street, Middlesex, sugar refiner. Improvements in steam boilers.
247 S. Price, Highbury, An improved mode of, and means or apparatus for, turning on and off the supply of gas to houses, also applicable to turning on and off the supply of other fluids.
248 M. Tildesley, manufacturer, and J. Bird, manager, Willenhall, Staffordshire. Improvements in the construction of furnaces, stoves, and fireplaces.
250 G. Severn, Hampstead-road. Improvements in valvular apparatus for giving vent to, and for excluding air from, casks or other vessels, and in bungs for closing the same, partly applicable as valves for other purposes.

Dated January 24, 1868.

251 W. J. Jennings, Little Bowden, Northamptonshire, permanent way inspector. Improvements in the permanent way of railways.
252 J. and D. Storer, Glasgow. Improvements in vessels or canisters to be used for holding liquids, solids, and other substances, for the purpose of economizing space and freight.
253 A. Small, Glasgow. Improvements in apparatus for removing excrements.
254 E. W. de Rusett, Lewisham, Kent, engineer, and R. F. Dale, Shoe-lane, City, founder. Improvements in water-closets.
255 A. M. Clark, Chancery-lane. Improvements in means and apparatus for lubricating parts of machinery exposed to the action of steam. (A communication.)
256 C. Woodroffe, Hill-street, Rugby. Improvements in travelling post offices and tenders, and in apparatus for delivering and receiving mail bags and parcels.
257 T. L. G. Bell, Plaistow. Improvements in preparing oxide of iron for purifying gas, and in treating the oxide of iron residues to obtain products therefrom.

Dated January 25, 1868.

258 K. J. Winslow, Montpelier-row, Twickenham, civil engineer. An improved method of conveying rotatory motion to axles.
260 J. M. Lewis, Pimlico. An improved apparatus for securing watches, purses, or other valuables, when worn or carried in pockets.
261 C. W. Dixon, Wickham-market, Suffolk, civil engineer. Improvements in rotating slide valves, and for improved suitable modes of applying these said and other rotating valves to certain kinds of engines.
263 C. Kilburn, Holloway. Improvements in the construction of life and swimming belts, jackets, waistcoats, and buoys.
264 C. E. Brooman, Fleet-street, patent agent. Improvements in breech-loading firearms and in the manufacture of ammunition for the same. (A communication.)
265 C. Ritchie, Brixton. Improvements in apparatus for utilizing heat for heating, warming, and ventilating, whether such heat be procured by the agency of steam boilers, furnaces, or from other sources.
266 T. Robinson, Widnes, Lancashire, ironfounder. Improvements in the formation or construction of fortifications.
267 R. G. Wells, Birmingham, aeronaut, and David Jones, manufacturer. Improvements in apparatus for producing optical illusions.
268 E. J. W. Parnacott, Leeds, engineer. Improvements in the manufacture of elastic rollers.
269 A. C. M. Prince, Trafalgar-square, Charing-cross. A new or improved bell pull for door bells. (A communication.)
271 J. H. Johnson, Lincoln's Inn-fields. Improvements in apparatus for melting and heating metals and other substances. (A communication.)

Dated January 27, 1868.

274 A. Middlemist, Saville-street, Hull. An improved apparatus for increasing, regulating, and controlling the heat and draught in stoves and other fireplaces.
275 A. H. Thurgar, Norwich. Improvements in securing the corks of bottles containing champagne and other effervescing liquids.
276 J. J. Hicks, Hatton-garden, Improvements in the manufacture of backs and handles for hand mirrors.
277 T. Dickinson, Lancaster, plumber. Improvements in apparatus for drawing off water.
G. Kellogg, New York. Improvements in hats, bonnets, and other coverings for the head, and in machinery for manufacturing the same. (A communication.)
279 W. E. Rendle, Welbeck street, Cavendish-square. Improvements in structures for protecting fruit trees, vegetables and other plants from frost, cold, winds, or rain, also in heating such and other structures.
280 W. E. Newton, Chancery-lane, civil engineer. Improved machine for grinding and polishing concave surfaces. (A communication.)
281 W. E. Newton, Chancery-lane. Improvements in machinery for forming hat bodies, skirts, and other articles of wool and other fibrous materials. (A communication.)
283 F. N. Clerk, Wolverhampton, manufacturer. Improvements in machinery for the manufacture of washers and other similar articles.
284 J. Roberts, West Bromwich, ironfounder, and J. Morgan, Kidderminster, manager of works. Improvements in joining metallic pipes.

Dated January 28, 1868.

285 W. Tranter, Birmingham, gun maker. Improvements in firearms and cartridges.
286 E. Egersdorff, Baldwin's-gardens, Gray's Inn-road. Improvements in tips for boot heels.
287 H. A. Bonneville, Sackville-streeet, Piccadilly, A new mode of preserving eggs, and improved apparatus connected therewith. (A communication.)
288 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in ribbon looms. (A communication.)
289 W. A. Gibbs, Gilwell Park, Essex. Improvements in mechanism or apparatus for drying wheat in the sheaf and other vegetable matters.
290 W. H. Crispin, Marsh Gate-lane, Stratford. Improved anti-scorbutic biscuits.
295 T. Corbett, Shrewsbury, manufacturer. Improvements in machinery for cleaning and separating grain, and for other like purposes.
297 J. Pearson, Jewin-street, City, oil refiner, and J. W. Young, Portland-terrace, Regent's-park, oil merchant. Improvements in refining or purifying oils, and in the apparatus employed therein.
299 R. J. Moser, High-street, Southwark. Improvements in bellows, applicable especially to portable and other forges. (A communication.)
301 J. H. Johnson, Lincoln's Inn-fields. Improvements in lithographic printing machines. (A communication.)

Dated January 29, 1868.

305 C. A. McCurd, Camberwell. Improvements in sewing-machines.
309 S. B. Ardrey, Manchester, machinist, and S. Beckett, spindle maker. Improvements in velocipedes.
311 D. Law, ironfounder, and J. Wharrie, foreman, Glasgow. Improvements in the manufacture of cast-iron pipes and similar articles, and in apparatus therefor.
313 W. Guise, Redditch, needle hardener. Improvements in scouring needles and other articles made of iron and steel wire, and in apparatus used for that purpose.
315 S. M. Martin, Pinner, and S. A. Varley, Roman-road, Holloway, telegraph engineers. Improvements in electrical train intercommunication, parts of which invention are applicable to electro-magnetic and other electrical apparatus.
317 W. E. Newton, Chancery-lane, civil engineer. Improvements in breech-loading firearms and in cartridges and bullets for the same, (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated January 29, 1868.

307 W. Snell, Parliament-street, Westminster. Improvements in steam fireproof safes. (A communication.)
308 W. Snell, Parliament-street, Westminster. An improved fireproof powder magazine. (A communication.)
310 W. Tasker, Halifax. An improved machine for opening and cleaning cotton, applicable also for other purposes. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," February 11, 1868.

2759 J. G. Jones. Hauling ropes.
2760 G. Allibon and A. Manbre. Conversion of cereal substances into saccharine matter.
2765 R. Fletcher. Castor for furniture.
2766 T. E. Clarke. Bedsteads.
2769 F. Parkes. Nails.
2773 J. H. Nelson and T. Briggs. Heating water.
2776 F. J. Jeffrey. Urinals.
2777 C. Mace. Marine steam boilers.
2778 H. Haschke. Breech-loading firearms. (A communication.)
2789 A. T. Becks. Utilization of Bessemer steel scrap.
2791 S. Johnson. Moulding bricks.
2810 J. Piddington. Pneumatic springs. (A communication.)
2817 R. P. Faucheux. Pipes and cigar tubes.
2821 T. Ollis. Registering apparatus.
2826 J. B. Hulme. Excavating.
2836 J. Barker. Consuming smoke.
2837 J. H. Johnson. Projectiles. (A communication.)
2838 H. Wallwork. Hats.
2845 W. Warren. Street sweeping machines.
2848 T. Blackhurst. Composition to prevent the oxidation of iron.
2852 A. M. Clark. Preparation of extracts of madder. (A communication.)
2854 J. Withinshaw and J. E. Baker. Machinery for working slide valves.
2883 W. Gadd and B. Walker. Narrow fabrics.
2887 W. R. Lake. Loading heavy ordnance. (A communication)
2888 W. R. Lake. Revolving batteries. (A communication.)
2899 A. M. Clark. Producing motive power. (A communication)
3001 F. D. Frost. Rollers for spinning.
3007 W. B. Adams. Locomotive engines.
3017 G. M. Wells. Boots and shoes.
3033 S. S. Maurice. Fastening for neckties. (A communication.)
2971 A. V. Newton. Dredging boxes. (A communication.)
3026 A. M. Clark. Railway brakes. (A communication.)
3138 C. L. Hett. Governors of steam engines.
3178 W. Thompson. Omnibuses.
3510 J. W. Burton. Treatment of fibrous materials.
3516 A. M. Clark. Presses for stamping. (A communication.)
60 G. Warsop. Mangles.
62 G. Warsop. Washing machines.
143 J. J. Ashworth. Looms.
174 H. H. Lloyd. Coffins.
207 J. L. Davies. Securing corks. (A communication.)
218 H. Brinsmead. Thrashing machines.
228 S. Bennett. Drying grain.
237 W. Oram. Heating buildings.
245 H. M. Ragland. Tanning hides. (A communication.)
283 F. N. Clerk. Washers.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed February 8, 1868.

2287 H. W. Withers	2315 J. Shanks and J. Cargill
2288 F. Wirth	2403 J. Newark
2292 W. R. Dawson	2455 W. B. Smith
2293 F. J. Seymour	2572 A. M. Clark
2300 J. Davenport and J. Kitson	2578 W. E. Newton
2305 R. Girdwood	2594 R. Lowe and J. Taylor
2306 R. Edmondson	2643 L. Lenzberg
2311 A. Turner and W. Hemsley	2980 A. M. Clark

Sealed February 11, 1868.

2220 J. H. Johnson	2347 T. Bushby
2310 E. Courtin	2350 E. Ormerod
2318 W. T. Eley	2351 A. F. Baird
2320 H. T. Everist	2356 M. Henry
2322 J. J. Bright	2362 A. Leveson
2323 G. and J. Pilling, and F. Jennings	2370 F. B. Houghton
2331 J. Fawcett	2372 M. Cahen
2332 T. Walker	2381 C. Reitert
2334 W. B. Leachman and J. Holroyd	2384 W. Burrow
2337 J. A. Jones, R. Howson, and J. Gjers	2388 A. Cohen
2341 G. Buxton and S. Bann	2389 J. Murgatroyd
2343 H. Bessemer	2507 J. Howard and E. T. Bousfield
2344 J. T. Way	3110 H. Allman and F. N. Gisborne
	3345 W. R. Lake
	3473 J. Durrans

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

309 S. W. Wood	371 J. Dale
328 A. Steven	396 A. V. Newton
330 A. A. Hulot	405 J. G. Tongue
345 J. Lake	426 B. Thompson
360 R. A. Brooman	450 A. V. Newton
370 A. V. Newton	470 W. Robinson

PATENTS ON WHICH THE STAMP DUTY OF £10 HAS BEEN PAID.

331 J. Higgins and T. S. Whitworth	315 T. and J. Blezard
	333 C. While

LIST OF SPECIFICATIONS PUBLISHED

For the week ending February 8, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1730	2 0	1851	1 0	1884	1 4	1906	0 10	1922	0 4	1947	0 4
1770	0 4	1855	0 8	1885	0 4	1908	0 4	1923	0 4	1950	0 4
1773	0 10	1863	0 6	1886	0 10	1909	0 4	1924	0 4	1952	0 4
1776	0 10	1864	0 8	1890	0 8	1910	0 8	1928	0 4	1957	0 4
1781	0 8	1866	0 8	1894	0 6	1911	0 4	1929	0 4	1958	0 6
1783	1 8	1867	0 10	1897	0 10	1912	0 4	1931	0 4	1964	0 4
1815	1 8	1868	0 4	1899	1 8	1913	0 4	1940	0 10	1965	0 4
1819	0 8	1870	1 4	1900	0 4	1914	0 4	1941	0 4	1967	0 8
1827	0 8	1871	1 2	1901	0 4	1918	1 0	1942	0 4	1969	0 4
1830	1 6	1874	0 8	1902	0 8	1919	0 8	1943	0 4	1970	0 4
1834	1 4	1875	1 0	1903	0 4	1920	0 4	1945	0 6	1986	0 4
1836	0 10	1880	0 6	1904	0 8	1921	0 8	1946	0 4	2279	0 10
1837	0 6										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, FEBRUARY 21, 1868.

AMERICAN ORDNANCE.

WHATEVER representations or misrepresentations may have been made on either side of the Atlantic with regard to the performances of American ordnance, it is certain that it comes out very creditably in this respect in the report of the U.S. Chief of Ordnance—General Dyer—just issued. The official facts contained in this report are at once interesting and instructive, and General Dyer demonstrates that the American heavy smooth-bores are "the cheapest and most effective guns possessed by any nation." Let us see how this assertion is borne out by the circumstances of the case. We should, however, premise that—as stated in the report—persistent efforts have been made for some time past in America by ignorant or designing persons to destroy public confidence in the heavy guns which have been provided by the Ordnance Departments of the Army and Navy. Iron castings, placarded as representing the condition of the metal in American heavy guns, have been placed in conspicuous public places, and publications have appeared in prominent journals asserting that those guns were worthless; that they could only be fired with very light charges of powder, and that they would burst if fired a few times rapidly. The Bureau of Ordnance accordingly directed experiments to be made to test the power and endurance of these guns, and it is upon their results that General Dyer takes his strong standpoint. The report states that the 20-inch gun has been fired with a charge of 200lb. of powder and a shot weighing 1,100lb., and the General states that this may be the regular charge for this gun. The range at 25deg. elevation was more than four and a-half miles. The 15-inch gun, about the performances of which, at Shoeburyness, we in England know something, has been fired as follows:—7 times with 40lb. of powder and and a shell weighing 350lb.; 5 times with 50lb. of powder and a shell weighing 350lb.; 70 times with 50lb. of powder and a shot weighing 434lb.; 59 times with 55lb. of powder and a shot weighing 435lb.; once with 60lb. of powder and a shot weighing 434lb.; once with 75lb. of powder and a shot weighing 434lb.; once with 80lb. of powder and a shot weighing 434lb.; once with 90lb. of powder and a shot weighing 434lb.; and 125 times with 100lb. of powder and a shot weighing 434lb. The mean range obtained with 100lb. of powder and an elevation of 32deg. was 7,732 yards. The mean initial velocity of the shot, with the same charge, was 1,510ft. per second. Ten rounds were fired in 35min., which was as rapidly as the gun could be fired with 100lb. of powder and a solid shot. An examination of the gun has failed to detect any enlargement of the bore from firing, neither has the metal been cut away by the powder. In fact, the gun is reported to be serviceable in every respect.

We next come to the trial of a 15-inch navy gun, which has been fired twelve times in 16min. with 40lb. and 55lb. of powder and solid shot without injury. It should not be forgotten that a number of 15-inch navy guns were fired in action several hundred times, and some of them with 60lb. of powder and solid shot. Two of these guns had their muzzles blown off in consequence of the premature explosion of shells in the bores, but no other injury was sustained. A 10-inch gun, the metal of which had a greater initial strain than the maximum limit which had been established, was fired without injury to the gun 18 times with 18lb. of powder and a shot weighing 127lb.; 17 times with 20lb. of powder and a shot weighing 127lb.; twice with 22lb. of powder and a shot weighing 127lb.; 453 times with 25lb. of powder and a shot weighing 127lb.; 120 times with 26lb. of powder and a shot weighing 127lb.; 4 times with 27lb. of powder and a shot weighing 127lb.; and once with 30lb. of powder and a shot weighing 127lb. The only 12-inch rifle gun made for the Ordnance Department was fired 107 times with charges of powder varying from 35lb. to 85lb. and a shell weighing 477lb.; 341 times with charges of powder varying between 35lb. and 80lb and a solid shot weighing 620lb. With 50lb. of powder, the mean initial velocity of seventy-five shot was 1,139ft. per second. This gun is reported as perfectly serviceable. It is a cast-iron gun, cast hollow and cooled from the interior. The cost is stated to be less than one-seventh that of wrought-iron guns. In concluding his report, General Dyer observes:—"While the results of actual trial have satisfactorily demonstrated the strength, efficiency, and reliability of our smooth-bore cast-iron cannon of large calibres, and similar trials have warranted the same expectations in regard to rifled cannon of cast iron, these latter have not as yet been tested to a sufficient extent to authorize their adoption for the service in preference to heavy rifled cannon of any other material. I should not, therefore, feel justified in procuring any large number of these rifled cannon at present, but would prefer to make further trials with such number only of them as may be necessary for that purpose, and to await the results before proceeding to procure the cannon of this kind which our permanent fortifications will require. So important is it, in my opinion, that these trials should be made, that I earnestly recommend that two 10-inch and two 12-inch rifle guns be made at once and fired to extremity, to test their power and endurance."

In glancing over this report we are first inclined to ask, what becomes of the observation Admiral Farragut is reported to have made when in England about the 100lb. charge for the 15-inch gun? We were told that the Admiral, on hearing that at Shoeburyness we were firing 100lb. of powder in the 15-inch gun, said "Ah! you may fire those charges if you like, but we don't do that in America." If they had not done so then, they have since, over and over again, so that the 15-inch gun has proved itself equal to 125 rounds with this heavy charge and a 434lb. shot, besides a long series of lesser charges. With the 100lb. charges the main range, with an elevation of 32deg., was 7,732 yards, nearly four miles and a-half, the initial velocity being 1,510 feet per second. We have, then, from official reports, two material points conclusively established, namely, that the 15-inch gun is fired with a succession of 100lb. powder charges, and that it is capable of sustaining these charges without damage or detriment. Another point raised in England, that this gun could not be fired with sufficient rapidity, appears to be answered very satisfactorily in the report. There we find that a 15-inch gun was fired ten times in 35min. with 100lb. powder charges and solid shot, whilst a navy gun of the same calibre was fired twelve times in 16min. with 40lb. and 55lb. of powder and solid shot. If the performances of the 15-inch gun are thus proved to be in every respect satisfactory, no less so are those of the 20-inch gun. This formidable weapon has been fired with 200lb. of powder and a shot weighing 1,100lb., the range at 25deg. elevation being more than four miles and a-half. This gun and its charge are difficult things for us to realize, but here they are, and here are their results, and, what is more, General Dyer has no hesitation in assigning this heavy charge as that which may be regularly used in this gun. However we may argue down the matter in theory, there is no getting over these practical facts, unless we dub General Dyer a fool, and his report a fiction.

LONDON GAS SUPPLY.

IT seems passing strange that London, the boasted capital of the world, should be so much worse served in the matter of gas supply than scores of provincial towns that might be named. Notwithstanding the enormous, constantly and rapidly increasing consumption, which should enable the gas producers to manufacture an article of the best quality, and deliver it with a profit, at a much lower price than the concerns requiring plant that do comparatively only a fraction of the work, the price charged is amongst the highest, and the quality of gas delivered amongst the lowest, known in the United Kingdom. The gas delivered in London at 4s. and 4s. 6d. per 1,000 feet, and nominally of fourteen candles illuminating power—often not ten, it may be doubted—is greatly inferior to what is delivered in Manchester—twenty-two candle power at 3s. 2d. per 1,000 feet. The charges in freight of coal cannot be the sole reason for the higher price, seeing that better gas is delivered at Plymouth for 2s. 9d. per 1,000 feet than in London for 4s. 6d. At Bradford the price is 2s. 4d. to 3s. 4d.; at Liverpool, 3s. for Cannel gas; at Birmingham, 2s. 7d. to 3s.; Nottingham, 3s., &c.; but scarcely in any city or town is the price so high or the quality as low as in London, where the annual income of the gas companies reaches, if we mistake not, nearly three millions sterling. The enormous profits which ought to be netted must either be squandered profligately or divided illegally, in violation of the statutory limitation of 1860 to ten per cent; or they must fail to be realized with such prices, because of sheer recklessness, ignorance, or inability in the management and manufacture. This grievance of dear and bad gas has long been a subject of loud and general complaint but notwithstanding its having been repeatedly before Parliament, no effective remedy has as yet been provided, and now the thirteen companies that supply London are threatening the perpetuation of the evil, in a bill they have before Parliament in the present session for their amalgamation and the guarantee of their "vested interests."

The exorbitant price paid by the inhabitants of London for the very bad gas served to them is practically a heavy and grievous tax upon a necessary of life. There was no argument applied against the defunct window duty that may not be applied with equal or greater force against this impost, which is the more vexatious indeed that it goes to the enrichment of private individuals, whereas the proceeds of the window duty went into the national purse. Artificial light, as a means necessary to the subsistence, not to speak of the comfort, of thousands of our population, is as essential as the daylight of Heaven, and neither the one nor the other seems to us a proper source from which the national exchequer should draw contributions, or the speculating capitalist his most safe and bountiful dividends. Whether the whole creed of the "Manchester school" may be safely accepted or not we will not venture to say, but in this matter the example of the Manchester corporation is well worthy of imitation. The gasworks of Manchester are amongst the largest and best managed in the kingdom, and the waterworks, of which the same might be said, are the property of the corporation, and any profits accruing from the supply of gas are devoted to public objects. Many splendid street improvements have been effected in Manchester from this source. The citizens of London will regard with general satisfaction the adoption of the same course by the Corporation of London. In their intercourse with the gas companies, the Corporation authorities have had repeated occasion, we

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believe, to complain of bad faith, and they are now trying to get the matter of gas supply into their own hands, by a bill to be prosecuted during the present session. The bill of the companies for amalgamation offers nothing to conciliate public support; it is a mere ark for the preservation of the proprietors' interests.

The Corporation bill is of a very different character. Its preamble declares its purpose to be to supply the City as abundantly as possible with gas of as good a quality, and at as low a price as circumstances will admit. The professions in the preamble are fairly carried out by the provisions in the clauses. The bill takes powers to purchase the works and mains of the Great Central, the City of London, the Gas Light and Coke, and the West London Junction gas companies. It is proposed to discontinue entirely the manufacture of gas in the City, and to erect new works at North Woolwich. The bill provides that the gas supply shall be of not less than eighteen candles illuminating power; that it shall not contain more than twenty grains of sulphur in any form in 100 cubic feet of gas; and that the gas shall not discolour turmeric paper, or paper imbued with acetate of lead, when such paper is exposed to a current of gas issuing for one minute from an orifice one-fourth of an inch in diameter, at a pressure of not less than half an inch of water. Dr. Letheby's sulphur test is to be employed. The chemical examiner's reports on the illuminating power, purity, and pressure of the gas will be had on request and payment of a small fee by the consumer. The Corporation propose that they should have powers under the bill to supply the City of London and its liberties, and the Metropolitan and Islington markets. The bill is a reasonable and, in all respects, proper document; it will be prosecuted, we hope, with vigour and perseverance, and will evoke such a measure of earnest support as is due to its merits, and as shall induce and justify the Legislature in converting the Bill into an Act.

A QUEER PERIODICAL.

ABOUT two years since a new periodical, ostensibly devoted to the interests of the engineering profession, was started in London. This paper is in every sense so unique in its character, so audacious in its pretensions, so clamorous in its appeals for support, so energetic in its abuse of all those who may chance to differ from it in matters of opinion, and so little scrupulous in its management, that it fairly challenges criticism. Its ostensible proprietor, editor, manager, all in one, is an American; we may add, indeed, an American of the Americans. Steeped to the very lips in the principles of United States' journalism, he might have sat for the portrait of Colonel Diver, as drawn by Mr. Dickens. When we peruse the weekly papers of our Yankee contemporary, we become convinced that Mr. Dickens' sketch was no caricature. The veritable Colonel walks and moves, and has his being, before us, and the picture is very far from not having its humorous side. The air with which our New York author, editor, manager, proprietor, speaks of "We English," is excessively comical—so comical, that if the man, by his writing, did not tend to injure the fair fame of British journalism, we could not resist a hearty laugh; and, besides, he deals so freely in libellous abuse of those who do not, according to his appointed method, secure his good will, that his paper causes no small annoyance to English engineering manufacturers, many of whom, failing to see through the shallowness of his pretensions to real influence as a journalist, hope to keep him quiet by contributing more or less largely to his advertising columns. We have said that his paper is unique, and it is especially unique in that, as a matter of notoriety, its chief supplies are believed to be drawn from the coffers of one of our most eminent steel manufacturers, whose productions, processes, and patents he is never weary of puffing and repuffing, and puffing again *ad nauseam*.

We do not wish it to be supposed that this paper is without some merit. The spirit of pugnacity is largely developed in the British character, and most young Englishmen like a good fight. Children are delighted by the whirling sails of a windmill, and this is the very windmill of literature. Its sails revolve with a mighty sweep, now ascending far into the regions of self-laudatory bombast, and anon sinking into the lower regions—alas that we should have to say it of a thing professedly so noble—of what is idiomatically termed Billingsgate. Each week its readers are treated to something new in the way of denunciation, or if for the moment it should happen that no one has offended grievously, the editor publicly pats himself on the back, and calls himself an excellent fellow. Like little Jack Horner, indeed his favourite refrain is "What a good boy am I!" Sensationalism has hitherto being confined to the realms of fiction, but our Yankee editor, proprietor, manager, has cut out a new path for himself. We guess he has laid out a new track in which he walks alone. He has succeeded in achieving the unparalleled feat of producing a sensational technical journal, and indeed it is no matter for wonder if he enjoys—as he says he does—a tolerable circulation, we presume among the juvenile members of the profession.

Sensation authors could not possibly get on without crime. If there were no murders their occupation would be gone. Our editor finds his murders in the leading articles of our respectable contemporary "The Engineer." "The Engineer," indeed, is far better for him than a murder can possibly be to Miss Braddon or Wilkie Collins. It is not only the murder but the murderer. He pursues it, and hunts it down, and gibbets it week after week with an energy and pertinacity worthy of a better cause. Indeed, we do not know what would become of him if "The Engineer" did not exist. Like Othello, his occupation would be gone, and his paper would cease to be funny. He makes no secret of a wish to bring about the collapse of "The Engineer," but he is injudicious and unreasoning. Like Samson, he would pull down the pillars of the building in which all his nobles sit. The destruction of "The Engineer" could be little short of suicide. For a time it is possible that he might manage to be funny in a gloomy sort of fashion about a well-known author, and he might possibly protract a wretched existence by falling foul of us, or of "The Builder," or of the "Practical Mechanics' Journal," but "The Engineer" is his mainstay, and, that gone, it is easy enough to see that he would of necessity be involved in the crash. Seriously speaking, the true character of the journal to which we refer deserves to be better known. We have laughed at it, and so no doubt have a large proportion of its readers. And our contemporary "The Engineer," staid, and serious, and truly representative, if it deigns to take any notice whatever of the lucubrations of our Yankee editor, no doubt does the same.

But the journal, such as it is, possesses just enough of cleverness to be mischievous. It is got up, too, by one who does not trade on his own bottom, as merchants say, and therefore it is lavishly illustrated, and rendered as attractive as pictures can make it. If the engravings are not always very refined, or very accurate, or very well selected, who among such readers as it has is likely to know the difference? It so bespatters itself with praise, too, that the unwary are likely enough to be led to believe that it is influential. We know as a fact that many engineers advertise in it without receiving any cash in return in the shape of orders, and woe betide the man who once advertises himself in its advertising pages and dares to draw back. One firm brought out a donkey pump some time since, and advertised in the paper under consideration for three months without obtaining a single order, as was to be expected from the nature of its circulation. In a rash moment they withdrew their advertisement. The week following, the world was told that Messrs. Brown's donkey pumps were "asinine abortions," and about once a month since on the average we have had the same story repeated in different forms. Last week the firm in question took their revenge. They published dozens of testimonials in favour of their productions, and with admirable satire published also some of the worst accusations which had been brought against the pump in question by our American friend, thus putting his opinions on record as very directly opposed to those of the most extensive employers of steam power and boiler feeding apparatus in the kingdom.

The effect of the author's lucubrations, too, is, unfortunately for himself, signally impaired now and then by curious inconsistency. While an advertisement is *in nubibus* he is usually excessively civil to his fish. If the fish slips off the hook, he pelts him with stones, and thrashes the stream into a perfect froth of mud. A notable fish was the advertisement of an eminent maker of wood-working machinery. We are told one week that this machinery was first-rate in the design of the framing, but the expected advertisement did not come. One week we had the bait; very shortly afterwards we had the stones. The handiwork of the firm was denounced even more vigorously than it had been praised. Our editor was determined that they should not be advertised by him; so, determined that, against all the rules of civilized journalism, he consigned a temperate letter of remonstrance and explanation to his waste paper basket. From his tribunal there is no appeal.

Our American friend has a hobby too—a hobby which is ridden very nearly to death. This hobby is Mr. Bessemer's process. No such process and no such steel ever was heard of before. The process is so magnificent, and the steel is so good, and Mr. Bessemer is so great a man that the £200,000 a-year which that gentleman receives as royalties is not sufficient reward. What a disgrace to the age that he is not made a baronet! Not a knight, dear reader; that is good enough for a man of science, but not good enough for Mr. Bessemer. The unfortunate "Engineer" ventured some time since to hint that we did not know all about steel rails yet, and that certain facts could be urged against their use. This was really an opportunity for our friend. The Yankee eagle screamed and danced on his perch till his feathers fell out, but, strange to say, "The Engineer" has survived the onslaught. Steel rails are being very slowly adopted, and many highly influential trade journals are endorsing its opinions. "The Engineer" offended again by venturing to criticise and explain Mr. Hargreaves' process of steel making. Then the eagle was a sight to be seen—not described. And yet Mr. Hargreaves has survived, and "The Engineer" too. The week before last, "The Engineer" had the temerity to publish an article full of playful *badinage* plainly indicating Mr. Bessemer's connection with the journal in question, which journal rose with the occasion, and denounced "The Engineer" with a vehemence only equalled by a want of knowledge of the Latin grammar. And so we suppose the play will go on to the end, and our Yankee contemporary will continue to delight appreciative but limited audiences.

At first sight it may appear strange that Mr. Bessemer should lend his aid to such a production as this, but the wonder ceases when we recollect the foolish horror which some men have of being publicly criticized—a horror increased tenfold when it is known

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that the critic is at once unscrupulous and possessed of a certain fund of cleverness. We see the operation of this terror in the fact that many good names are included among those who advertise in our American friend's pages. They may chance to get an order which will pay all the cost of the advertisement, and they may consider peace and quietness cheaply purchased at such a price. Whether the immunity from criticism is purchased too dearly by an inevitable loss of self-respect each man will decide for himself. It is to be regretted that any journal conducted on such principles should receive support, and people will possibly find this out after a time. As for ourselves, we should hardly have dared to write this article did we not know that the means of safety were in our grasp. If our New York editor, proprietor, manager, is only a little savage next week we think we can survive it. If he is very ferocious we shall adopt the means of defence provided. We shall send him a good long advertisement, paid in advance.

THE ROYAL NAVAL ENGINEERS.

JUST twelve months since we uttered a plea on behalf of the engineers of the Royal Navy, pointing out various disabilities under which they laboured, and from which they very properly sought to be relieved. Some of these grievances, we are happy to say, have since been redressed, although others have been left unnoticed. The Royal Naval Engineers have again recurred to these unremedied points in a very temperate and straightforward statement, in which they confine themselves strictly to those points which bear directly and certainly most injuriously upon their interests. The first request is that chief engineers should be allowed to reckon for increase of full and half-pay the whole of the service rendered previous to attaining that rank, instead of only four years, as at present. To our minds, nothing appears more reasonable than this request, and for many reasons. In the first place, an engineer, on entering the Navy, must be possessed of the necessary educational and practical attainments to qualify him for immediately entering upon a course of arduous and responsible service. This service extends over a period of from twelve to fifteen years before he attains the rank of chief engineer. The average is now above thirteen years, and is, we understand, rapidly increasing. In many instances a very large portion of that time is served in the capacity of senior engineer of a small vessel. Here, being in charge of the machinery, the officer is called upon to perform the duties and incur the responsibilities of chief engineer. Now, it is certainly a great hardship that so large a portion of time, during which valuable service has been rendered, should be lost.

It further appears that the average age at which an engineer officer arrives at ward-room rank is much higher than is the case with officers belonging to any of the collateral branches of the Navy. This disproportion threatens to become greater in future, unless means are devised to insure a more satisfactory flow of promotion. What the present rate is may be judged from the fact that during the past two years the promotions to the rank of chief engineer have not reached one per cent. upon the number of juniors! It thus appears probable that the long period now required to attain the rank of chief engineer will be much extended in the future. Another point which should not be lost sight of is that in consequence of not having been promoted at an earlier period of life, the majority of present chief engineers will be unable, under existing regulations, to attain the highest rate of full pay allotted to that rank sufficiently early to realise any other advantage than the increased rate of half-pay or retirement contingent upon its attainment. Indeed, a large number will fall short even of that benefit by being unable to render the amount of service required, viz., 21 years in the rank of chief engineer. The result is that the rate of full pay, instead of being enjoyed for a moderate period as a reward for long and meritorious service, is practically unattainable, except by a limited few, who, from exceptionally fortunate circumstances, have reached the rank of chief engineer at an age considerably below the average. Now, the Admiralty view of the case is that an assistant engineer on first entry in the Navy can only be regarded as inexperienced. But this is no answer to the present question. Our authorities must allow that four years is a most inadequate recognition of the long period of service rendered prior to the attainment of the rank of chief engineer. This is the more apparent when we find that the Queen's regulations and the Admiralty instructions require that an assistant engineer must serve at sea for three years, and be fully competent to take charge of a watch at sea when steam is up, before he can receive his first promotion. In common fairness, then, we say that permission ought to be given to reckon for increase of full and half-pay the whole of the service rendered previous to attaining the rank of chief engineer.

The next point is one to which a passing allusion has already been made. It is that means may be devised for insuring a more satisfactory rate of promotion to the rank of chief engineer. The simple facts bearing on this subject are that only five officers were promoted to that rank in 1866 and twelve in 1867 from a body numbering more than 500, exclusive of all first and second class assistants. Those so promoted had served from six to eight years in the rank of engineer, and about fourteen years in all ranks. Of course, these gentlemen feel keenly that every day served over four years is, as far as future recompense is concerned, utterly lost to them, and that however long they may serve in that position—from no fault of their own—they receive no increase of pay. To remedy this unsatisfactory condition of matters, and to improve the rate of promotion in some degree, it is suggested that chief engineers should be allowed to retire at fifty years of age with an increase of half-pay beyond that to which an officer retiring would be entitled by service. The reasonable expectation is that this would result in the retirement of a number of officers, and, consequently, of the promotion of a corresponding number of engineers. It is further suggested that chief engineers should be appointed to all vessels in which other departmental chiefs are borne. If, notwithstanding the adoption of these, or any other measures, an engineer should remain in that position after duly qualifying for the rank of chief, it is only fair that he should receive an increase of pay. We are aware that there are a few difficulties in the way of dealing with these matters in the manner suggested, but they are by no means insuperable, and we think that the Admiralty Lords could easily find a way by which these grievances could be redressed. It is a matter for serious consideration, and we appeal to those within whose province its consideration comes to deal equitably with the question, and to ameliorate the present position of the naval engineers, which is assuredly one of great hardship.

It now only remains to draw attention to one more request which the naval engineers prefer, and that is that an increase of full and half-pay should be allowed at shorter intervals than five years, as at present. This request was made last year, but not having been acceded to is now repeated. And it is a matter worthy of every attention; for, as the case now stands, a real grievance is experienced by those officers who, from illness or other cause, may be removed, temporarily or permanently, from active service at a time when a large portion of the required term of five years has been served. By the present system, these officers are, for want of the remaining portion of the term—perhaps only a few weeks, or even days—deprived of a very large fraction of their income, being in some cases as much as one-fourth. The old system of requiring five years' service to be rendered for each increase of full and half-pay has been broken through in the case of other classes of officers of rank corresponding to that of the naval engineers. We therefore trust that this will be borne in mind, and will lead to a favourable reception of so fair and reasonable a request as that we have considered.

In urging upon the Admiralty authorities the necessity of taking some steps to remedy the very defective condition of the naval engineers' regulations, we would not be considered as blind advocates of the question. Apart from the justice and moderation of the requests, we look at the duties and responsibilities of those who prefer them. Progress is everywhere the order of the day, and nowhere is improvement more general than in the machinery of the vessels of the Royal Navy. And this refers not only to propulsion, but to various other purposes to which machinery of a delicate and complicated nature has been applied on board ships of war. The great extension in this direction has materially increased the duties and responsibilities of the engineers, upon whom the supervision and maintenance in a proper state of efficiency of this machinery devolves, and who have to perform any repairs required at sea. Hence the services of experienced and skilful engineers are of continually increasing value to the country, and whilst anything like senseless complaining ought to be scouted, such perfectly equitable and moderate requests as we have been discussing ought to be granted, and the unquestionable hardships which they represent ameliorated.

DOCKYARDS OF THE MEDITERRANEAN.

SITUATED upon the shore of a tideless sea, the little town of Seyne presented, nearly a century ago, advantages for the construction of vessels that were not disregarded by the somewhat primitive class of shipbuilders that carried on their business at that port. About the year 1790 it could boast of two or three workshops, where the description of vessels constructed was upon a very limited scale. With a liberality not usual among corporate communities, the authorities of La Seyne exacted no toll or duty from anyone who chose to lay down a keel, and when the labours of the temporary occupant were accomplished, the slip was at the service of the next comer. This truly happy method of managing business did not, however, continue very long. In the year 1830, the first steamship was put upon the stocks, no longer by simple right of "first come first served," and in about ten years subsequently, when the dimensions of the vessels assumed a respectable size, a harbour was constructed. The building of iron ships commenced twenty years ago, but it was not until 1856 that a company took up the management of the works, expended a considerable amount of capital upon them, and started business upon a large scale. Among their early improvements was the construction of a wet dock, measuring 420ft. by 160ft.; the deepening of the canal leading to the workshops, so as to allow of vessels drawing a good deal of water coming right up to them; and the reclamation of a large quantity of land lying immediately adjacent to the Mediterranean, and which has since been turned to good account for erecting additional warehouses and sheds. At La Seyne the keels of a dozen vessels can be laid down contemporaneously upon the inclined slips, between which the forges and every

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mechanical appliance necessary for their completion are placed. In addition to the water communication, a railway runs to different parts of the premises. Towards the eastern side is situated the timber store, and that of the iron towards the west, in the latter of which are kept the plates, angle, tee, channel, and other sections of iron usually employed in marine engineering. A continual supply of these modern indispensable accessories to shipbuilding is forwarded from the well-known establishments of Creusot, Terre-Noire, Saint-Chamond, and others, which furnish material of an equally good quality, but which have not yet attained to the "prestige" of those mentioned. Our columns of last year contain full information respecting those great "foci" of foreign manufacturing industry. The thickness of the plates supplied varies from 0·12in. to 1·20in. Most of the angle iron is the produce of the works at Alsace, owned by M. Dupont-Dreyfus, and are invariably sent in straight lengths, any bending being effected upon the premises at La Seyne. All the iron received is tested, numbered, and classed accordingly. Were the plan of testing iron adopted universally by our English firms, who use it for constructive purposes, it would tend to promote a greater degree of confidence in the material among engineers than at present exists.

So soon as the working drawings of a vessel have been got out, the component parts are all drawn to a scale of full size upon the floor of a large room called the tracing room, which, besides ensuring great accuracy in the workmanship, frequently leads to advantageous modifications and alterations which escaped the original designer. Timber is rarely employed at La Seyne in the actual shell of a ship, its use being confined to the construction of the masts and planking for the decks. The ribs, after being drawn to a full-size scale, are modelled in wood, which serve as templates for the bending of the iron. The ribs having been curved to the proper form, are punched for rivets, and numbered consecutively. Solid blocks of timber, bound together by an angle iron, the angle of which is very obtuse, constitute the keel. The lower rib of the angle iron is the real keel, and the upper one is a portion of the side of the vessel, and to which the lower part of the ribs is attached. A punching machine, and a treble cylindrical bending rolls, are the principal machinery required for the preparation of the plates of vessels destined simply for the purposes of commerce. The introduction of armour-plated vessels necessitated the erection of more powerful adjuncts to work the solid plates intended to stand the test of powder and shot, the chief implement being an hydraulic press capable of exerting an enormous pressure. Among the ships of war built at the workshops of La Seyne may be mentioned the "Numancia." As this vessel has obtained some little notoriety, a short account of her will be interesting to our readers. She is an armour-plated frigate of nearly 7,500 tons, and was built for the Spanish navy. In the service of that nation she figured in the attack upon Callao, and is remarkable as being the first European armour-plated vessel that passed the Straits of Magellan, and floated upon the waters of the Pacific Ocean. She occupied a period of nearly two years in building, is entirely of iron, and carries no ram. Immediately above the line of flotation there are fixed two longitudinal partitions reaching to the gun deck, and constituting, with the external skin of the vessel, two extensive watertight compartments. Five additional partitions of a similar character, but placed at right angles to the two described, complete the system of defence against any ingress of water that might arise from a ball penetrating the hull below the water line. The plates, which were manufactured at Rive-de-Gier, are a fraction over 5in. in thickness, and cover the whole of the sides, which have a total length of 320ft. A backing of teak, 16in. thick, serves to support and hold the plates. Four times their nominal power is the working ratio of the "Numancia's" engines; the diameter of the cylinder is 7·03ft., and the stroke of the piston 4·28ft. At the assault upon Callao the plates of the "Numancia" successfully resisted the impact of shot weighing 330lb. fired from the Blakeley gun, one only of which pierced her armour and lodged in the teak backing. The cost of this vessel, without including the item of artillery, was upwards of £300,000.

Another ship of a similar nature was constructed at La Seyne for the Italian Government, named "La Regina Maria-Pia"; she was built in sixteen months, and took part in the battle of Lissa, coming out of the engagement with no greater damage than the indenting of some of her plates, which are 4·8in. thick, to the depth of a couple of inches. Her length over all is 250ft.; her displacement is nearly 4,500 tons, and her cost, exclusive of war material and cannon, £175,000. Upon a similar plan the sister vessels, "La Terrible," "La Formidable," "Le Palestro," and "Le Varèse," were built and launched from the same ways. The establishment at La Seyne has also been called upon to extend its aid to the Brazilian Government, which forwarded an order for an armour-plated corvette, which was finished in the short space of time of one year. Her chief feature was very small draught, as she was required to navigate in 12ft. of water, whereas vessels of this description usually draw double that depth, and frequently a good deal more. The plating extends to the upper deck, and there are two transversal partitions. A number of gunboats designed expressly for river warfare were built at the establishment under notice, for the Ottoman State, and also those, capable of being readily taken to pieces and put together again, which were intended to be employed upon the Lac de Garde, at the commencement of the first Italian campaign. The largest screw steamer constructed in France was launched from the port of La Seyne, and was a yacht, completed in twenty months for the Viceroy of Egypt. She was christened the "Masr," and was 380ft. in length by only 40ft. in breadth, and attained a velocity of 14½ knots per hour. Her fittings and appointments were on the most sumptuous scale, but her principal feature was the arrangement of the machinery. To impart a greater velocity to the screw, the shaft is connected with a pinion which is acted upon by a multiplying wheel, in a manner very similar to that adopted in the "Gharbie," which enjoys the reputation of having made the fastest run on record from Marseilles to Alexandria. The cost of the "Masr" was £150,000. We shall recur to this subject next week.

PHOTOGRAPHY.

THE ELECTRIC LIGHT FOR ENLARGEMENTS—THE PRESIDENT OF THE PHOTOGRAPHIC SOCIETY—PHOTOGRAPHIC RECORD OF EARTH CURRENTS AT THE ROYAL OBSERVATORY.

LAST week, on Thursday afternoon, Professor Tyndall announced, at the Royal Institution, that Mr. Ladd, the philosophical instrument maker, is going to construct a small gas engine to be used in connection with his magneto-electrical machine, for the production of the electric light. The want of some such means of obtaining the electric light has been long felt by photographers. The cost, maintenance, and poisonous fumes of the Grove's battery prohibit its commercial use for the production of photographic enlargements: hence Mr. Woodbury and others who use the electric light in photography, adopt one of Wilde's, Ladd's, or Siemens' magneto-electric machines, driven by steam power. Of course the fitting up of a steam-engine simply for photographic purposes is a thing rarely done, and those who produce enlargements in moderate quantity usually employ the light of the sun, or the rays of the oxy-hydrogen lime light. For many processes the latter light is not sufficiently rich in chemical rays to answer well, whilst for other processes it is nearly everything that can be desired. When the light of the sun is used for enlarging purposes, the operator is very dependent upon the weather, changes in which affect his interests most seriously.

A magneto-electric machine which will give a brilliant electric light when turned by hand has often been demanded by photographers, but such a powerful current as this can never be so obtained, because the law of the conservation of energy forbids that human muscular strength can ever produce in any machine more heat than is generated in the original source of power, the human body. Hence a little gas cylinder and piston attached to a magneto-electric machine will make it a very valuable instrument, especially if Mr. Ladd can make the whole arrangement portable enough for lecturing purposes. Such a machine would give the death-blow to Grove's battery in the great majority of cases where a powerful current is needed.

There are three kinds of novel magneto-electric machines now in the market. The first of these is the great invention of Mr. Wilde, which attracted so much attention two years ago, in which the induced current from permanent magnets is made to excite a row of electro-magnets, so that the armature of these secondary magnets gives off a powerful current of electricity, which may be at once applied to experimental purposes, or made to excite a third row of electro-magnets, and so on *ad infinitum*. Messrs. Siemens and Wheatstone next invented a curious machine, wherein the trace of residual magnetism in a soft iron electro-magnet was made to act upon the armature, and the wires from this armature, being carried round the electro-magnet, of course increased the intensity of the magnetism already present there. This in turn increased the power of the current from the armature, so that by constantly turning the handle, the quantity of electricity increased, according to the compound interest law, till at last a powerful current was obtained. The third machine is that of Mr. Ladd, and was invented by one of his assistants. By this plan, the electro-magnet is fitted with a double armature. The current from one armature is used to increase the power of the electro-magnet, as in Siemens' and Wheatstone's machine, and the current from the second is the one used for experimental or commercial purposes. Yesterday week, this machine, when turned by hand, heated seven inches of platinum wire ·01 inch thick to redness. It also gave flashing sparks of the electric light between carbon points, but did not give continuous illumination, for the reason already mentioned.

Of the comparative merits of these machines for photographic purposes it is too early yet to speak. Mr. Wilde's must be driven with great velocity, and this tells upon the bearings, but he is now manufacturing a new instrument, which will shortly be introduced into the market. Mr. Ladd's is a strong machine, little liable to get out of order; but he also, as already stated, is about to make further improvements. Mr. Woodbury, who has just been fitting up enlarging apparatus for M. Disderi, the celebrated Parisian photographer has there employed a magneto-electric machine sold by the Alliance Company of Paris. This machine cost about £250, and is driven by one of Lenoir's gas engines, at a cost, at the present rate of working, of a shilling per hour for gas, and twopence or threepence for carbon points. In a few months, when the improvements now contemplated are carried out, it will be easier to speak with certainty as to the relative merits of the different machines.

Sir Frederick Pollock, F.R.S., ex-Lord Chief Baron, has since his retirement from office devoted more of his time to mathematics, photography, and other favourite scientific pursuits of his younger days. As President of the Photographic Society of London, he has of late more frequently attended its meetings, and last week, on Thursday evening, a paper of his, on "The Mysteries of Numbers," was read at a meeting of the Royal Society. Some little amusement was caused at that meeting by the appearance of one of the "Daily Telegraph" staff to take down the substance of Sir Frederick Pollock's paper, because the contribution consisted wholly of abstract mathematical researches, impossible to be put in popular form for the readers of any daily journal. The reporter, however, was not "beaten," for the secretary, chancing to mention the title of a paper by the Astronomer Royal on "Earth Currents," gave him an opportunity of explaining last Friday,

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in the "Telegraph," how the movements of these wandering currents are registered by photography.

In a darkened room in the meteorological department of the Royal Observatory at Greenwich, the Astronomer Royal fixed, some two or three years ago, a sensitive little galvanometer, with reflecting mirror, to register earth currents by photography. One end of the wire of this galvanometer is connected with the earth, and the other end with a telegraph wire, which, after running several miles along a neighbouring railway, is again connected with the earth. Now, currents of electricity are continually running to and fro in the earth, and sometimes these currents enter the telegraph wires; also, when they are strong enough, they overpower the ordinary working batteries, and send unreadable messages on their own account. Such disturbances sometimes stop for a time all messages and news, and on one exceptional occasion caused a panic on the Stock Exchange, by delaying news of importance. Being a source of great occasional loss to the telegraph companies, the endeavour of electricians has always been to neutralize and get rid of the currents as soon as possible. The object of the apparatus in Mr. Glaisher's department at Greenwich, is, on the contrary, to watch and examine all the movements of these earth currents. From the description already given, it will readily be seen that as currents from the earth flow through the wire erected from Greenwich Observatory, the needle of the galvanometer shows the direction, and approximately the strength, of the current. On the little magnetic needle a mirror is mounted, and a ray of light from a steady flame, after falling upon the mirror, is reflected as a spot of light upon a sheet of photographic paper. Hence, as the needle moves, the ray of light moves to and fro upon the paper. This sheet of sensitized paper is fixed round a cylinder of ebonite, which, by clockwork, makes one revolution every twenty-four hours. At the end of the twenty-four hours the paper is taken off the cylinder, and a fresh sheet substituted. The record upon the first sheet is then developed in the usual way, and a zig-zag dark line passing across it from end to end shows the movements of the galvanometer needle and spot of light during the past twenty-four hours. The darkened room, in which this self-registering apparatus is at work, is built without iron nails, and this metal is used nowhere in the room, so that the magnetic instruments shall not be disturbed by artificial causes. In a communication made by Professor G. B. Airy, F.R.S., to the Royal Society, a fortnight ago, he made known the fact that the declination magnet and the earth current galvanometer are affected at quite, or very nearly, the same time, showing some relationship between the two phenomena, the causes of both of which are at present a perfect mystery to men of science.

TELEGRAPHY.

INDO-EUROPEAN TELEGRAPH.

THE growing importance of our Indian territory, and the vast commercial interests of this country, with its dependencies in and beyond India, render a sure and speedy system of communication every day more and more necessary. The great importance of our relations with India cannot be overrated, and it was undoubtedly this that led our Government in 1859 to promise a guarantee to the line of telegraph laid from Suez to Bombay. Unfortunately, that line lasted but a brief period, and owing to the necessary delay that took place in submerging so long a line, by the time the last section was laid, one of the earlier ones had failed, and through communication was never realized. A portion—that from Suez—was, after the laying of the Malta and Alexandria cables in 1861, diverted to Jubal, an island in the Red Sea, and messages were sent to and from that place, the mail boats calling there on their passage. This reduced the time of communication considerably, and our merchants and others were enabled thus to send at least a week's later news.

This time has, through our Government laying a cable along the Persian Gulf, been considerably shortened, and messages have been sent since the beginning of 1865, at various speeds, ranging from one day to two weeks. This submarine cable starts from Fao, at the mouth of the Euphrates, in he Shat-el-Arab, to Bushire, at the head of the Persian Gulf, thence down the Gulf, with stations at Mussendom and Gwadur, to Kurrachee, where it joins the system of Indian telegraph to Bombay and Calcutta. Previous to the laying of the cable, arrangements had been made with the Turkish authorities, and a line constructed from Constantinople to Fao, partly at our expense and partly at that of the Turkish Government. Arrangements were also made for an alternative line from Bushire, through Persian territory. By this line messages leaving England pass through the various continental systems to Constantinople, and from thence through Asia Minor to the cable. On the whole, this route has been working satisfactorily for some time, but even now it is subject to interruption, continuing on some occasions for some time. The interruptions formerly were more frequent and lasting on the Indian portion between Kurrachee and Bombay, owing to the bad construction of the lines. These, we are happy to say, are now greatly improved. Other interruptions took place through the breaking of the submarine cable, but the wise precaution of having a repairing ship on the station has prevented them from causing too serious a stoppage to traffic. For a long distance the wires pass through an uninhabited portion of the country in Asia Minor, where accidents have occasionally happened, and great delay, on account of the want of transport, has been the result. A second line has lately come into use, that through Russia and Persia to Teheran, and thence to Bushire. This line, during the late interruption in the Turkish route, was found most useful, for by it messages were continually arriving of the previous day's date, but this route, from the nature of our convention with Turkey, cannot be constantly used; besides, it is subject to similar interruptions to the Turkish lines. From the time a message leaves England it is entirely without our control until it arrives at the Persian Gulf. During that time it passes through various administrations, through the hands of numerous clerks speaking different languages. Can it be wondered, then, that messages, when they arrive at their destination, are frequently rendered so unintelligible as to be perfectly useless. Under such circumstances the number of telegrams must of necessity be less than under a perfect and good system. In mentioning these errors that take place, we must except that portion of the transit that passes through the hands of our own operators in the Gulf, for, from examination and statistics, it is proved that a very small percentage of error is due to that section. What, then, is really required is that a message should be entirely throughout its route under the control of the staff of one of our own administration. Until such comes to pass we cannot hope for that perfect system of telegraphy which the growing interests of our political and commercial relations with our Indian empire demand.

With this in view, negotiations have been for some time on foot for the establishment of a line of telegraph through Europe and Persia, so as to join our existing system in India, and we are now happy to announce that matters have been so satisfactorily arranged that we trust ere long to see commenced the erection of lines which shall place the entire control of a message throughout its route under one management. It is to the Messrs. Siemens principally we owe this result, and we now place before our readers the principal points of their scheme, which, from the features we have mentioned, command our greatest attention.

Conventions and concessions have been obtained from the various governments and authorities by the Messrs. Siemens which will enable them to erect a double wire system from England through a most direct route to Teheran, where they join the system now in connection with the Persian Gulf cable. Their interests and concessions in the matter they propose to hand over to a private company which shall be formed for the express purpose of finding the necessary funds for erection, and of undertaking the management of the lines. The proposed route will be as follows;—Two wires throughout, commencing at Nordeney, an island in the German Ocean on the Prussian coast (late Hanoverian), through Hamburg and Berlin to Thorn on the Prusso-Russian frontier, thence through Russia *via* Warsaw, Odessa, Kertch, and Poti, to Tiflis. from there through Persia to Teheran.

The Prussian concession gives the company the right of landing its own cable on the North German coast, but provisional arrangements have been made with the Electric and International Telegraph and Reuter's Telegram Companies securing to the company the use of two well insulated wires between London and the Prussian coast, including office accommodation in London. In consideration of this accommodation a royalty will be paid on each message. By the Prussian concession the Prussian Government undertake at its own cost the construction of a special double line connecting Nordeney with the Russian frontier at Thorn, and to reserve it for the exclusive use of the company in good working condition on payment of a message royalty; this, as well as in the Russian conventions, will be reduced should the through rate to India be materially reduced; and all Indian messages will be handed over to the company.

By the Russian convention the company are authorized to construct a double line from the frontier at Thorn to the Persian frontier at Tiflis, with stations at Warsaw, Odessa, Kertch, Poti, and Tiflis, and by the Persian concession, lately obtained, the right of constructing a similar line from the Russian frontier to Teheran.

The proposed line is to be constructed principally with iron posts, and in the most substantial manner; a cable of three conductors will have to be laid between Kertch and Poti, in the Black Sea, over a distance of about 250 miles, in order to avoid the Circassian Mountains, where the existing lines are subject to interruption; the line when completed will be worked by improved recording instruments with mechanical transmission of message.

The proposed amount of capital is £450,000, the tariff £3 10s. for a message to India, which, reduced by the royalties and the amounts to be paid out, will give a profit of £1 3s. per message.

The principal advantages of the proposed line are—the expenditure will be moderate—the security of the line guaranteed by conventions—the working of the line will be in the hands of the company, and of the Indian Government, giving a through communication, ensuring the greatest promptitude, and freedom from error.

The lines are to be completed within a twelvemonth, and it is proposed that they should, in the interest of the company, be constructed by Messrs. Siemens and Halcke, who, having constructed important lines in Russia, have a large staff of engineers and assistants at their command, who are thoroughly conversant with the work, and with the difficulties of language, habits, and climate, which will have to be encountered, and are, consequently, eminently qualified for the work.

This scheme is the one above all others which appears to meet the requirements of our Indian communications—the freedom from outward control—the message passing almost entirely under the hands of one administration. These are what we want to preserve a message intact and intelligible, so that the receiver may understand what is required; and believing that this scheme is eminently suited to meet our necessities, we bring it before our readers, believing that they with us will wish it every success.

Parliamentary Notes.

THE House of Commons re-assembled yesterday week after the Christmas recess, and on Friday, amongst its first deliberations, came the question of the West India mail stations as affected by the late disasters at St. Thomas's. The subject was entered upon by Mr. Kinnaird, who asked the Under Secretary of State for the Colonies whether the Royal Mail steamers were to continue running to St. Thomas's as the place for delivering and receiving the mails, or whether it was intended to adopt any English island for that purpose; and, of so, what island and harbour.

Mr. Adderley said the West India mails were not to continue to run to St. Thomas's, but one of the English islands would be selected for a new station. In deciding what this is to be, several points must be taken into consideration—the best port to which the steamers can run, the best time of running, and the capacity and suitableness of the several harbours which the different islands offer. The matter is under consideration, but no decision has yet been arrived at.

The dangerous state of the Nuneaton station and level crossing on the Trent Valley Railway were referred to by Mr. Newdegate, who asked the Vice-President of the Board of Trade whether his attention had been directed thereto, as well as to the fatal accidents which have recently occurred

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there; and whether he would have any objection to lay upon the table of the House two reports of Colonel Yolland to the Board of Trade on the subject.

Mr. Cave said attention had been directed to the condition of the station, and, in consequence of the fatal accidents which had taken place at it, an inspector had been directed to report upon its condition. A copy of the report made had been sent to the directors, which was all the Board of Trade could do in such matters, and it would shortly be printed in the returns of railway accidents presented to Parliament. He should move that the report be referred to the select committee on the London and North-Western Railway.

In the House of Lords on Monday, Lord Airlie asked the Under Secretary for War whether any steps had been taken to carry out the recommendations of the Defence Committee in 1860. In the course of his observations his lordship entered into the comparative merits of turret as against broadside armour-ships, pointing out that of the whole armoured fleet we possessed hardly any two were alike either in armour or armament, size or draught of water. He deemed it the duty of the Government to have two distinct classes of vessels,—one as seagoing cruisers, and another class of enormous strength for coast and harbour duty only. It was useless to say that vessels of the latter class could be built as soon as wanted. He doubted if this was true in fact, and, even if it was true, and they could be so built, our sudden hurry would only leave us, as we were left in the Crimean war, to the high charges and bad work of the private contractors.

The Earl of Longford said it was true that the Defence Commission of 1860 did recommend the construction of a system of floating vessels for the purpose of harbour and coast defence, and they also indicated several rivers and harbours in which such vessels might with advantage be placed. The estimate of the Commission, including £1,000,000 specially devoted to those floating batteries, was £11,850,000. When the Government reduced that vote to a sum of £7,000,000, they excluded entirely the £1,000,000 for harbour defences. He believed it had been hoped that these defences might be gradually provided out of the ordinary Navy Estimates annually voted by Parliament; but it very soon became apparent that the hope was futile. Year after year it had been found that there was no surplus applicable to such a purpose. The members of the Defence Commission, who still turned their attention to such subjects, entertained the same opinion that they formerly did as to the great importance of floating batteries. But he feared that no immediate prospect existed of their construction being proceeded with unless Parliament consented to make some special appriation of moneys to this purpose, a course of which at present there did not seem to be any indication.

The East London Museum Site Bill was reported to the House with amendments. Whilst it was passing through committee Lord Redesdale explained that his opposition on a former occasion had been directed, not against the provisions of the bill itself, but against the want of sufficient notice with regard to the lands proposed to be taken or affected. The interval which had elapsed since last December had afforded ample time for residents in the locality to make themselves acquainted with the character of the proposals contained in the bill; but it was right that these should be also understood by the public at large. In establishing, as was contemplated, a museum for the east end of London, at the national expense, they were laying, he feared, the foundation of claims to have similar institutions established at the national cost, not only in other parts of the metropolis, but in all the great towns of the kingdom as well. For his own part, he could not see why Lambeth had not as good a claim to a museum as Bethnal-green, and Dublin, he believed, was already petitioning with this object in view. It might be quite right to establish this institution, but the precedent would certainly prove inconvenient. Very good, Lord Redesdale, but let us hope that the convenience of the museum will outweigh the inconvenience of the precedent.

As some of our readers may have forgotten the object of this bill, we may explain that it is to provide out of the public treasury a sum of money for the erection of a museum in Bethnal-green upon a piece of ground which has been purchased by means of subscriptions for the purposes of a museum. The erection of this museum is much desired by people in the east of London, and the bill is the fulfilment of the promise made by the late Government on this subject. It is understood that this is a special case, and there is no intention on the part of the Government to build any other local museums.

In the House of Commons on Monday, that dangerous point Daunt's Rock was brought forward by Mr. Maguire as a matter needing immediate attention. The hon. member asked the Vice-President of the Board of Trade if the Government had had under their consideration the danger to the naval as well as mercantile interests caused by the existence of this rock, and whether, after the late accident to one of her Majesty's ships, occasioned by the frame of the "City of New York" still lying on the rock, it was proposed to place a lighthouse on the rock or to effect its removal by blasting; or if he would say what were the intentions of the Government with respect to an admitted source of constant apprehension.

We are glad to find from Mr. Cave's reply that the subject has not only been considered, but that action has been taken upon it. Mr. Cave explained that in 1864 the Irish Lights Commissioners changed the light on Roche's Point to a revolving light, which threw a white light on the rock, and also placed a bell-boat there. That expense was paid out of the Mercantile Marine Fund. With reference to placing a lighthouse on the rock itself, it was one of those cases in which the light would affect the local trade, and it would be unfair to settle the expense of it on the whole mercantile marine. Captain Shadwell's report showed that the danger had been very much exaggerated, as from 1859 to 1866 only one casualty had occurred on those rocks. It was true that since that time the "City of New York" had been wrecked there, and that the rock had been touched by the "Research," and that the "Chicago" was wrecked several miles from it. The circumstances would not justify the Irish Light Commissioners in fixing the charge of any light on Cork, but if the trade was willing to defray the expense the commissioners would have no difficulty in placing one there. A proposition had lately been made for blasting the rock, and it was now under the consideration of the Admiralty and the Board of Trade. We should say, blast away, and get rid of the pest, by all means.

The Peninsular and Oriental Company's steamers having ceased to touch at Malta, the Under Secretary of State for the Colonies was asked by Sir G. Bowyer what steps the Government were prepared to adopt for the conveyance of letters to that island.

Mr. E. Egerton stated that by the new arrangement of passing through the Straits of Messina, instead of stopping at Malta, the transit of the mails between Marseilles and Alexandria would be accelerated by twelve hours. Other mails would still be conveyed to Malta by the Peninsular and Oriental Company, but what substitute would be given to Malta for the mail between that island and Alexandria was still under the consideration of the Government.

INSTITUTION OF CIVIL ENGINEERS.

AT a meeting of the Institution of Civil Engineers, held February 18, C. H. Gregory, Esq., president, in the chair, the paper read was on the supporting power of piles; and on the pneumatic process for driving iron columns, as practised in America, by Mr. W. J. M'Alpine, M. Inst. C.E. (of New York).

The first part of this communication related principally to the experience gained in driving 6,539 piles an average depth of 32ft., for the foundation of the Government graving dock at Brooklyn, N.Y., when the support was mainly derived from the adhesion of the material into which the piles were driven, and slightly from their sectional area. The piles were in rows 2½ft. apart, and at transverse distances of 3ft., all from centre to centre; intermediate piles of tough second-growth oak being frequently employed. The main piles were chiefly round spruce spars, very straight, from 25ft. to 45ft. long, and not less than 7in. in diameter at the smaller end, and on an average 14in. in diameter at the larger end. From a record kept during the progress of the work, it was ascertained that it took two and one-third blows to drive each foot of pile, and that the distance moved uniformly diminished from the first to the last blow, ranging from 8in. at the beginning to no movement at the end, the average distance moved by the last five blows being 1in. A considerable number of the piles were driven by a Nasmyth steam piling machine, with a ram of 3 tons, and a stroke, or fall, of 3ft., and making from sixty to eighty strokes per minute. The other machines were generally operated by steam power, giving an average of a blow per minute; but occasionally the hammers were hoisted by manual and horse power. The rams in the latter machines were of cast iron, swelled out at the bottom to concentrate the weight at that point, and weighed about 2,200lb. each, though were some were used of 1,500lb.; the fall being 30ft. It was observed that the heaviest ram, when striking blows of the same effect as lighter ones, did the least injury either to the head of the pile or to the protecting iron ring, and this injury was still less with the Nasmyth hammer. It was also found that no advantage was gained by the fall of the ram being more than 40ft., as the friction on the ways then prevented any increased velocity to the ram when falling from a greater height. With the Nasmyth hammer piles were driven 35ft. in 7min., while with the other machines similar piles required one hour or more to drive them the same distance.

Experiments were made at different times to ascertain the weight which the piles would sustain. For this purpose a long lever of oak timber was employed, with which a number of the foundation and coffer-dam piles of nearly the same size, and driven under exactly similar conditions, were withdrawn. It was thus ascertained that a weight of 125 tons was required to move a pile, driven 33ft. into the earth, to the point of ultimate resistance, with a ram weighing one ton, and falling 30ft. at the last blow. These trial piles averaged 12in. in diameter in the middle. From a number of other experiments, it was believed that the extreme supporting power of the pile, due to its frictional surface, was 100 tons, or one ton per superficial foot of the area of its circumference. From an analysis of the experiments, the following general laws seem to have prevailed in these cases:—1st. That the effect of lengthening the fall of the ram was to increase the sustaining power of the pile in the ratio of the square root of the fall. 2nd. That by adding to the weight of the ram, the sustaining power of the pile was increased by 0·7 to 0·9 of the amount due to the ratio of the augmented weight of the ram. 3rd. That a pile driven by a ram weighing one ton, and falling 30ft., would sustain an extreme weight of 100 tons. The formula based upon these data, as applicable to rams weighing from 1,000lb. to 3,000lb., falling from 20ft. to 30ft., was $X = 80\ (W + 0{\cdot}228\sqrt{F} - 1)$, in which X was the supporting power of a pile driven by the ram W, falling a distance F; X and W being in tons, and F in feet. The author was of opinion that under the most favourable circumstances, the pile should not be loaded with more than one-third of the result given by this formula; and when there was any danger of a future disturbance of the material around the pile, or when there was any vibration in the structure which might be communicated to the piles, the load imposed should not exceed one-tenth. The bearing support due to the sectional area of the pile had not been considered in the preceding inquiry; but numerous experiments had been made, which gave results of from five tons to ten tons per square foot.

The island occupied by the city of New York was separated from the mainland by a navigable tidal estuary, called the Harlem River, and this was spanned by several bridges. In reconstructing the bridge forming the continuation of the Third Avenue, it was decided to make a pivot draw in the centre; and, with a view of creating the least possible obstruction to the current, the draw pier was composed of one central and ten circumscribing iron columns, each 6ft. in diameter and 50ft. in height, the water in the middle of the river being 20ft. deep. Careful experiments upon the supporting power derived from the frictional surface of these columns, when sunk from 20ft. to 30ft. in moderately fine material, had led the author to adopt a coefficient of half a ton per superficial foot of the exterior surface. These piles were sunk by the pneumatic process (both plenum and vacuum), and the method of sinking them was next described in minute detail, as well as the apparatus and means taken to ascertain their sustaining power. Although the lateral support, as determined by the experiments, in addition to that which would be derived from a base of 6ft. in diameter, showed that it would be ample for that place; yet, in view of subsequent operations, the importance of devising a method of increasing even the large base due to the size of the column offered advantages too great to be neglected, and various methods of accomplishing this result were proposed. The one adopted was as follows:—It had already been decided to fill the columns with concrete, and it

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was naturally suggested to extend this masonry below the bottom as deep as men could work in the water, and also to undermine the adjacent earth, as far as practicable, and to extend the concrete into the space. This was done in sections of about 2ft. in width, and when the ring had been completed, it was found that the column was virtually extended, and that the water would readily sink under pressure to a level with the bottom of the concrete, so that the sand within it was easily removed, and the space filled with concrete to a depth generally of 4ft., or more. Contrary to statements occasionally made, it was found that the cement set with far greater rapidity under pneumatic pressure than in the ordinary atmosphere.

The experience gained, and the reflections resulting from the operations at the Harlem Bridge proved, among other things, the rapidity, facility, and economy of driving iron columns of large size, under favourable circumstances. The extracts from the author's journal showed that the last columns were driven from 16ft. to 20ft. in from three to six days, in sand and porous material, free from obstructions. The economy of this work was indicated by the small force employed at Harlem, which was twelve men, all told, including the engine drivers, stevedores, and foreman. Their aggregate wages, and the expense of fuel, did not exceed £6 per day. The cost of the plant was under £1,500. The metal in the column, if but 1¼in. thick, was quite sufficient, would have been in New York £13 per lineal foot of the column. It was remarked that at Harlem the officers and workmen experienced neither temporary nor permanent ill effects from a pressure of two and a-half atmospheres. It was believed that cylinder piles might be driven to great depths, through extraordinary obstacles, such as rocks, logs, and sunken vessels, without serious loss of time, or at much cost; and that they would penetrate quicksand, which was so troublesome by all other methods, with unusual facility. Again, the columns might be regulated in their descent, and be suddenly arrested at any precise point, at the will of the director, by means of a pneumatic reservoir. Thus, the descent was commenced at first slowly, the velocity gradually increasing until the movement became dangerous, when it was instantly stopped. In some cases the piles could be driven by the vacuum process alone, in all cases by the plenum, and sometimes both might be employed with advantage; and the driving could be further aided by the use of mechanical pressure or weight. The support which such columns derived from their exterior frictional surface in ordinary earth was, as previously stated, at least equal to half a ton per square foot, but in the finest earth it would amount to three tons. The support from the area of the bottom in shallow depths was from five tons to ten tons per square foot; and at the great depth to which these columns would be ordinarily sunk, it must be considerably more.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

PRESIDED over by Mr. Whitworth, and supported by Mr. Reed and Mr. Penn, the London Association of Foremen Engineers may congratulate themselves that at their annual dinner, on Saturday last, they possessed among the company the respective representatives of attack and defence. Over 250 members and guests assembled in one of the large banqueting rooms in the City Terminus Hotel of the South Eastern Railway, which afforded every facility and accommodation for the required purpose. Among the guests were Major Jocelyn, Messrs. Penn, Napier, Rennie, Robertson, S. Smiles, E. J. Reed, Chief Constructor of the Navy; Captain M'Neile, Mr. Chetwynd, of the Post-office; and Captain Shaw, of the Fire Brigade. The room itself is deserving of notice. Beautifully but chastely decorated, richly gilded, and embellished with the armorial bearings of the City of London, Dublin, Edinburgh, and several other important European and continental towns, it was illuminated by six of the new sun lights, appropriately so termed, as, from the absence of all flicker, unsteadiness, and colour—the distinguishing features of artificial light—the illuminating source produces the same description of uniform glow obtained from natural causes. The room is furnished with a couple of galleries at the ends, the lower of which was occupied by ladies, but unlike those attached to the interior of St. Stephen's, no envious screen hid the occupants from the eyes of the beholders.

Among the various topics discussed in the different speeches, the one more especially of interest at the present time to us as a nation, and peculiarly so to the members of the Association, was that embracing the question of foreign competition. Different views were entertained, and different opinions expressed by different speakers, some maintaining that our long-vaunted supremacy in the various branches of mechanical and industrial art was as potent as ever; others contending that it was lost irrevocably. In neither of these views do we altogether concur. That our former supremacy is on the wane is undeniable; that we no longer possess the monopoly once in our hands is incontrovertible, with the tangible evidence in our markets, our workshops, and buildings. Divesting ourselves of all narrow prejudices and selfish considerations, and regarding the question in a broad light, the course of events existing at present, and certain to ensue in future, is an inevitable result of the age of progress. It must not be forgotten that we have, so to speak, reached the end, and in common fairness we cannot deny to others the attainments of that goal to which we have long ago ourselves arrived. The real difficulty lies in the fact that while continental nations have acquired our knowledge, have become "learned in all the learning of the Egyptians," we have not acquired theirs, which they possessed even during the time when we esteemed them ignorant almost of everything. In a word, while we have no absolute reason for fearing the competition of other nations, provided we take the proper means to maintain our own position, at the same time the signs of the times are unmistakable, and cannot be slighted or disregarded without serious consequences resulting from a neglect so reckless and so injudicious. In responding for the Army and Navy, Mr. E. J. Reed made an able speech, and noticed the importance of a ship possessing the quality of high speed as well as the advantages of thick plating and heavy guns. The secretary's report was next read, containing an interesting statement of the numerical, social, and financial condition of the Association. As is usual upon all similar occasions, the chief toast was "Prosperity to the Association," which met with an excellent reply from the energetic chairman, Mr. Newton. Mr. Wood and Mr. Smiles responded for "The Scientific and General Press," and after a few more speeches and replies the company separated.

It appears from the fifteenth annual report of the Association that during the year eight ordinary and fifteen honorary members have been added to the list, the total now being ninety-eight ordinary and sixty-three honorary members. The funds show a balance in treasurer's hands slightly diminished, but which has, however, been made up by arrears of contributions since paid. The following is an abstract of the annual balance sheet:—Income: Honorary members' subscriptions, £26 5s.; nominations and entrance, £7 7s.; members' contributions, £158 7s. 9d.; ditto, ditto, to library fund, £22 16s. 6d.; interest on stock, £11 16s.; with income for January and February, 1868, £27 2s. 6d.; total income, £253 14s. 9d. Expenditure: Books and periodicals for library, £13 19s. 0½d.; cleaning book-case, removing, and rent for ditto, £4 17s. 6d.; printing, £25 2s. 6d.; postage, £6 3s.; stationery, £2 11s. 8d.; advertisements, £1 8s.; committee meetings, £7 6s. 4d.; representative at Leeds, Foreman Engineer's anniversary, £5 11s. 8d.; rent of room, £8 8s.; secretary's salary, £10; advance to Dinner Committee, £32 4s. 3d.; paid to unemployed members, £119; sundry expenses, 15s. 10d.; expenditure, January to February, £10 14s.; total expenditure, £248 0s. 11½d.; increase of funds to February, £5 13s. 9½d. The total ordinary funds invested in purchase of £400 Three per Cent. Consols, £364 4s. 9d.; in savings bank, £60; in treasurer's hands, £62; total value of funds, £486 4s. 9d. The committee look upon the year's balance sheet as a proof of the substantial basis upon which the society is founded; and it is gratifying to reflect that at such a time, when the ordinary income is stopped, this Society has provided a partial substitute, entailing neither loss of dignity nor injury to the most delicate feelings. The superannuation fund has been increased since the last report £110 1s. by subscriptions from the following gentlemen:—Messrs. J. and A. Blythe, £20; E. J. Reed, Esq., £10 10s.; S. W. Worssam, Esq., £10 10s.; Messrs. J. and G. Rennie, £10 10s.; Messrs. G. and C. Bowen, £10 10s.; Robert Mallet, Esq., C.E., £5 5; Major Palliser, £5 5s.; Messrs. Campbell and Johnson, £5 5s.; Joshua Field, Esq., £5 5s.; John Penn, jun., Esq., £5 5s.; Charles Barclay, Esq., £5; Messrs. John Brown and Company, £5 5s.; Messrs. Morton, Wilson, and Company, £2 2s.; Messrs. John J. Bagshaw and Company, £2 2s.; Messrs. Gravel, Ewing, and Company, £2 2s.; S. W. Worssam, jun., Esq., £2 2s.; Charles Manby, Esq., £1 1s.; Jabez James, Esq., £1 1s.; Alfred Moore, Esq. (Braby and Son), £1 1s. There has been no application yet made for the benefit of this fund, which is now assuming such proportions as give additional stability to the Society.

IMPROVED PHOTOGRAPHIC PROCESS.

BY the usual manner of producing photographic impressions when the invisible impression is formed in the camera, it is removed into a dark room, and at once developed or rendered visible by means of solutions or analogous ponderable agents. Mr. F. B. Gage, of St. Johnsbury, Vermont, U.S., under a recent British patent, employs, on the contrary, what may be termed a partial development in the camera by the aid of diffused light. The development is afterwards completed in the usual way, taking the precaution to reduce the strength of the developing fluid with water.

Mr. Gage takes a photographic impression in the usual manner, and then places some plain dark dead surface in front of the camera, the sensitive surface still remaining in the camera. He then removes the covering from the lens tube, and exposes the sensitive surface on which the impression has been formed to the light reflected from the dark surface, while the dark surface is kept in gentle motion, so as to prevent the sensitive surface from taking an impression of any wrinkles or other variations on the surface from which the light is reflected. The time of this exposure is varied according to the amount of light reflected and the effect it is desirable to produce. The usual amount of time occupied in this exposure will be from one-fourth to double the time employed in taking the invisible impression; but in some cases ft can be extended much beyond this time. For a dark dead surface Mr. Gage usually uses a piece of thick black woollen cloth about 18in. square attached by one edge to a stick about 2ft. long, which is held horizontally and gently moved in front of the camera with the left hand, while the lens tube is uncovered with the right hand. It is not absolutely essential that this dark surface be kept in motion, but it is safer. This exposure of the sensitive surface to the light reflected from a dark dead surface apparently leaves the lightest portions of the impression but little changed, while it effects a much greater change in the darkest portions of the same, and thus harmonizes and properly blends the two, giving to the whole an atmospheric effect never before realized in photographic impressions; it also renders it less difficult to obtain the necessary intensity in negatives.

This invention applies equally well and is operated in the same manner in taking positives or negatives in the camera, and it may be used without further instructions in producing any style of photographic pictures. It is necessary that the dead surface be suitably lighted, and the time of exposure proportioned to the result desired to be produced. The best results are produced when the dead surface is as strongly lighted as possible without sunlight, using a diaphragm to reduce the aperture of the lens to prevent the development being so rapid as to become unmanageable. Mr. Gage has produced excellent results with a silver bath of twenty grains of nitrate of silver to the ounce of water, being about one half the usual strength in use, the sensitizing of the collodion being proportionally reduced; it will effect a great saving of expense for this reason. The inventor believes his invention also removes the most important obstacle to the production of dry plate impressions by harmonizing the lights and shades, which have heretofore usually been hard and inartistic. Exposing the sensitive surface in the manner described before the impression is formed has less tendency to blend the lights and shades than when done afterwards; but it gives a different and peculiar tone to the impression, which in some cases is very desirable, especially in negatives.

When the object to be impressed is strongly lighted, accompanied with deep heavy shadows, it is advisable to illuminate in the manner described the sensitive surface both before and after the impression is formed. This is effected by moving the black cloth before the camera a short time before as well as after, and operating otherwise in the same manner as before described. Some good effect may be produced by admitting transmitted light upon the sensitive surface, or light reflected from yellow and even red and other coloured surfaces, either before or after, or both before and after the photographic impression has been formed. The reflection from a dark dead surface, however, is much to be preferred, and Mr. Gage states that he has found his method of operating perfectly convenient and practical for use.

A VERY severe easterly gale swept over Gibraltar on the 11th and 12th inst., during which several vessels were wrecked on the eastern beach, attended with much loss of life.

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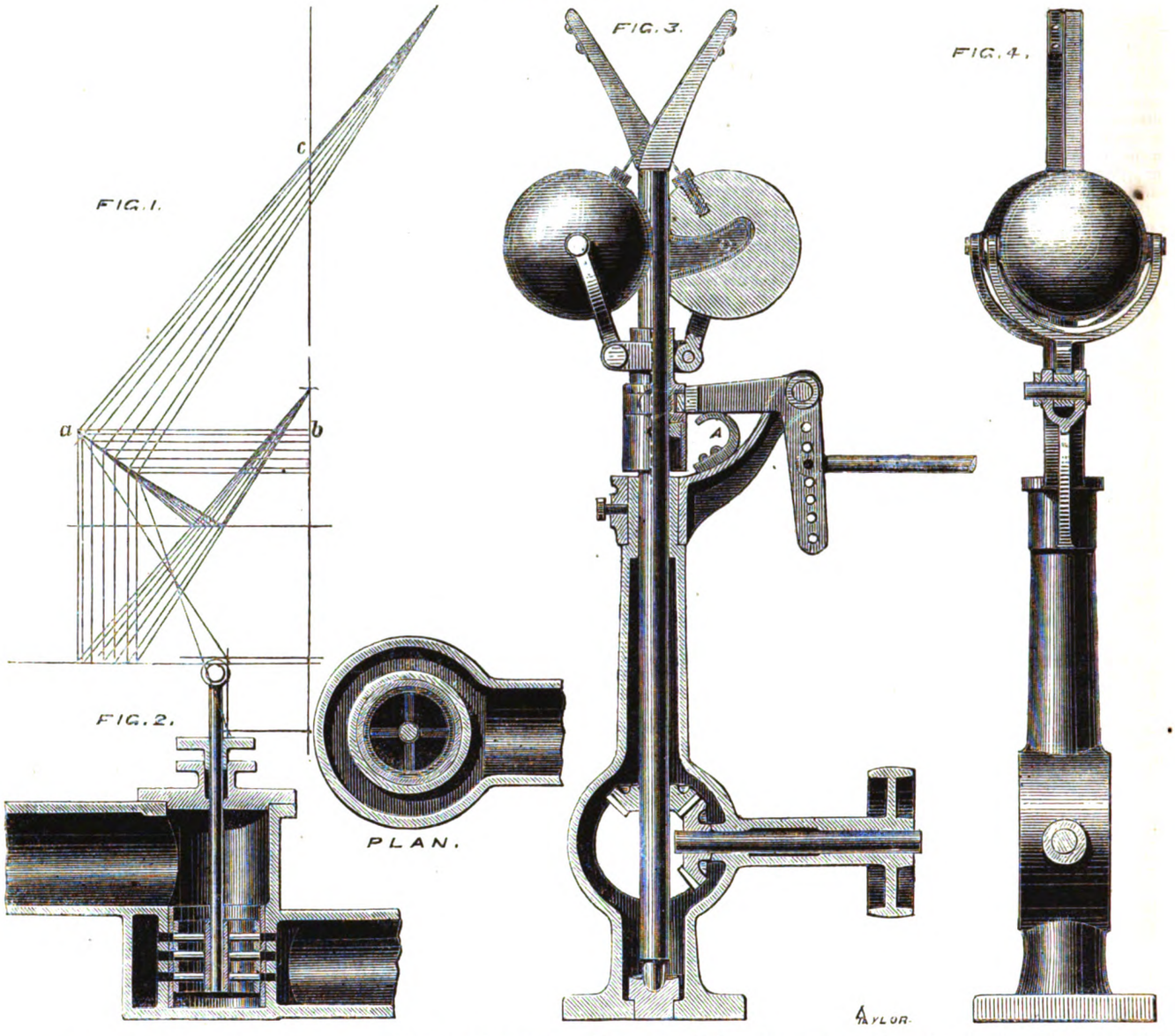
THE ISOCHRONAL GOVERNOR.

BY MR. HENRY DAVEY.



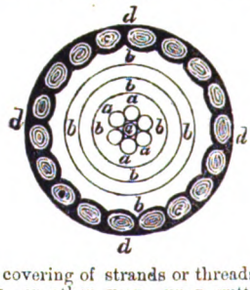
THE ISOCHRONAL GOVERNOR.

SINCE the time when James Watt invented the governor which bears his name, there has not been perhaps more time devoted towards perfecting any of his inventions than there has been towards producing a perfect governor which shall preserve a constant speed on the engine under extreme variations of load. It follows, from an abstract view of the problem, that if a governor is to depend on a change of velocity for its action, then no governor can absolutely preserve a constant speed, and all that can be done is to reduce that variation to which the engine must inevitably be subject to a minimum. With centrifugal governors, where the balls move in the arc of a circle, there exist two evils—the one is friction and the other is that every change of the position of the balls—that is to say, every new plane of rotation—demands an altered speed; this has long been recognized, and it has been well known that the arc of a parabola and not that of a circle is the curve in which the balls should move. Many governors have been constructed on what is termed the parabolic principle, but none appear to have been so practically carried out as the isochronal governor, which we illustrate above. Fig. 1 of our engraving is a diagram showing the mode of setting out the governor. Fig. 2 is a section of the throttle valve; figs. 3 and 4 are sectional and side elevations of the governor. This governor is the invention of Mr. H. Davey, of 9, Victoria Chambers, Westminster, and has for some time been in use. It possesses some peculiarities which we shall proceed to describe. It will be seen by reference to the engravings that the balls are suspended by means of a flexible leg of steel, from curved horns provided on the spindle, which causes them to move in a parabolic path. Fig. 1 represents the mode of setting out the governor, and it will be noticed that the legs are extremely short, and that the balls are made to move in a high portion of the parabola, the object of which is to make the centrifugal force represented by the line $a\ b$ as great as possible compared with the weight of the ball, or the line $b\ c$. The vertical height, or the line $b\ c$, determines the speed, and if the line be preserved constant then the speed will be constant also, and for a given velocity the balls will rest indifferently in any portion of their path, but with the Watt governor the vertical height varies constantly with every change of speed.

If a weight be made to move in a parabola without friction, the smallest change of velocity would cause it either to rise or fall as the case may be. The friction cannot be altogether dispensed with, but in the isochronal governor it is very small. It will readily be perceived that the momentum of the balls when rising or falling rapidly would cause them to move too far in either direction. To obviate this a small air cylinder is placed on the spindle, as shown in the engraving. Another feature of the invention consists in a means by which the engine is prevented from racing, in event of the governor gear breaking, or the belt accidentally falling off. It is effected in this way:—A spring shown at A is provided sufficiently powerful to keep out the balls when working, at, say, one quarter their proper speed, but not when at rest. A throttle valve, shown in fig. 2, is provided, and when the balls of the governor are just beyond the range of the spring, the valve is in the position represented in the engraving. The spring prevents the valve shutting when the engine is running slowly, but should the governor stop altogether, the valve is caused to close, or nearly so, as desired. The advantage of this arrangement is very great, especially with beam engines. We have before us now an instance in which a beam engine was reduced to a complete wreck, and the boilers completely emptied of water, from the breaking of the governor gear.

SUBMARINE TELEGRAPH CABLES.

THE object of the invention illustrated in the annexed cut is to give and preserve strength to electrical telegraphic conductors so as especially to adapt them to submarine purposes. The improvements are the patented invention of Mr. M. Gray, of Binswood House, Highbury Hill. They relate to



applying a covering of strands or threads of manilla, hemp, silk, or other yarn, upon gutta-percha or iudia-rubber, or other suitable insulating material enclosing the conducting wire, the yarns being coated with a protecting and preserving material. After applying a coating to the insulating conduct-

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ing wires of the insulating material, strands of manilla, or of other yarn, saturated with tar, are applied, and then coated with gutta-percha and bitumen. A convenient way of carrying out these improvements is to pass the wires coated with gutta-percha through the opposite side of a chamber containing a heated compound of gutta-percha, by which it becomes coated, and simultaneously to pass the hemp (previously saturated) through other holes around but at some distance from that through which the coated wire enters, in order that these yarns may all become thoroughly coated with the gutta-percha and bitumen. The yarns and coated wires then pass out from this chamber through the same aperture or die so as to be compressed closely upon the insulated conductor, and the insulated conductor with its covering of yarn may then be passed together through a chamber for receiving a coating of insulating material.

The accompanying engraving represents a section of a series of conducting wires enclosed in the manner described. The circles *a* represent seven wires enclosed in four separate coatings *b* of gutta-percha compound, *c c* represent the strands of yarn, and *d* represents an outer coating to the whole. In some cases the whole is enclosed in coils of tape, which are laid on the coated conductors from a carrier which rotates round the coated conductor, as it travels forward.

TOUGHENING GOLD.

A PROCESS for toughening brittle gold bullion, refining of alloyed gold, whilst in a melted state, and separating therefrom any silver it may contain, forms the subject of an English patent granted to Mr. F. B. Miller, an assayer of Sydney, New South Wales. This is effected by means of chlorine gas (or hydrochloric acid gas, mixed with atmospheric air or oxygen) brought in contact with the alloyed gold when the metal is in a molten state. In this way the silver present and any baser metals which render the gold brittle are converted into chlorides whilst the gold remains in a purified and tough condition. Mr. Miller melts the gold in a good clay crucible (plumbago crucibles are not recommended); the pots known as "creusets de Paris," and manufactured by Payen, Rue Pierre Levee, Paris, are very suitable, and the sizes Nos. 12, 14, and 16, are most generally useful; they are suitable for refining charges of 100, 250, and 500 ounces respectively. The crucibles are prepared for use by dipping them into a strong and hot solution of borax, and afterwards drying them. The object of this is to render them less liable to absorb the melted chloride of silver. The crucible is heated in a furnance, and the gold is melted in the usual way with a small quantity of borax, about three-quarters per cent. The crucible has a closely fitting cover with a small hole bored through it, and when the metal is melted a fire clay tube of about 3-16ths of an inch internal diameter, is inserted through this hole, so as to dip into the molten gold down to the bottom of the pot. The upper end of this tube is connected by a vulcanized india-rubber pipe with a glass or stoneware vessel, in which chlorine is generated. The joints are tied round with wire, and the india-rubber pipe is protected from the direct radiation of the fire. The chlorine generator is fitted with a safety tube, six feet long, dipping at its lower end into the liquid in the generator, and the liquid stands in this tube to such a height as is equivalent to the pressure necessary to force the gas through the melted gold which is above the end of the fire clay tube. The current of gas through the metal is maintained for about three hours, and the metal may advantageously be agitated from time to time by stopping the flow of the gas for a moment by pinching the india-rubber pipe until the pressure increases, and then allowing the accumulated gas to pass suddenly. At the end of this operation the gold will be nearly pure, and the chloride of silver formed will be found floating on its surface, together with such other chlorides as may be formed and are not readily volatilized.

The contents of the crucible may be poured out altogether into moulds, so as to form ingots, and the chlorides are in this case detached from the surfaces of the ingots when they are cold. Or the metal is allowed to cool in the crucible until it sets, and the still liquid chlorides are then poured from its surface into a mould, so as to form a slab. The borax is in this operation retained in the crucible, and in this no difficulty will be found, as it is much less fluid than the chlorides. The crucible still containing the gold is at once replaced in the furnace until the purified gold is again melted, and it is then cast into ingots. The crucible if it is to be used again should not be allowed to cool, but be replaced in the furnace as soon as the charge is poured. The chloride of silver and other chlorides mixed therewith are reduced to the metallic state by one or other of the processes commonly employed for this purpose, but very conveniently the slab of chlorides may be placed between two flat pieces of wrought iron and immersed in water acidulated with sulphuric acid and there left for a day or so until the reduction is complete; the metal thus obtained is treated with nitric acid. The silver and other baser metals are dissolved, whilst some gold is left undissolved and is collected and remelted with other charges. The silver is precipitated from the solution with common salt, as chloride of silver, by again reducing which a pure silver may be obtained.

In this process hydrochloric acid gas mixed with atmospheric air or oxygen may be passed into the molten gold in place of chlorine. The operation is in all respects similar, except that a generator of hydrochloric acid gas is substituted for the chlorine generator, connected by means of a vulcanized india-rubber pipe with a gasholder, from which either common air or pure oxygen can be supplied under pressure regulated by a stop-cock. A mixture of hydrochloric acid gas with air or oxygen is thus obtained, which is passed through the molten gold in the manner described for the similar operation with chlorine. This mixture of hydrochloric acid gas with air or oxygen is, however, less efficient and convenient than chlorine, more especially when the object is the separation of the silver rather than the toughening of the gold by the removal of the baser metals it may contain. A very small quantity of the silver contained in the alloyed gold will be volatilized during the process; it may be recovered from time to time by treating the sweepings from the flues. A much larger but still a small quantity of the chloride of silver is taken up by the borax or is absorbed in the substance of the crucible; this is recovered by crushing the flux and the crucible when it is past further use, and treating them with weak ammonia which dissolves out the chloride of silver, and this is afterwards precipitated by the addition of an acid, and the silver is reduced from it. Or the powdered flux and crucible may be placed in a revolving barrel with scrap wrought iron and mercury with sufficient water to form a thin paste. By this means the silver is recovered as an amalgam, together with a little gold.

SULPHUR AND ITS REFINING.*

By Mr. Charles N. Ellis, F.C.S.

SULPHUR mines abound nearly all throughout Sicily, but, as the Sicilians have neither roads nor railways, those only are worked situate in the neighbourhood of a port, that is, in a radius of 40 miles, because the transport comes too dear. The transport is generally carried on with donkeys or mules as far as a high road, and then by small carts, which hold from 10 to 14 cwt., or direct to the port, the carriage of which costs from 1-8 tari per cantaro of 175 rottoli (= 1·75 cantaro ordinary.)

Sulphur mines are generally situated in the hills, being found and worked in the crudest manner possible. If, from indications of sulphurous water or other appearance, a man supposes there is sulphur, he begins to dig a hole. If he is successful in his search and finds sulphur, well and good; if not, he gives it up. Should he be successful, he hires a capomaestro (*i.e.*, a master who has apprentices under him, or young workmen), a sort of small contractor, with some five or seven lads, who digs out the hole, and the boys carry away the thrown-out material in small baskets on their shoulders (containing from 30lb. to 40lb.) The ore is dug out, and when a sufficient quantity is thus obtained a ring of stone is first built, from 20ft. to 50ft. in diameter and 10ft. high, with a slanting floor. This is then filled up with a very high cone with ore. It is then thatched with earth outside. This is termed a "calcarone." It is then set fire to at the top and burns downwards. When it has burnt for about a fortnight they then tap it at the bottom, and let the sulphur run out into forms made of wood—rinsed out with water (the water answering like buttering a pie-dish, &c.), and you can turn it out when cold without sticking to the mould—called "battate," of about one to two hundredweight each.

There are, of course, large mines, where seventy or one hundred capomaestri are employed with their boys.

If water is met with, a drain is either built under the mine (which is very expensive), or it is pumped out with drums, which is very inadequate, consequently most mines with water are given up.

Some mines there are with steam pumps, which have seldom done well, for the following reasons:—

1st. The English drivers were drunken fellows.

2nd. The proprietors would not sink shafts.

3rd. If there is the least thing wrong in the machinery, repairs cannot be done on the spot. If sent for repairs to ——, much delay is caused by the dilatoriness of the foundry officials, and when the things do arrive they do not fit. They have then, at last, to send to England, consequently nearly a year's time is lost.

But most of the mines are worked by people without means, who, of course, cannot afford to buy machinery, and, what is very extraordinary is, that the richest mines contain water. This water does not appear to rise from wells, springs, &c., but is chiefly caused by the heavy penetrating rains of winter.

It is but rarely that mines can be bought, as nearly all the land belongs to nobles, who reside in Palermo, and who let their mines at the rate of from 15 to 45 per cent. of the produce.

Thus, as things are carried on, it requires but little capital; but, with a good capital, I am convinced a very good business would be done, so as to net not 10 to 20 per cent. on the outlay, but a good deal more.

Let us suppose a man with a capital of £100 takes a mine, and engages some capomaestri with their boys; he pays them, perhaps, once a month, or more seldom, and according to the number of "casse" of ore they have worked out; he then at once sells sulphur for delivery, either at once, one month, three, six, nine, or twelve months, and receives perhaps one-third, half, or the whole price, but of course suffers heavily, for the merchants won't lay out their money for nothing. The sulphur is then deliverable at the port, where there are stores which receive it, where the carriage is advanced, for which he pays again from 2 to 2½ per cent. in sulphur.

This is a brief sketch of how the Sicilians carry on sulphur mining. As a profitable investment, I should recommend boring to ascertain where the greatest quantity of ore was to be found—if a mine not already in work be obtained. A company with a capital of £20,000, with part paid up (or private firms for their own consumption in England, with overplus for sale), would be amply sufficient, at all events for a commencement. The great thing would be to have pumps that do not easily get out of order. There should be a blacksmith's forge, with a fitter, a man who thoroughly understands the working of pumps, and could do all repairs when out of order, and a general manager who has a good general practical knowledge. Steam engines of 10-horse power, or even less, where the work cannot be done by mules, I should think would be the best. The engines should be of such a kind that they can be easily transported and put together; no part should weigh more than 3¼ cwt. or thereabouts, as perhaps they would have to be transported to their destination on the backs of mules, depending entirely upon the situation of the mine; these things managed, all the rest is easy.

There are hundreds of mines ready for work, and there would certainly be a good dividend the end of the first year. Here I should observe (Girgenti) that the mining goes on all the year round, but the burning only from the beginning of June, when the harvest in the neighbourhood is over, to the end of October, when the sowing season commences, else one has to pay damages. A mine with water would be let at from 15 to 25 per cent. for a number of years. "Calcarone" are generally made of from 200 to 600 "casse" of ore, and a "casse" weighs (more or less) about six tons, and produces from 12cwt. to 16cwt. of sulphur; the fusion of such a calcarone lasts about two months.

There are, of course, preliminary expenses, such as finding veins, building calcarone, making of passages, or sinking shafts, engines, coal, &c. For other charges the following may be taken.

Say a mine, producing 25,000 cantari (175lb. per cantaro)—about 1,154 tons, at 13 cantari to the ton, would require for administration as follows:—

1 Administrator, paid at the rate per ann.	...	£75
1 Capomaestro (species of mining engineer)	...	40
1 Accountant		40
2 Measurers, each £30 to £35		65
1 Policeman		25
Total	...	£245

The miners with their boys are paid according to the situation or richness of the mine, at the rate of 45 to 60 tari per casse (or even less, a taro = 4d.), but this includes all charges, as follows:—

Administration	...	£240
2,500 casse of ore at 50 tari	...	2,083
I assume for general expenses, such as finding, building calcarone, &c.		500
		£2,823

From 25,000 cantari deduct 25 per cent. for proprietor; this would leave 18,750 cantari, or worth 9 tari per centaro; at the mines for best seconds, about 18 tari.

But, of course, one must make allowances for many other expenses, and for accidents, such as part of the mine falling in, &c., calculations differing at every mine, as also the qualities. There are, however, a mine or two which might be got close to the sea-side, which would produce 50,000 cantari of best seconds, where the sulphur could be embarked without charges, and might be got by good parties for 22 per cent. for nine or eighteen years, and no damage could be done in the neighbourhood. No doubt they would require pumps, but in other respects they are in working order. I have been informed that close to Girgenti there is a coal-mine, or rather a mine of schist, containing a kind of tar (it smells like petroleum), which might be made useful, with knowledge and means; it is not worked, and is close by a sulphur mine, which has water, and might be had cheap.

* "Society of Arts Journal."

In the year 1841 the quantity of tobacco cleared for consumption in the United Kingdom amounted to 13¾oz. per head of population. In the year 1851 the amount had increased to 1lb. 3¼oz. per head of population; and in the year 1865, to 1lb. 5oz. So greatly is the habit of smoking tobacco extending in this country.

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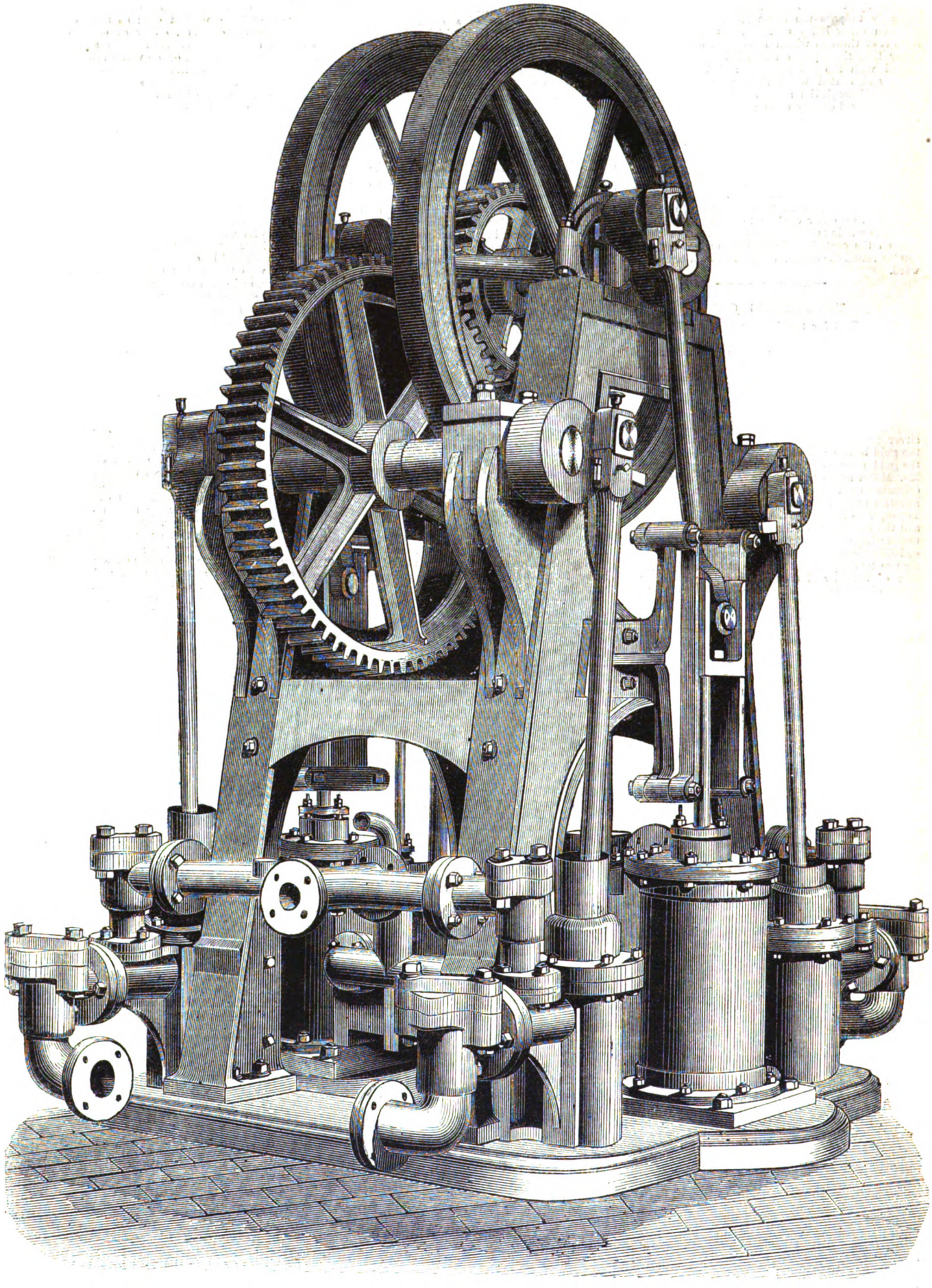
COMBINED ENGINES AND PUMPS FOR THE WEARDALE AND SHILDON WATER WORKS.

BY MESSRS. CARRETT AND MARSHALL, LEEDS..



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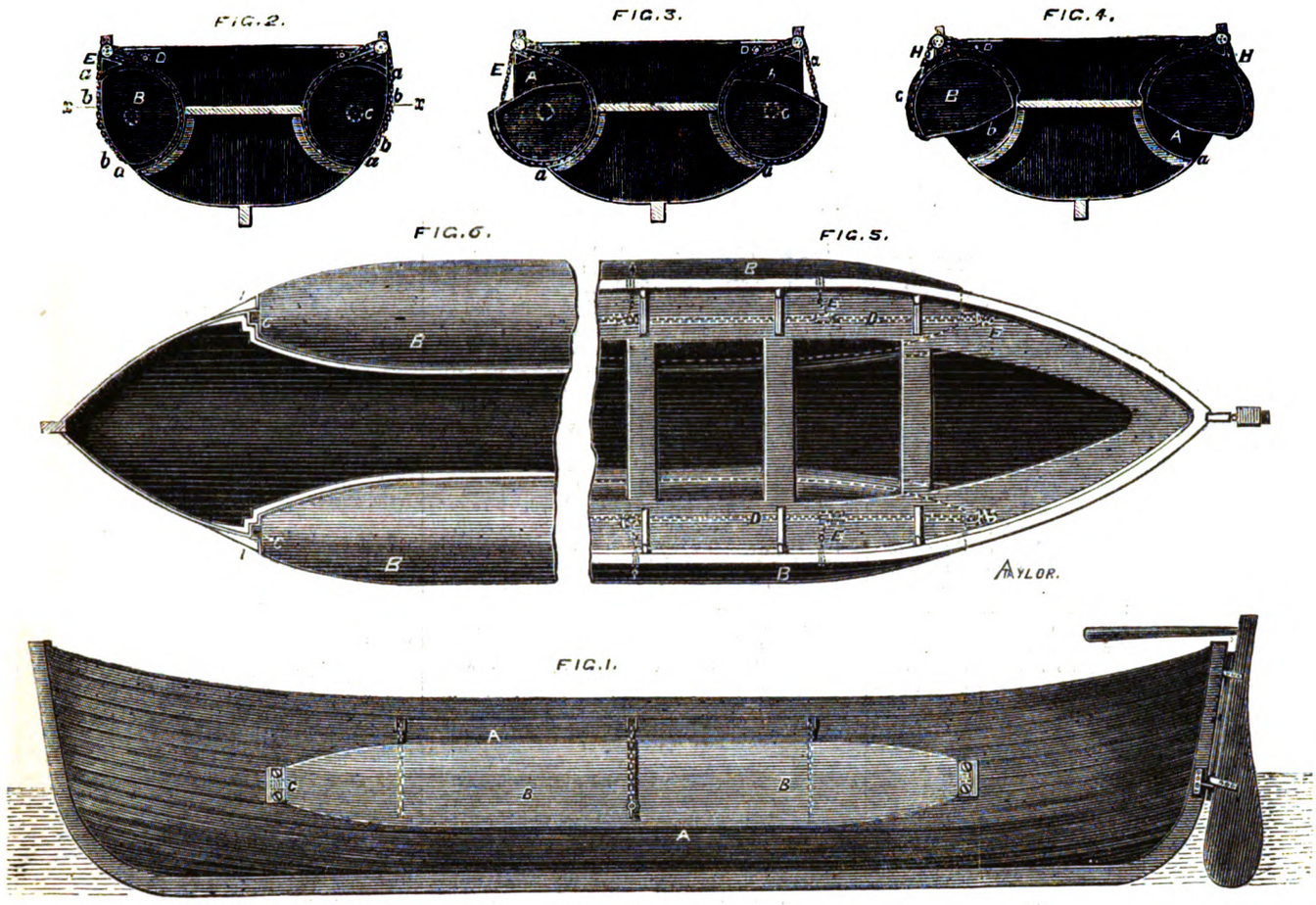
THE INSUBMERSIBLE LIFEBOAT.

BY MR. H. W. WITHERS.



ENGINES FOR THE WEARDALE AND SHILDON WATERWORKS.

OUR page engraving this week shows a combined pair of engines and four pumps, of 30-horse power, now in course of erection at the Weardale and Shildon Waterworks, at Shildon. This engine was designed and manufactured by Messrs. Carrett and Marshall, of Leeds, upon a principle they are now largely carrying out in practice. This principle, as applied to a horizontal engine, was illustrated by us in the MECHANICS' MAGAZINE for November 15, 1867, when we fully described it, so that we need not now more fully refer to its details. The engine in question, as will be perceived from the engraving, is self contained on one bed plate, and can be used independently of any foundation. The steam cylinders are 14in. diameter with a 20-inch stroke. The four ram pumps are 7½in. diameter and 12-inch stroke. They are of simple construction, with brass rams guided the whole length of the working barrel. These are packed with hydraulic leathers which are easy of access for renewal. This engine is designed to force a continuous stream of water at 500lb. pressure to any required distance. At the Shildon Waterworks this engine will have to force 35,000 gallons 470ft. high in twenty-four hours. Messrs. Carrett and Marshall are now constructing another of these engines for the same company. Besides waterworks, these engines have been successfully applied to the working of hydraulic coal cutters, hauling engines, and dip level pumps in mines.

THE INSUBMERSIBLE LIFEBOAT.

THE chief characteristics of the boat which forms the subject of the accompanying illustration are its great extra buoyancy and lateral stability, which are obtained without too great a diminution of its internal capacity. It is the patented invention of Mr. H. W. Withers, of New Cross, and although calculated chiefly for ship service—being a great improvement upon the present lifeboats carried by emigrant ships, troop ships, and steamers—will be found invaluable if used for other lifeboats for land service. The invention consists in forming externally in each side of the boat a longitudinal recess of curved form, and in fitting in each recess a hollow cylindrical structure, or a corresponding solid structure of cork or other sufficiently buoyant material. When the boat is stowed away these structures fit into the recesses and then form part of the ordinary contour of the boat, but when the boat is required for use and lowered into the water, and more carrying power is required, they are turned upon their centres so as to extend out from the sides of the boat and thus give additional bearing or surface, whereby the buoyancy and lateral stability of the boat are greatly increased. The structures are narrowed towards their ends, so as not to interfere with the way of the boat.

In our engraving fig. 1 is a side view, and fig. 2 a mid-ship section of a boat constructed according to Mr. Withers' invention, the structures being in the position in which they form part of the ordinary contour of the boat; A A are the longitudinal recesses formed externally in the sides of the boat; the transverse section of these recesses forms at all parts a segment or portion of a circle *a a*. B B are the hollow structures of iron or other material fitted in the recesses A A; in the position shown in fig. 1 and fig. 2, the inner faces *a a* of these structures correspond with the curve of the recesses A A, while their outer faces *b b* correspond with and form part of the ordinary contour of the boat, as shown. The hollow structures B B are centred on pivots at C C. When the boat is required for use, and great buoyancy and lateral stability are necessary, the hollow structures are turned upon these pivots, so as to extend out from the sides of the boat, either as shown in the midship section fig. 3, or in the similar section fig. 4. In the former case the portion of the structures which was outside is brought uppermost, while, in the latter case, it is brought lowermost. Fig. 5 is a top view, and fig. 6 is a horizontal section through the line *x x* of fig. 2, showing the narrowing or tapering of the structures B B towards their ends, so as not to interfere with the way of the boat.

Mr. Withers sometimes employs chocks I, forming continuations of the bow ends of the structures and running them off, as it were, to a point; these chocks may be made to ship and unship as required. To move the hollow structures B B on their centres, chains E E are fitted thereto, and are carried to the inside of the boat, and led round a bar D, shown in dotted lines in fig. 5. This bar is connected by gearing to a vertical bar F, which may be turned by a handle. In the engraving, three chains E are shown on each side of the boat, two of which are passed partly round and connected to one side of the structure B, and the other is passed partly round in the reverse direction, and connected to the other side of tho structure. Sometimes, instead of or in addition to the pivots C C, the structures B B are supported by means of curved bars G G, as shown in fig. 4, attached to the structures B B, and moving in guide eyes H H, fitted in the recess A A of the boat. The eyes H H, with the turned-in ends of the bars G G, also act as stops to prevent the structures being moved round too far. The bars G G may be fitted in the recesses A A, and the eyes H H secured to the structures B B. In some cases, Mr. Withers divides and strengthens the structures by partitions, so that if they are forced in or damaged at one part they will still retain a considerable portion of their buoyancy. Any convenient arrangement or appliance may be adopted to prevent the water entering the spaces above or below the structures B B, when moved on their centres. Although we have spoken chiefly of the structures B B as being hollow, they may be made solid, provided they be of cork or other sufficiently buoyant material. This invention will be found of great advantage in fishing boats, as by moving out the structure B at the side at which the nets are being drawn in, greater buoyancy is obtained at that side and additional safety thereby secured.

It will thus be seen that this boat has a large amount of buoyancy in such a position as to give the greatest lateral stability, rendering her powerful and safe, impossible to sink, and most unlikely to capsize. Besides these features, it combines the other qualities required in a lifeboat—roominess for large numbers of passengers and provisions, width to pull, double banked, stability to resist people moving and pressing down on one side, in rescuing men from the water, liveliness in a seaway, and power and stiffness under canvas. With a view to give extra buoyancy, the ordinary lifeboats are fitted with air cases running under the level of the thwarts, which can only be of service when the boat is full of water and the passengers in a perishing state; in Mr. Withers' boat the greater portion which remains in the other boats useless is removed to the outside of the boat and becomes exposed to the action of the water. Air cases inside boats, of course, do not give stability. In the event of the broadside of an ordinary boat being stove in she would be likely to sink, as the water would find its way into the boat, whereas Mr. Withers' cylinders, being fitted in

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compartments, if stove in, the water would be confined to that spot only, the other parts retaining their buoyancy. Air cases, if built in the boat, are too often found out of order; in times of peril they are also difficult to repair. In the boat under notice these structures can be readily taken out and kept in order. The opinion of practical boatbuilders who have investigated Mr. Withers' system is that, from her roominess and power, a boat on this principle could leave a wreck with a large number of passengers and provisions without much fear of either capsizing or sinking, and there would be no difficulty in constructing such a boat. We believe this to be an invention so promising that it only requires bringing prominently before the Admiralty and the public in order to insure its adoption.

THE BRITISH HOROLOGICAL INSTITUTE.

THE last half-yearly meeting of the members of the Horological Institute took place at the close of last year, and we are glad to find from the report, which we lately received, that the number of members has increased since the previous meeting. It is also satisfactory to learn that the finances of the Institute are, considering the depressed condition of the trade, in a better state than could have been expected. An offer having been made by a gentleman to give lessons in geometry and its application to watchwork, the council have formed classes which are now in full operation. The council refer with deep regret to the loss the Institute has sustained in the death of their president, Valentine Knight, Esq., an event we recorded at the time it occurred. Certainly a gentleman more devoted to its interests it was impossible to have found, one more influential in effecting its progress could not have been desired. The Journal of the Institute, we are glad to see, continues to show an improved sale, one of the evidences of its usefulness to the trade. The labour, however, connected with its monthly preparation of literary and scientific matter is, the council regret to say, still performed by the able editor, Mr. B. Strachan, without remuneration. This state of things has so long continued that the council appeal to the members to aid them by introducing fresh members to the Institute, that the council may be able to offer some equivalent for such valuable service. In the meantime, we are glad to observe that a meeting has been set on foot to present Mr. Strachan with a testimonial. In editing the "Horological Journal," Mr. Strachan brings a large amount of mathematical knowledge to bear upon his work, and renders the journal a worthy exponent of the science of horology. We, therefore, trust that the members generally will follow the initiative taken by the council, and subscribe largely to the fund.

SOCIETY OF ENGINEERS.

(Continued from page 111).

THE PANAMA LINE.

THE Liberator, Simon Bolivar, President of the Republic of Colombia, gave a commission dated Bogota, the 29th of November, 1827, to Captains John Augustus Lloyd and Maurice Falmark, officers of engineers in the Colombian service, to survey this route. Captain (afterwards Colonel) Lloyd's observations were published in the "Philosophical Transactions," and in vol. i. of the "Journal of the Royal Geographical Society." In 1840, Mr. Wheelwright was commissioned, by the Directors of the Pacific Steam Navigation Company, to report upon the best means of opening a communication between the river Chagres and the Pacific; but his suggestions were not carried out.

In consequence of the representations made by M. Salomons, of Paris and Martinique, who obtained a privilege and concession, in 1836, and again in 1839, for constructing a canal by this route, and who was the promoter of the Franco-Grenadian Company, Louis Philippe and M. Guizot gave orders in September, 1843, to M. Napoleon Garella, to make a detailed survey of it. Garella, assisted by M. de Courtines, and other engineers, made a survey of the country under the most favourable circumstances, having had the assistance of a French vessel of war, and the support of Colonel Pineda, the Governor of Panama. On concluding it, he submitted a plan for a canal of dimensions sufficient for the transit of sailing vessels of 1,200 tons only. He proposed to make it 23ft. deep with locks 45ft. 6in. wide, and 218ft. between the aprons. Its width was to be sufficient to allow two vessels to pass freely, except at the summit, where there would be a tunnel. He proposed to make a cut from Navy Bay to the Chagres, to partially follow the river to the junction of the Trinidad with it, and to complete the remaining distance by a canal along the valleys of the Bernardino and Caimito to the Pacific terminus at the little bay of Vacat del Monte, about 2½ miles east of the river Chorrera, and 12½ miles west of Panama. The direction of the line was nearly south-east; and its length 47½ miles,* of which nearly 42 would require to be canalized. The lowest summit level found was the Col de Ahogayegua, 459ft.,† at which height a sufficient supply of water could not be obtained. It was only by means of open trenches 1·65ft. deep and 62½ miles in length that he could convey water to a level of 135ft. He therefore proposed to establish his summit level at 135ft. above high water of the Pacific, for a distance of 25,361ft., of which 17,750ft., or 3¼ miles, would require to be tunnelled. To this level he would rise by 18, and descend to the Pacific by 17 locks. The latter would be much crowded, as Ahogayegua‡ is only 8 miles from the Pacific. The tunnel was to have been of height sufficient to allow a vessel of 1,200 tons to traverse it with her lower masts standing. The canal would require 36 locks and 6 aqueducts. He estimated that the work could be done for 12 francs per cubic mètre, or 9s. per yard, and that the whole cost would be 105,455,442 francs 75 centimes. In this sum he included the tunnel, 5,350 mètres in length, which would cost 6,700 francs per mètre, or 35,845,000 francs, equal to £1,433,800. The construction of a pier or mole, 1,100 yards long, in Navy Bay, and the formation of an entrance basin in the bay of Vacat del Monte, would raise the expense to 125 millions of francs, or about five millions sterling. Garella made another estimate for a canal of smaller size, with locks 170ft. long, 38ft. wide, and 20ft. of water, capable of admitting vessels of 600 tons, which amounted to about £3,600,000.

The necessity of excavating a tunnel 3¼ miles in length, and the great number of locks required, were considered objectionable by the promoters; but the principal reasons which decided them to abandon the project were the insecurity of the anchorage on either coast, and the insurmountable obstacle presented by the sandbank which extends from the shores of Panama Bay three miles out, and is high and dry at low water, except in the tortuous and impracticable channel of the Rio Grande. Vessels of even less than 300 tons have to lie two miles to seaward of Panama, and are obliged to discharge their cargoes into flat-bottomed boats. If it were even possible to cut through this sandbank, a single high tide might fill up the channel with sand again. Though the anchorage is generally safe, it has happened that all the ships lying there have been stranded; and all the vessels in Panama Bay were wrecked in a gale that blew with almost the force of a hurricane for twelve hours on the 17th of October, 1833. The houses at Chagres and Nicaragua were blown down by this gale. H.M.S. "Comus" quitted her anchorage at Chagres, when the barometer was observed to be falling rapidly, and so escaped.

Navy Bay is still more objectionable as an anchorage, being open to winds from N.E. to N.W., round by N., whilst hard northers are of frequent occurrence there. Great damage was caused by one on the 31st of December, 1854; and another which blew early in the morning of the 22nd of November, 1862, destroyed the wharves, drove the R.M.S. "Avon" ashore, and wrecked every vessel at anchor, except the American steamer "North Star," and the R.M.S. "Derwent," which left just in time. Although the notion of cutting a canal by this line has long since been given up, Garella's admirable work,§ in which a number of interesting hydraulic problems are solved, and minute calculations given, is a most valuable addition to our knowledge.

THE CHEPO LINE.

The line from the mouth of the Chepo or Bayano river, 24 miles east of Panama, to Mandinga or San Blas Bay, is the shortest between the two oceans. Mr. Wheelwright attempted to cross there in 1837, but was stopped by the Indians. In 1847, the late Mr. Evan Hopkins, M.E., who was employed by Gen. Mosquera, then President of New Granada, to survey the route, endeavoured to cross in company with Don José Marcellino Hurtado, of Panama, but they were driven back by the Indians, the chief of whom flogged a man who had accepted from them a present of a scarlet military coat. In 1849 the author visited the Chepo, but an examination of its entrance satisfied him that a canal there would be impracticable. More recently, Laurence Oliphant, Esq., ascended the river, and his observations were communicated in a paper read before the Royal Geographical Society, on the 24th of April, 1865. In 1864, a survey was made by Messrs. M'Dougal, Sweet, Forman, and Rude, at the expense of F. M. Kelley, Esq., of New York. The line taken was up the Chepo to the Mamoni, then along the valley of the latter to the Cordillera, and from its Pacific foot to the mouth of Mandinga river. The Chepo is a large river, navigable as far as Terable, a ruined fort, one mile above which the tide reaches. The total length of the line would be 30·030 miles. The lowest summit level is 1,500 feet. The length of tunnel required would be seven miles. The harbour on the Atlantic is safe, capacious, and deep, and the survey shows that the channel leading from the Chepo to Panama Bay has not less than 18ft. of water at mean low tide, whilst the ordinary rise of tide is 16ft.; but this result does not accord with the Admiralty chart. The latitude of Chepillo Island, off the mouth of the Chepo, was found to be 8deg. 59min. 40sec., and its longitude 79deg. 7min. 40sec. High tide in the San Blas Bay was 2½ft.

It is not likely that the Darien Indians would quietly give up their sovereignty over the Atlantic portion of this territory, since their largest villages and the residence of their oldest chief are on the shores of Mandinga Bay, on the cays and islets in which they strike turtle, which is their principal occupation. In 1848, Colonel Hughes, of the United States' Topographical Engineers, visited the bay in an American ship of war, and endeavoured to obtain permission to cross the isthmus, but received a decided refusal. The route by which Lionel Wafer crossed the Isthmus of Darien, in 1681, was from the mouth of Congo river, in the Gulf of San Miguel to the mouth of the Concepcion, 30 miles east of the Mandinga. His account of the stupendous mountains he crossed between the Chepo and the Atlantic shows the impossibility of making a canal communication in that direction. The Chepo route follows the boundary line between the Isthmus of Panama and the Isthmus of Darien, which corresponds nearly to the meridian of 79deg. W.

THE ATRATO LINES.

At about 4deg. N. the Cordillera of New Granada bifurcates, one branch continuing northwards close to the Pacific, the other, after diverging a little to the eastward, re-assuming a northerly direction, under the name of the Cordillera of Chocó, for of Antioquia, till it terminates on the eastern side of the Gulf of Urabà, or Darien. The two branches thus enclose a large oval space, reaching from about 4deg. to 8deg. N. latitude. This is divided into two unequal parts by spurs thrown out from either branch in 5deg. N., which separate the smaller and southern valley of the San Juan from the larger and northern valley of the Atrato. The Atrato valley is a great alluvial plain, separated from the Pacific by the Cordillera of the coast, and from the valley of the Cauca and the province of Antioquia by the Cordillera of Chocò. It lies between the parallels of 5deg. 26min. and 8deg. 5min. N. It has a width of from 100 to 150 miles, a length of 159 miles, and an area of 21,000 miles. Immediately under the surface of the plain is a stratum of firm clay and vegetable mould, overlying, at a depth varying from a few inches to several feet, the gold-bearing clay and gravel. This auriferous stratum, called cascalho, varies in thickness from 2 to 20 and even 50ft. Branches and roots of trees abound in it, as also beds of leaves carbonized and resembling compact peat; and coal is said to exist in the Antioquian range. Through the valley flows the Atrato, almost due north. It is formed by the confluence of the Quito and the Atrato, and in its course receives the Bebarà Murri, Pato, Andagueda, Napipi, Murindo, Sucio, Pavarando, Truando, Salaqui, Cacarica, Tumarador, and many other tributaries; and, after a course of 300 miles (following its sinuosities) empties itself by thirteen bocas or mouths into the Bay of Candelaria in the Gulf of Darien.

The great quantity of water in this river is owing to the fact that the clouds seldom pass over the Cordillera to the Pacific, but discharge themselves into the valley, thus maintaining an ample supply through all seasons of the year. Its banks are nowhere high, being principally levées or embankments formed from the sedimentary depo-

* Bief de Partage, 7,730 metres; Versant Sud, 13,450; Versant Nord, 55,360 = 76,540 metres.

† A much lower level was found afterwards, that of the Panama Railroad being only 287ft.; and a few years ago a summit level of only about 150ft. was found; thus substantiating the accuracy of the assertion made years before by Alphonse Morel.

‡ This Spanish word means "drown (or choke) the mare."

§ Garella, M. Napoleon, Projet d'un Canal a travers l'Isthme de Panama. Cavilian-Gœury et Dalmont, 39, Quai des Augustins, Paris, 1845. Prix 10 francs.

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NEW MUZZLE LOADING FIELD GUN.

its brought down by the current and precipitated. In some places the surface of the water is above the land on either side. From its mouth to its source no rock has been discovered in the river, nor stone of any kind, except small detached pebbles, in any part of the valley. In the lower part of its course there is a level expanse thickly covered with mangroves (Avicennia nitida and Rhizophora mangle), and inundated at high water. It may, indeed, be said that there is no shore for 60 miles above its mouth. Further inland are some gentle, rounded elevations, and beyond them is the Cordillera on each side. At Quibdò,* the capital of the province of Chocò, at the elevation of 75ft. above the level of the sea, from which it is 220 miles distant, its width is from 800 to 900ft., and its average depth 9ft.; but during floods it rises to 15 and even 25ft. The rate of fall from thence to the sea is only 3in. in a mile. Below Quibdò it increases in width and depth, and is an immense river down to the point where it divides into the canos, or channels. About 15 miles above its mouth, it winds round the base of the Lomitas, or hills of Cacarica, which are spurs of the Sierra de Maly, of Darien, that approach its left bank; and thereabouts are the river and lagoon of Cacarica, from which there may be an Indian trail across the Cordillera into Darien. Immediately below the Cacarica mouth, but on the opposite or east bank, there is a hill, named Loma de Pulgas,† which is formed by an accumulation of mud. Lower down, on the east bank also, there is another, 140ft. high, called Loma de Tumarador, at the mouth of the Tumarador river, just above the Delta.

About 8 miles in a direct line from Candelaria Bay the Atrato divides into two channels; these, dividing and sub-dividing, its waters find their way to the gulf through a submerged delta, densely covered with a tangled jungle of mangroves, between banks having no consistency and no soil visible. The canos, thirteen in number, are named from N.W. to S.E., Tarena, Candelaria, Pavas, Barbacoas, Coquito, and Coco Grande (formed by the bifurcation of the Matuntuvo) Pantano, Pedrito, Pedro, Urabà, Urabacito, Pinchindi, and Pichindicito. In front of them all a formidable sandbank extends outwards, and the mouth of each is obstructed by a bar formed by the deposition of alluvial matter. Within the bar the depth averages 50 to 60ft. The Tarena is the widest and deepest, and follows the general course of the main stream, running N., and is thence called the Rio Madre, or mother river. It averages 40ft. in depth, and 500 yards in width, but the bar at its mouth is at times almost dry, and the gulf waves break heavily over it. At its separation from the Barbacoas it is 1,550ft. in width. The latter is 80 yards wide. The Cano Coquito is the most practicable of the channels, but has only from 6 to 12ft. of water for the distance of 4,546 yards above its mouth, and the latter has only from 2 to 4ft. of water on the bar. Dr. Halsted's boat grounded there, though it drew only 3½ft. of water. Its width, moreover, is very small, being only from 25 to 35ft. between the bushes at its sides, and in some spots only 15ft. The mouth of this cano is called in the "Derrotero de las Antillas" (Madrid, 1817), the Faisan Chico, and is thus noticed:—"Of all the mouths, the Faisan Chico offers the greatest advantages. This arm of the river has 3ft. of water on its bar, and the tides rise only 2ft. throughout the whole of the Gulf of Darien." In front of its mouth is a long, low island, called Islat de Muertos, or dead men's island. The hull of the "Stella" and the boiler of a small steamer that was wrecked were visible when Lieutenant Craven surveyed this mouth. In the Candelaria and Pavo channels, Trautwine and Halsted found only 2ft. of water at a quarter of a mile from the shore; and in the Matuntuvo only 3ft. From the mouth of the Sucio, a tributary which rises in the Antioquian chain, and falls into the Atrato about 70 miles up, the current is 3 miles an hour. Near the headwaters there are rapids, and the current is 7 miles an hour.

* Population in 1851, 8,471, mostly negroes. It is a miserable town of mud huts built on swampy ground.

† Fleas' Hill.

THE ATRATO AND SAN JUAN LINE.

This is the most southern and the longest line between the Atrato and the Pacific. Humboldt was told that, in 1788, the curate of Novita, or Citharà, set his flock to work to dig a canal from the San Juan, at the village of San Pablo, to the sources of the Raspadura, which flows into the Quito, an affluent of the Atrato. San Pablo is half-way between Novita and Tado, and about 40 miles N. of Noanamà. By this cut, called the Canal de la Raspadura, it was said that, when the rains were abundant, and the rivers overflowed their banks, an actual water communication existed between the two oceans, and the isthmus was separated from the continent of South America, so that canoes used to pass from one river to the other. But Mr. Trautwine and Dr. Mina B. Halsted, a young physician of New York, who surveyed the pass in 1853, learned, by inquiry at the spot, that the canal never was made, but that canoes had been dragged across. They examined the Santa Monica and the Raspadura, both of which rise in the same ridge, and unite to form the Quito. The head of canoe navigation on the Santa Monica, which is the more practicable, was found to be 103ft. above the San Juan; and the lowest depression of the dividing ridge was ascertained to be 80ft. higher, or 183ft. above the San Juan. The breadth of the isthmus of San Pablo, as the ridge is called, is 3¼ miles. The distance from the Coquito mouth of the Atrato to Santa Monica is 281, thence to San Pablo 3¼, and from San Pablo to Chirambirà, at the mouth of the San Juan, 123 miles. The total distance would, then, be 407¼ miles. The elevation of the ridge above the level of the sea was not ascertained, but it must be very considerable. Mr. J. C. Trautwine, C.E. (in his book, entitled "Inter-oceanic Canal Route," Philadelphia, 1854), reported that a canal by that line would be totally impracticable. It was afterwards surveyed by Mr. Porter and Mr. Lane, who gave the same opinion, and was also examined by Mr. Vincent, of Southwark, with the same result. Mr. Trautwine's book contains interesting views of the Cano Coquito, Quibbò,* San Pablo, Chirambirà, and other places on the Atrato and San Juan.

THE ATRATO, PATO, AND BAUDO LINE.

At the distance of 237 miles above its mouth, the Atrato receives the Pato, the head of which is thirty miles above the confluence. From its head a pass of 1¾ mile, with a summit level of 365ft. above the ocean, leads to the Baudo, which, after a course of eighty miles, falls into the Pacific between Cape Corrientes and the mouth of the San Juan. Its length, 348¾ miles, is less than that of the San Juan route; but Mr. Lane, Mr. Porter, and Mr. Trautwine, each of whom surveyed it separately, found that it had no other superiority over that line.

THE ATRATO, NAPIPI, AND CUPICA LINE.

About 150 miles above its mouth, the Atrato receives the Napipi, and 75 miles above the mouth of the latter is the Tambo (shed) de Antado, which was erected by the Government of New Granada for the convenience of travellers. From thence a path leads over the hill, called Pié de Andé, to the Quebrada (rivulet) del Mar, which is the head of the Cupica, that falls into the Pacific, south of Cape Marzo. The distance from the Tambo to Cupica is sixteen miles. The entire length of the line from sea to sea would therefore be about 241 miles. This route was first noticed in 1799, by Goguenèche, a Biscayan pilot, and was afterwards recommended by Humboldt. In January, 1820, Colonel Cancino, Captain (now General) Tomas Cipriano de Mosquera, Captain Joaquin Andre, and Senor Deserein were conveyed from Bueventura to Cupica, in the Chilian frigate "Andes," the commander of which, Captain Illingsworth, had a six-oared launch dragged across to the Napipi in ten hours, the crew cutting the bush as they advanced. The above officers and the doctor of the frigate then descended in her to the village of Murri, on the Atrato, whence, General Mosquera told the author, they drove away the Spaniards. This launch was in a shed at Quibdò when Captain Cochrane visited that place in 1824. An account of the above excursion was given on the 20th of May, 1834, in the "Reverberacion Mercantil del Atrato," a paper edited by Senor Cardenas, one of the victims who perished in the "Amazon," on the 4th of January, 1852. Dr. Florentino Gonzales and Cardenas had received a concession for a canal by this route, and Eliot Warburton was going out with the latter to the Atrato mouth, where he erroneously supposed that the Scotch colony of Darien had been located.

In 1827, Lieutenant Charles Friend, R.N., crossed from the Napipi to Cupica and back, having ascended the Atrato in the little steamer "Libertador." About the year 1843, Louis Phillippe and Guizot sent J. F. Landreau, M.D., to examine and report upon this line; but, as Dr. Landreau went thence to the province of Esmeraldas, in Ecuador, where he discovered three mines of gold and one of platina, and settled, his report was, probably, unfavourable. In 1848, Commander Wood, of the "Pandora," walked in a few hours from the Cupica to the Napipi and back. However, from the examination made by Don Juan de Dios Ulloa, a Granadian engineer, and the surveys afterwards made by Mr. Trautwine and Dr. Halsted, and then by Messrs. Kennish, Nelson, Rude, and Dr. Jameson, it appears that the dividing ridge is of such an elevation (about 500ft.) and breadth, that a tunnel about 6½ miles in length would be necessary. Cupica Bay, moreover, is small, and only an open roadstead, and the obstacles presented by the bars and sandbanks at the mouths of the Atrato are most formidable. Mr. Trautwine estimated the cost of a canal by this line at 325,000,000 dollars.

(To be continued.)

* Dò ortdor, in the language of the Choco Indians, like tee in that of the Darien Indians, signifies a river: thus, Quibdo means river of gravel; Murindo, of mud; Munguido, of mosquitoes.

NEW MUZZLE-LOADING FIELD GUNS.†

OUR readers are doubtless aware that most of our field pieces are Armstrong breech-loading guns. We are not aware that any serious objection has ever been urged against Armstrong breech-loaders up to and not exceeding what is known as the 40-pounder in dimensions, but it is certain that they possess no peculiar advantage over the muzzle-loading rifled guns of the same size. These last, indeed, can be loaded more rapidly, and they are obviously less complicated and less liable to get out of order than any Armstrong gun. Armstrong lead-coated shot, too, sheds the soft metal by a curious and not very well understood process of decomposition while lying in store. It has been decided, therefore, to revert, tentatively at least, to the old muzzle-loading system, and on January 16, last, experiments were carried out with three new guns, in order to determine the best pitch, &c., for the rifling. As the new guns are likely to play an important part in our future armaments, we feel pleasure in being able to place before our readers an illustration showing their general appearance very accurately, but we do not feel ourselves at liberty to publish drawings of the rifle groove; therefore we give the gun in external elevation only. The typical gun is 3in. bore, and the three pieces tested at Shoeburyness differed only in the rifling from each other. No. 1 has three grooves and a twist of one turn in 75in.; No. 2 has three grooves and one turn in 90in.; and No. 3 has but two grooves, making one turn in 75in. All the grooves are rounded, and 0·4in. wide by 0·1in. deep. The shells for these guns are 9·5in. long, and contain a bursting charge of half a pound of powder. The result of the trials was as follows:—No. 1 gun gave a minimum range of 1,296 yds., and a maximum range of 1,357yds., the deflection of the projectile being, maximum 2·5yds., minimum ·4yds. For No. 2 the maximum range was 1,422yds; the

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minimum, 1,324yds.; maximum deflection, 5.2yds.; minimum, 4yds. No. 3 gun; maximum range, 1,431yds.; minimum, 1,349yds.; maximum deflection, 5yds.; minimum, 1·4yds. The charges were, in all cases, one-seventh of the weight of the projectile, or 11b. 11oz., from which it appears that No. 2 gave rather better results than either iof the others. The guns are made of wrought ron, with steel tubes, and will prove very much less costly, and more durable in service than the Armstrong breech-loader.

PRACTICAL NOTES ON GREEK FIRE.

By Mr. John Horsley, F.C.S.

THIS preparation is altogether a misnomer, as the original Greek fire was simply a fire-ball made of various combustible materials, which was thrown in an ignited state into an enemy's camp, whereas the so-called Greek fire is a solution of phosphorus in a very volatile spirit known as bisulphide of carbon, which when sprinkled upon substances of a loose or spongy character more or less rapidly produces spontaneous ignition, as may be seen from the following table. The constant temperature of the particular part of the room in which my experiments were made, for a fire was burning at the other end, was 55deg. Fah.:—

Paper ignited in.....	1 min.	Packing or sail cloth	2 min.
Wood shavings	1½ „	Woollen cloth	5 „
Linen.....	1½ „	Carpet.....	6 „

At higher temperatures of course the ignition would be much quicker (summer weather, for instance), as phosphorus instantly fires when a direct heat of 70deg. is applied to it, and the slightest friction with the finger in its dry state produces a serious burn which heals with difficulty. I, therefore, particularly caution persons against meddling with it under any circumstances. Atmospheric changes, such as cold and damp weather, appear to exercise a considerable influence over phosphorus in checking or retarding its ignition, hence it is that the application of liquid phosphorus to paper and other light substances will not then inflame them so quickly as when the weather is warm and dry, as I have now satisfactorily ascertained; for even at a temperature of 47deg. some of the articles mentioned above took a considerably longer time to ignite, but the day, however, was very wet, and there was no fire in the room during the time of conducting the experiments, thus:—

Paper required.....	6 min.	Linen	20 min.
Wood shaving.....	7 „	Woollen cloth.....	34 „
Packing or sail cloth	11 „	Carpet	45 „

So that although no spontaneous combustion follows the use of Greek fire or liquid phosphorus in the open air on a cold or damp day, it is nevertheless quite as much, if not more dangerous than if it had succeeded, as the slightest heat or friction, either by the hands or feet, on a part containing phosphorus would readily inflame it like an ordinary lucifer match, and in the case of a female, her long clothes might be speedily set on fire. In a warm room the danger would be even greater still, therefore the utmost caution should be used in walking about or handling any article of furniture. The peculiar smell of phosphorus would at once indicate the fact of its having been used at all, and if white fumes are being evolved, say from a carpet, instantly proceed to wet it with water to prevent its ignition, cut out the spot, and throw it into the yard to dry and be burnt; the same with curtains, bed clothes, &c.; in fact, this is the only way of getting rid of any danger. In proof of cold retarding ignition I placed in the open air on the window ledge of the laboratory, the temperature being 35deg. Fah., a small saucer containing some shavings sprinkled with liquid phosphorus. Several hours elapsing without any visible effect, the saucer was brought just inside the room, when the shavings instantly inflamed.

If a naked floor board has had some liquid phosphorus spilt on it, although unlike the more spongy articles, it will not inflame to any great extent otherwise than superficially, yet it is equally liable to do so by heat or friction, to avoid which the boards mus t be first well wetted, and then planed as quickly as possible, throwing the shavings into the fire—keep wetting and planing as long as white fumes appear to be evolved. A floor-board may, however, be set on fire indirectly through the medium of the carpet on which the liquid had been sprinkled, spontaneously igniting. By way of showing what may be done with a naked floor board, I sprinkled some liquid phosphorus on a small deal board ¼in. thick, placed on a stout sheet of iron, with a thermometer at 56deg. standing by its side, and in ten minutes the surface of the board burnt with considerable activity. Again, I took another board, sprinkled some phosphorus over it, and when dry, gently drew across it a pointed iron instrument, and the friction was quite sufficient to set it on fire, so that it cannot be denied that there is great danger attending the use of this liquid.

Some persons have recommended the use of wet sand to stay or prevent the absorption of the liquid, but that does not appear to be of much value, as by its density, it still finds its way to the board, which, unless kept constantly wetted, is liable to be fired by the slightest heat or friction of any kind. If a fire has been actually produced the best thing to extinguish it before it goes far, is to have ready a solution of carbonate of ammonia (common smelling salts), say 1lb. of the salt to seven pints of water, adding one pint of the crude ammoniacal liquid of the gas works, and keep projecting it on to the flaming body till it is put out. This appears to be all the consolation and advice I can at present offer, but I propose continuing my experiments and investigations upon this infernal liquid, as the present excited state of society, and the country generally, demand that something should be done to counteract, if possible, the mischief being perpetrated by those misguided and cruel wretches calling themselves Fenians, who will assuredly find that this stuff is not quite so easy to manage, nor so harmless to themselves as they imagine, as the following recent incident clearly shows. A few more such occurrences will probably cause it to be laid aside altogether, and the sooner the better, for there is no question as to its danger.

"Greek fire" appears to be a dangerous weapon to carry. Two men were going along a street in Cork lately, when the explosion of a bottle in the pocket of one of them made him throw off his coat instanter. The man and his companion then made off. On a bystander lifting the coat, another bottle exploded, and before the police came up, the garment, and what seemed to be a number of documents in it, were partly destroyed.

Correspondence.

SUGGESTIONS ON THE DEFENCE OF FORTRESSES.

No. IV.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—A thorough knowledge of the configuration of the surface of the ground surrounding a fortress—and even of the composition, geological nature, and structure of such ground—is indispensable for a successful defence, because such a knowledge would be one of the many points which, if taken advantage of to their utmost extent, would invariably be in favour of the defence. On the land environs of a fortified harbour, the same, or very similar, measures for the defence will have to be taken as are necessary for the defence of an inland fortress; one of these measures would consist in artificial changes of the natural surface configuration of the surrounding ground, in such a manner as to insure additional advantages to the defenders. Eminences which could not conveniently, and with the certainty of a successful defence, be covered with works, had better be removed altogether, and in the case of many British harbours, the material thus removed could most advantageously be applied to various harbour improvements. Hollows or indentations of the ground likely to afford cover to the enemy should be filled up, and so forth. The attack by means of trenches, parallels, &c., dug out of the natural ground, is generally admitted to be the easiest and cheapest to the besieging enemy; and it follows, hence, that it ought to be one of the chief objects on the part of the defenders to take such measures as would render that mode of attack exceedingly difficult, if not altogether impossible. One of these measures would simply consist in removing, for a considerable distance around the fortress, and to a depth of, say, twelve or more feet, all the natural ground which is of a tough cohesive nature, and in replacing said ground by a correspondingly thick layer of loose stones, pebbles, and shingle. It is not difficult to imagine how an enemy would fare while attempting to open his trenches under our fire in such artificial ground. On such portions on the land side of our fortress where the taking away of such a depth of ground would enable us to set such ground under water at high tides, by means of sluices, the placing such an artificial layer of pebbles, &c., may be dispensed with; although it cannot be denied that by even then covering the ground to a certain depth with a layer of loose pebbles, we would render far more difficult the enemy's task of opposing our inundation by means of counter dykes, &c.

In an engagement between the Prussians and Austrians, during the Seven Year's War, a large body of troops were compelled to abandon an otherwise very strong position, by the enemy firing solid shot from what at that time was considered an almost harmless distance—simply because the destructive effect of each solid shot thus fired was very considerably increased by the circumstance of the ground being covered with a number of heaps of loose pebbles, which, during many years, had been gathered by the peasants from their adjoining fields, and carted to that spot—and each shot, on striking any of those heaps, scattered a load of pebbles all around, thus acting, in fact, like grape and canister would at a shorter range. About twenty years ago the writer of these suggestions had occasion to be behind a temporary entrenchment, part of the parapet of which happened to be built of large but loose stones, which, though affording ample protection against the hostile small-arm bullets, were scattered about in a most destructive shower on being hit by a six-pounder solid shot. By now purposely placing here and there heaps of loose stones and pebbles, we would increase the effect of our shot at very long range, care being taken that by previously fixed aim lines of mathematical precision our gunners be enabled to point their guns, even during the darkest night, so as to hit such heaps. I may here parenthetically remark that a table of aim lines, carefully drawn up from previous practice, should be in the hands of the gunner of every piece of ordnance in the fortress, so that by adjusting the gun at the angle indicated by the respective column in the table of aim lines, any given point within range could be hit without being seen. In the case of a fortified harbour, a thorough knowledge of the surrounding ground should also embrace the adjoining sea; and a relief map or model correctly representing the configuration and composition of the bottom of the sea for a considerable radius around a harbour, with contour lines showing the various levels of the sea surface at the various tides, with arrow-headed or vane-headed pins stuck into the proper spots on the model to show the direction of currents, with, say, movable wire or thread, arrangements to indicate the range at various elevations of each of the principal guns, should be prepared, and should be accessible to all those officers and others engaged in the defence, who might require the assistance of such a map. Obviously, such model maps ought not to be accessible to the general public, simply because a knowledge thus laboriously acquired ought to be the sole property of the defenders, and the publishing of any such information would indeed be equivalent to pasting on the outside of a burglar-proof safe a detail description of the construction of the lock.

In the defence of harbour and coasts, submarine engineering will yet play a far more important part than it did hitherto; and the suggestion of the formation of special local corps of "submarine engineers" and "divers" would hence appear quite natural. It would indeed appear very desirable that the bulk of the men composing such a corps ought not to be liable to be drafted into service elsewhere, because their efficiency would naturally depend upon the fact of their being most thoroughly acquainted and familiar with the sub-aqueous environs of the seaport where they may be stationed. The formation of such a branch of the service would probably result in the individual members of the same discovering, by their minds being constantly turned in that direction, various improvements for enabling men to carry on submarine operations with greater ease than they ever could hitherto. The services of our corps of "submarine engineers" could be made to assist in the defence of our harbours in a variety of ways. Occasions may arise where an enterprising enemy's ships or floating batteries may come so very close to our own defending floating or stationary works, that the attempt of blowing up the enemy's ships by means of torpedoes might be dangerous to the defenders themselves. But even then the enemy's vessels may be destroyed by the discharge of huge mortar-like submarine guns, so placed that all the force of their explosive charge would be expended only in the direction of the attacking enemy's ships. Obviously, for the construction and working of such submarine batteries we should have to rely on our corps of submarine engineers. Submarine permanent roads may be laid down for the conveyance of huge masses of explosive substance, destined for the destruction of the enemy's ships.

It would be but natural that the thoughts of the individuals, of which our corps of submarine engineers is composed, would be concentrated upon that special branch of the service, and that thus new and improved methods would be devised for enabling human beings to walk about and work at the bottom of the sea with greater ease and efficiency than has been possible hitherto. Some remarks on submarine "chevaux de frise" and temporary "artificial breakers" I shall defer to a future letter, as I could hardly convey my meaning of those novel arrangements clearly without the assistance of diagrams. Balloons might be advantageously employed by the defenders, not only for the purpose of observing the enemy's movements from a great

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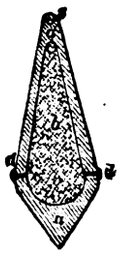
height, but also, if the state of the weather be favourable, for attacking the enemy's fleet, by dropping shells upon his ships from a great height. The accompanying diagram gives the section of such a



shell, exclusively constructed for that purpose. *a a* is the section of the body of the shell, with the loop *c*, by means of which it is attached to the car of the balloon; *b* is the explosive charge, and *d d* the percussion arrangement for exploding the shell as soon as it strikes the object. A shell of such a shape being dropped from a very great height, would strike a ship with tremendous power and do very great damage. As regards aeronautics in general, I feel convinced that they may play a not unimportant part in warfare; but I may here, *en passant*, remark, that all attempts to raise a body in the air, and keep it suspended therein by means of fans or screws, must invariably result in failure; and that all mechanical contrivances and their motive power ought to be exclusively directed to the steering and propulsion through the air of the balloon—the car or cars being kept sustained in the air by means of an inflated balloon or several balloons. Who would ever think of attempting to keep a ship afloat in the water by means of revolving fans or screws?—I am, Sir, yours, &c.,

February 19. G. J. GÜNTHER.

SQUARING THE CIRCLE.

SIR,—Knowing well the Astral physical generalizations, affirmed in what are called Kepler's planetary laws, which have properly made his name so famous, and taking a deep interest in astronomy, I wish to ask from your correspondent "Commander, R.N.," who, in your issue of to-day, justly corrects my use of the word "Magazine" for "Almanack," what he exactly means by the last paragraph of his letter, viz.:—"In the computations of which the value of trigonometrical lines are based upon the long accepted ratio of the circle to its diameter."—I am, Sir, yours, &c.,

WILLIAM HARVEY.

London, February 14.

SIR,—I am afraid, from Mr. Nicholson's remarks, that in my desire to spare your space I may have been a little obscure in my last letter. When I stated that Mr. Nicholson's proposition was not new, I had in my eye the rule for finding the area of a circle by multiplying half the circumference by the radius, with which his demonstration coincides. As to "squaring" the circle, of course his parallelogram can only be approximately squared by exactly the same infinite series of decimals as is the circle now, unless indeed he propounds a different ratio for the circle from that generally accepted at present. The rule I have referred to may be found in Keith's "Practical Geometry." I think with Mr. Nicholson it would be a very narrow and illiberal idea that none but professors should be allowed to write in periodicals on scientific subjects.—I am, Sir, yours, &c.,

THOMAS SCUTT.

February 15.

SIR,—Mr. Harvey, in replying to my letter, states that he does not allow the correctness of trigonometrical tables, but he does not say anything at all against the manner in which I find by construction, and by employing only the (even by Mr. Harvey acknowledged) rule for the area of a triangle, that his rule gives the area of a circle of 1' diameter about 1,2 square inches larger than the area of the circumscribed polygon of twenty sides. If Mr. Harvey has made the drawing and calculation, as explained in my last letter, he must have found out his mistake, and must know that the statements in his last letter are not true. If he did not make the drawing, he acted on the principle "Where ignorance is bliss, 'tis folly to be wise;" and even after being proved wrong, he can then fancy that at some future period, when technical education is more appreciated, every schoolboy will know the name "Harvey" as well as "Pythagoras," and will be thankful to him for simplifying 3,1415926 into 3,2.

I have also read some letters of Mr. Nicholson, and if I translate his last letter into figures, I find his value of $\pi = 3{,}14053$. The correct $\pi = 3{,}14159$, and Mr. Nicholson's value is too small by 0,00106 or about 1-30th per cent., which is very good indeed. But even if Mr. Nicholson should find a real construction for a square nearly equal in area to a given circle, it will be of no use whatever, because all those who want areas of circles can find them very quickly in their tables; but if they use Mr. Nicholson's construction, they will finally find the side of a square, and will have to look in their tables for the area of that square, so that the time spent with the construction is lost, and the result is after all too small by about 1-30th per cent.—I am, Sir, yours, &c.,

A. W.

February 17.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—C. B.—G. W. H.—J. B. T.—F. P.—H. E. R.—J. B.—T. G.—Messrs. C. M. and Co.—W. R.—B. M'L.—W. T. F.—W. M.—R. S.—T. H.—R. I.—H. K.—T. S.—M. B.—A. W.—G. E. P.—G. W. H.—L. O.—G. J. G.—G. R.—R. G. S.—F. H.—T. W. F.—H. R.—Messrs. W. T. H. and Co.—W. M'D.—J. S.

Meetings for the Week.

MON.—Royal Geographical Society.—C. R. Markham Esq., on "The Geographical Results of the Abyssinian Expedition to January 22, 1868," at 8.30 p.m.

TUES. — The Institution of Civil Engineers. — 1st, renewed discussion on "The Supporting Power of Piles, &c.;" and, 2nd, Mr. C. P. Sandberg, A.I.C.E., on "The Manufacture and Wear of Rails," at 8 p.m.

Royal Institution.—Professor Tyndall on "The Discoveries of Faraday," at 3 p.m.

WED.—Society of Arts.—Wentworth Lascelles Scott, Esq., on "The Supply of Animal Food to Britain, and the Means Proposed for Increasing it," at 8 p.m.

THURS.—Royal Institution.—Professor Tyndall on "The Discoveries of Faraday," at 3 p.m.

FRI.—Royal Institution.—A. Vernon Harcourt, Esq., on "Chemical Actions," at 8 p.m.

SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

Naval, Military, and Gunnery Items.

THE "Brenta," of Bassano, a city of what was formerly Austrian Italy states that a bomb exploded in the cathedral there during the celebration of the *triduum* for the victory of Mentana, but that fortunately it caused no injury.

The 64-pounder Palliser rifle gun has completed its test at the Woolwich butt of the 2,000 rounds ordered by the War Department, and has undergone the usual searching and examination, without the appearance of any blemish or signs of weakness.

SIR W. G. ARMSTRONG has been made a Knight Commander of the Order of San Maurizio e Lazzaro by his Majesty the King of Italy, in recognition of his services as an artillerist, and as the consequence of the definitive adoption of his ordnance for the Italian naval service.

We, "United Service Gazette," are given to understand that H.M.S. "Wyvern" is at present armed with "three guns and a half," the explanation of this circumstance being that in experimenting with 150lb. shot the breech of one of the muzzle-loading 300-pounders was blown completely off. An order has been given that the "Wyvern" is not to fire her guns for the present.

THE Bureau Veritas of Paris has published a statement of the marine disasters which occurred during the past year. The total number of vessels lost in 1867 is 3,045, an increase of 113 as compared with 1866. Of these losses nearly one-half have fallen upon England, whose contribution to the unfortunate list has been 1,438 vessels, while the United States has lost 364, France 273, Prussia 156, Norway 116, Holland 112. Of steamers lost the number was 145, and of sailing vessels 2,900.

THE lighthouses on the coasts of Italy have of late received the special attention of the Government. The sum of 1,750,000f. (£70,000) has been expended in the construction of new lighthouses. Previous to the year 1860 the Italian lighthouses, not including those belonging to the Venetian and Roman States, were fifty-eight in number. Since then thirty have been constructed, and eight are now building.

THE "Melbourne Argus" states that an attemp is to be made to open up a direct trade from Melbourne to Japan. The barque "St. Bernard," which cleared out on the 21th of December, chartered and loaded by Mr. Tallerman, a well-known Melbourne importer, was the first vessel to leave Hobson's Bay for a Japanese port. More than half the cargo consists of colonial produce, among which are about 100 tons of beef and mutton preserved in various ways, colonial beef and mutton hams, bottled fruits, leather, flour, hay, oats, horses, cows, sheep, and furniture. Among the imported articles shipped for this new markt were wines and spirits, clothing, and fire-arms.

ASEL ECTED armour plate from a number made at the rolling-mills of John Brown and Co. for the turret-ship "Monarch," was tested on Monday on board the "Thunderer" target-ship at Portsmouth, under the superintendence of Captain A. Hood, C.B., commanding the gunnery establishment of H.M.S. "Excellent." The plate weighed 6 tons, was 12ft. in length by 3ft. 6in. in breadth, and 8in. in thickness. Nine shots were fired at the plate, all striking in a space measuring 35in. by 18in., and seven of the shots in a central space 18in. square. The plate proved to be of unusual excellence, and will receive a high classification. Messrs. J. Ellis and J. C. Bayley were present as representing the manufacturers.

A RECENT Admiralty order directs preparations to be made at Chatham for the construction of another powerful armour-clad war ship of the "Hercules" class, in the large dock from which the "Hercules" was recently floated out. The instructions accompanying the order state that the new vessel will be in all respects the same as the "Hercules" below the water-line, and that the ironwork for the keel of the new ship is to be immediately commenced.

IT has been a common expression in the mouths of Englishmen that "boards" have no soul; but, to prove that the Admiralty Board has some sense of feeling, we, "Army and Navy Gazette," can say that only lately a commander in the Royal Navy, who had met with a fearful accident, had his case properly represented and, to the gratification of himself and friends, a decision was rapidly arrived at by their lordships doubling the pension, which, under ordinary circumstances, he would have received. Again, a poor assistant-surgeon died who had not served sufficiently long to qualify his widow for a pension—in fact, she was in deep distress. My lords lost no time in directing a handsome gratuity to be sent to her, following up the principle of "*bis dat qui cito dat.*"

IN consequence of the new army organization in Southern Germany, Baden, with her 1,400,000 souls will possess an army of 18 battalions of infantry, 15 squadrons of cavalry, ten field batteries, and the usual auxiliary branches in due proportion. This force will number in peace, 14,828. In war it will be raised to 24,000 inclusive of non-combatants, but exclusive of 8,900 depot troops, to fill up losses. In addition to this there is a reserve force of 8,000 Landwehr; the whole forming a total of 936 officers, 38,547 rank and file, 4,194 non-combatants, with 7,517 horses.

THE following appointments have been made at the Admiralty:—Lieut. Robert H. Harris, to the "Britannia;" Edwin Boulton, chief engineer, to the "Lion;" William H. Rundle, chief engineer, to the "Indus," for the "Princess Royal;" Thomas F. Hall, chief engineer, to the "Fisgard," for the "Wolverene;" Sub-Lieut. William B. Rennell to the "Beacon;" Frederick Maitland, midshipman, to the "Achilles;" A. Irwin, surgeon, to the "Bristol;" Samuel M'Bean, assistant-surgeon, additional, to the "Wellesley;" and Samuel E. Lark, assistant-paymaster, additional, to the "Mersey."

The following are the items of the extraordinary estimates of the War Department and of the Navy of Austria for the present year:—1. Extraordinary expenses once for all.—(*a*) Armament of the troops with breechloaders and complement of deficiencies in ammunition and material of artillery, £2,170,000. (*b*) Complement in uniform and accoutrements, £270,000. (*c*) New organization of army train and deficiencies in harnessings, £68,500. (*d*) Extraordinary requirements of remounts for the newly-organized artillery, £12,600. (*e*) Ambulances, £7,500. (*f*) New fortifications and barracks, £180,000. In all, £2,708,600. 2. Transitory extraordinary expenses.—Pay of supernumeraries for the campaign of 1866. £360,000. In all, £3,068,600. For the Navy, once for all, 1st, stores and expenses of the arsenal, £27,000; 2nd, land and sea fortifications at Pola, £73,000; together £100,000.

Miscellanea.

THE number of visitors at the Patent Office, South Kensington, for the week ending February 15, was 3,656; total number since the opening of the Museum, free daily (May 12, 1858), 1,246,788.

THE value of the silver ore imported into the United Kingdom during the 12 years ending 1866, was as follows:—1855, £564,580; 1856, £354,970; 1857, £299,511; 1858, £209,154; 1859, £342,637 1860, £382,806; 1861, £289,373; 1862, £331,564

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1863, £272,826; 1864, £251,568; 1865, £382,391; and 1866, £275,599. These imports are thus making little or no progress.

THE visitors to the South Kensington Museum, during the week ending February 16, 1868, were—On Monday, Tuesday and Saturday, free from 10 a.m. to 10 p.m., 10,003. On Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. to 4 p.m., 1,496—Total, 11,499. Average of corresponding week in former years, 10,016. Total from the opening of the Museum, 7,197,749.

THE thermometer at the Melbourne Observatory reached 104deg. in the shade on December 19. An instance of the extreme variability of temperature in the climate is afforded by the fact that at Grant, on the Crooked River, on the 10th, the heat was very great, the glass standing at 88deg. in the shade—an altitude uncommon in that alpine locality. On the 12th—only two days afterwards—the temperature was at freezing point, and snow was lying six inches deep on the plains.

A FIRE broke out on Saturday in the port of Antwerp, which was extinguished during the evening. Two vessels containing 208 barrels of petroleum were consumed by the flames. The amount of the property destroyed is estimated at 150,000f. The whole of the loss is said to be insured, partly in Belgian and partly in Dutch insurance companies.

We read that an *employe* on the Orleans Railway has invented an amalgamation of coal and other combustible materials, especially petroleum, made for convenience of use in the form of bricks, which, it is said, is calculated to effect an immense saving in the fuel necessary for generating steam. It burns with intense heat, and for a long time, and is likely to be extensively employed very shortly on the Orleans line, where some very satisfactory experiments have been made with this material. The compound is called *briquettes bordelaises*.

THE last relics of the old Fleet Prison are fast disappearing. The other day the materials of several houses and other premises at the corner of Ludgate-hill and Farringdon-street, including the boundary wall of the old Fleet Prison, were disposed of by auction, in order to carry out the long-contemplated improvements in that locality, and in a few days not a vestige will remain of that celebrated place of incarceration for unfortunate debtors. The prison was burnt in the great fire of 1666; built anew, and again destroyed in the riots of 1880; rebuilt, and finally pulled down in April, 1844, when the site was purchased by the Corporation of the City of London for £29,000.

THE Academy of Agriculture, Commerce, and Arts, of Verona, intend celebrating, in the course of the present year, the one hundredth anniversary of their establishment, by an agricultural and industrial exhibition, with a show of cattle, to be held at Verona from the 14th of September to the 15th of October. For this purpose, the Minister of Agriculture has granted a subsidy of 4,000f. and sixteen medals; the Provincial Council, 4,000f.; the Chamber of Commerce, 1,000f.; and the Municipality of Verona, 3,000f.

A SINGULAR and fatal accident lately formed the subject of inquiry at Liverpool. An old man troubled with rheumatism, had obtained a colourless liniment, which on Sunday last he gave to his wife and asked her to rub it upon one of his hips. She poured some of the liquid upon her hand, and after rubbing her husband for some time, in order to increase its efficacy, she warmed her hands at the fire. The liquid on her hands became ignited, and she was very severely burned. Her husband approached to render her assistance, and the liquid upon his hip became ignited also, his clothes were burned, and he sustained such serious injuries that he soon afterwards died.

WE have to record the death of Mr. William Herapath, the well-known toxicologist, of Bristol. The deceased gentleman, who was seventy-two years of age, had only been ill for a short time, and expired on the evening of yesterday week at his residence in the Old Park, Bristol. Mr. Herapath was the son of a maltster, and for some little time followed the occupation of his father. He had, however, a strong inclination for scientific pursuits, and he devoted himself to the study of chemistry. Nearly forty years ago he gained a reputation by his analysis in a case in which a woman named Burdock was convicted at Bristol upon circumstantial evidence of poisoning. In the more celebrated case of Palmer, of Rugeley, Mr. Herapath was a witness, and he had also been concerned in many other important criminal and civil trials.

A CONSIDERABLE portion of the ruin at Wemyss, known as Macduff's Castle, recently fell down, probably owing to its having been weakened by the late severe storms. The castle is extremely old, an age of 1,000 years at least being attributed to it. Centuries of exposure to the weather have honeycombed some parts of the masonry to the depth of 8in. It was the north-eastern portion of the ruin which fell the other day, the western part still standing. Underneath the western building is a large cave, in which there is a well, and it is supposed that there had been a subterranean passage from the case to the castle in former times.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—2009, 2042, 2043, 2048, 2049, 2050 2075, 2086, 2099

BUILDINGS AND BUILDING MATERIALS—2028, 2039, 2041

CHEMISTRY AND PHOTOGRAPHY—2006, 2011, 2012, 2055, 2100

CULTIVATION OF THE SOIL, including agricultural implements and machines—2023, 2060, 2071, 2088

ELECTRICAL APPARATUS—2015, 2016

FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2013, 2014, 2017, 2020, 2058, 2068, 2076, 2085, 2087, 2096

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—2034, 2051, 2079

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—2032, 2035, 2056

GENERAL MACHINERY—2010, 2022, 2025, 2027, 2029, 2030, 2037, 2044, 2047, 2053, 2054, 2063, 2073

LIGHTING, HEATING, AND VENTILATING—2045, 2065, 2078

METALS, including apparatus for their manufacture—2046, 2092

MISCELLANEOUS—2007, 2019, 2021, 2024, 2031, 2033, 2062, 2064, 2067, 2069, 2070, 2072, 2074, 2081, 2082, 2083, 2084, 2090, 2093, 2094, 2095

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2018, 2026, 2038, 2061, 2080, 2089

SHIPS AND BOATS, including their fittings—2052, 2057, 2059, 2066

STEAM ENGINES—2036, 2077, 2097, 2101

WARFARE—2040, 2091, 2098

2009 J. CREDLAND. *Improvements in the arrangement of the flues of certain boilers for generating steam.* Dated July 9, 1867.

The object of this invention is the saving of fuel by a better application of the heat arising from its combustion, and the improvements are applicable to boilers with one or more internal flues, and where the products of combustion, after passing through the internal flues, are then circulated round the exterior of the boiler by flues formed in brickwork, and the invention consists in contracting the flue so that its area is much less than that of the ordinary flue, and in making the line or face of the brickwork of the flue to come parallel to the external surface of the boiler, or nearly so, and at an average distance of about 3in. therefrom, the upper part of the flues terminating a little below the water line of the boiler. The lower part of the boiler rests upon a wall passing the lengthway of the boiler, and upon each side of this wall the flues descend to make a recess or receptacle for dust and soot. The products of combustion pass through the internal flues of the boiler, then return towards the front of the boiler along one external flue at ore side, and then back towards the chimney along the external flue upon the other side of the boiler.—Patent abandoned.

2010 E. and F. CROOK. *A new or improved machine for crushing bones and other materials.* Dated July 9, 1867.

Here the inventors employ rollers, by preference two, mounted on shafts opposite to and parallel with one another. The circumferences of these rollers are fitted with concave teeth, the number of which may be varied. These teeth, which are sharpened, somewhat overlap and work between each other, the distance being regulated according to the size to which it is required to reduce the bones or other material. Motion is communicated from a flywheel on a shaft extending across the machine, and carrying at its other end a pinion in gear with a wheel on one of the roller shafts, the other end of which carries a toothed wheel which is itself in gear with a wheel of a similar size on the other roller shaft. The material to be crushed is placed in a hopper, passes between the teeth of the rollers, and falls into a receptacle underneath provided for the same.—Patent abandoned.

2011 W. E. NEWTON. *Improvements in the rectification and purification of alcohol.* (A communication.) Dated July 9, 1867.

This invention consists, first, in the employment of water in admixture and in contact with the alcoholic vapours of the column, as an active purifier of the odorous products to be eliminated. Second, in the employment also of water as the vehicle of all chemical agents for fixing the extraneous products to be eliminated, by applying these agents in direct contact with the alcoholic vapours in the interior of the column. Third, in the substitution for the ordinary analysers of the analyser and concentrator described acting simultaneously by its surfaces of condensation, and by filtration or separation, of the vapours and liquids.—Patent completed.

2012 R. SMITH. *Mixing water, iron, sulphur, arsenic, and oils together, making a perfect coating for iron or wooden ships, yachts, and steamboats.* Dated July 9, 1867.

Here the inventor takes 1lb. of crude brimstone, and a quarter of a pound of steel or iron filings; the filings are to be in a state of rust; he pounds them together with a little water, and afterwards adds 1 pint of water, mixes all together, adds 1 part of linseed oil, and stirs until he produces a mixture fit for use. Arsenic may be added in the proportion of about 3oz. to the above, and the same quantity of filings must be added. If fish oil be used, a double portion of filings is needed to cause the mixture to dry.—Patent abandoned.

2013 W. R. LAKE. *Improvements in machinery for manufacturing cards for combing or carding fibrous materials.* (A communication.) Dated July 9, 1867.

This invention is not described apart from the drawings. —Patent completed.

2014 W. WOOD. *Improvements in the manufacture of Turkey, Wilton, and Brussels tapestry, and other terry and cut-pile carpets and rugs.* Dated July 9, 1867.

These improvements consist in forming the piled surface of these fabrics of yarns made wholly or partly from undyed natural coloured wool, hair, or other animal fibres, adding thereto, to produce a required shade of colour, a portion of dyed wool or fibres. The improvements relate, second, to the binding warp of the above-named fabrics, and consists in discarding one half of the ordinary binding warp threads, and in using but one thread in each space of the reed, and making this half warp bind both the upper and lower weft shoots alternately, the dead worsted or "dead warp" lying between the said weft shoots. The improvements relate, third, to the dead warp in tapestry and other terry and cut pile carpets and rugs, and consist in twisting together the separate threads ordinarily employed so as to form but one compound thread in each space of the reed, whether the separate threads be made from the ordinary linen or cotton, or from wool, silk, or jute; and in making, when a stronger or smoother compound thread is desired, the twist of the doubling in the same direction as the twist of the spinning.—Patent abandoned.

2015 W. S. ANDREWS. *Improvements in means or apparatus used in effecting telegraphic communications.* Dated July 9, 1867.

The object of this invention is to enable instruments, such as those now known as Hughes' type printing instruments (and also other instruments), to work long distances for land or submarine purposes in various weathers, by providing a relay or relays at one or more points between two termini to reinforce or renew the electric current.—Patent completed.

2016 W. S. ANDREWS. *Improvements in means or apparatus used in effecting telegraphic communications.* Dated July 9, 1867.

The patentee claims arranging or combining means or apparatus used in effecting telegraphic communications whereby instruments of the character of those called "Morse" ink writing instruments are adapted to make indications by short currents of equal duration, and of opposite polarity, on one wire, substantially as described. Also arranging apparatus used in effecting telegraphic communication so as to obtain relays between distant parts when communicating to long distances, in manner substantially as described. He also claims the mode described of arranging insulating supports for suspending conductors used in effecting telegraphic communications.—Patent completed.

2017 H. ENGLISH and J. FARNDON. *Improvements in apparatus for operating the shuttles of looms for weaving narrow fabrics.* Dated July 9, 1867.

According to one portion of this invention the parts taking immediate effect on the shuttles in the operation of driving are comprised entirely within the limits of the length of the race, and consist of levers mounted on axes having spur or other gearing taking into a rack bar below, by which the motion is communicated. Another part of the invention relates to means of driving the shuttles by the oscillating motion of the batten, which, as usual, is suspended from above.—Patent abandoned.

2018 J. E. WHITING. *Improvements in suspension bridges and other structures in which girders are employed.* Dated July 10, 1867.

This invention consists in connecting by a hinge, or other flexible joints, the ends of the upper chords of two diagonally braced girders, so that each girder may have its top chord always in tension; and these girders are constructed so that this may be the case, and they are inclined to one another at an angle properly chosen, according to the proportions of the structure, and the requirements of the case, as to moving and fixed loads, and so as, the girders being free, to adapt themselves to changes of length consequent on changes of temperature and strain. —Patent completed.

2019 J. S. HOOD. *Improvements in life buoys.* Dated July 10, 1867.

The object here is to render the buoy self-inflating, which may be effected by a stop-cock, the opening of which admits air into the buoy for inflating the same, and allows the air to escape when the buoy is out of use.—Patent completed.

2020 D. and J. COLLINGE. *Improvements in looms for weaving sponge cloths by power.* Dated July 10, 1867.

This invention is not described apart from the drawings. —Patent completed.

2021 H. B. FOX and J. T. HALL. *An improved stopper for bottles, jars, casks, and other vessels.* Dated July 10, 1867.

The patentees make these stoppers of a combination of wood and an elastic material, such as cork or india-rubber. The central part of each stopper is made of wood, and the periphery of a ring or piece of cork, or other flexible material.—Patent completed.

2022 F. HOLMES. *Improvements in pumps.* Dated July 10, 1867.

By this invention a treble action is obtained from a single-acting pump with two pistons on the same rod. From about the middle of a pump barrel having a double piston, or two pistons, the upper of which is a bucket piston, on the same rod, a pipe is carried down which terminates at its lower end in the liquid to be raised; a pipe leads from the upper part of the barrel to deliver the liquid raised by the first pipe. From the bottom of the pump barrel a pipe is carried down, which also terminates at its lower end in a closed chamber immersed in the liquid with which it is filled. The chamber is provided with inlet valves, and a pipe is carried up from its lower part to deliver the liquid. The patentee prefers to employ two pump barrels, and two sets of pumps, the two pumps acting alternately.—Patent completed.

2023 J. N. PAXMAN and H. M. DAVEY. *Improvements in drying wheat and other grain, and pulse and seeds, and in the apparatus employed therein.* Dated July 10, 1867.

This invention consists in the use of a cylinder within which may be placed one or more cylinders heated by steam, and through which the wheat, &c., to be dried are caused to pass, such substances being kept in agitation whilst a current of air is made to pass through the cylinders, and so disperse or dispel the moisture from the wheat, &c., under treatment.—Patent completed.

2024 G. DAVIES. *An improved metallic eye for laces.* (A communication.) Dated July 10, 1867.

Here the patentee first takes a thin plate of metal, and by punches and dies cuts from the plate pieces consisting

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of two flat rings connected by a strip. He then, by dies, forms on one ring a projecting annular flange, thereby reducing it to the form of an ordinary eyelet. Another operation is to turn up the edges of the intermediate strip, so that it may be rounded underneath. He now bends the strip so as to form an eye or loop, causing the eyelet to pass through the other ring, after which the device is ready for attachment. A hole is formed in the fabric, and the eyelet portion of the device passed through the hole, after which an ordinary eyelet is inserted into the interior thereof, when the whole is removed to an eyelet machine and riveted, so that the device consists of a ring or loop standing out at right angles from the material, and attached thereto by a metal eyelet formed of one piece with the former.—Patent completed.

2025 W. HEYES and W. BEVAN. *An improved self-acting buckle or coupling, to be employed for lifting, hoisting, or winding at coal pits, or for other similar purposes.* Dated July 10, 1867.

This invention consists in the use of a peculiar clasp or coupling which forms the connection between the cage, &c., to be raised, and the rope or chain employed for raising the same.—Patent abandoned.

2026 W. L. WISE. *Improvements in the manufacture of crossings for the permanent ways of railways.* (A communication.) Dated July 10, 1867.

In constructing crossings (which the inventor makes non-reversible) he takes blocks of steel, &c., in a cold state, and submits them to the action of planing machinery, so as to form grooves or recesses therein, to bring out in relief the various portions constituting the point and side rails, and other raised parts of the crossings, which he, in some cases, subsequently tempers, and to otherwise prepare them for use, the crossings being in one piece, and being so formed as to render them capable of ready renewal or repair by the simple process of planing. He fixes the crossings on the sleepers by bolts passing through the thickness of the metal, thus dispensing with the necessity for special chairs—at least, in so far as regards the intermediate sleepers.—Patent abandoned.

2027 W. E. NEWTON. *Improved apparatus for boring or perforating rocks, metals, or other substances.* (A communication.) Dated July 10, 1867.

This invention is not described apart from the drawings. —Patent completed.

2028 G. R. B. AMOTT. *Improved machinery for making bricks for building and other purposes, and of coal peat or other substances to be used as fuel.* Dated July 10, 1867.

This machine includes both a pug mill and a moulding apparatus. Mounted upon the bed of the machine is the pug mill, which is fitted with knives for working the clay, &c., and forcing it down towards the bottom of the mill. At the bottom of the pug mill cylinder openings are made to permit of two or more endless chains of moulds passing through the cylinder. These moulds are carried by tumblers or drums mounted in bearings at opposite ends of the machine, and they receive their traverse motion from the axle of one of the tumblers, which is driven by suitable gearing. As the moulds pass through the pug-mill, they are filled with the material to be compressed, the surplus of which is removed by the lip of the exit opening of the pug mill cylinder through which they pass. The filled moulds in passing along the bed severally come under the action of a compressing plunger and a discharging plunger, the former of which completes the moulding of the brick, &c., while the latter serves to discharge it from the mould on to a transverse travelling apron for delivering the bricks, &c., out of the machine. —Patent completed.

2029 A. H. BRANDON. *Improvements in wood-planing machines.* (A communication.) Dated July 10, 1867.

Here the inventor, according to one arrangement, places the timber to be planed on the table of a machine, and he advances it towards a rotating cutter by an upper feed roller turning in fixed bearings above the timber, and a lower feed roller let in the table immediately below the first, and beyond these rollers and above the timber he places transversely a cutter running at a high velocity, on either side of which, and parallel with the same, he also places guiding rollers to maintain the timber steady under the action of the cutter. In order that the feeding rollers may adapt themselves to any thickness of stuff to be passed through the machine; he terminates the under edges of the table in which the lower one runs in the shape of inclined planes, and by advancing and withdrawing horizontally two inclined planes on which the table rests he causes it to rise and fall vertically to the required extent.—Patent abandoned.

2030 A. H. BRANDON. *An improved circular saw machine.* (A communication.) Dated July 10, 1867.

This invention refers to a machine provided with two rotating circular saws, either of which can be brought to bear on the wood or other material to be operated upon. The patentee mounts each saw on the extremity of a shaft, and one of these shafts is mounted in bearings adapted to the extremities of two parallel levers, kept at a proper distance apart by a hollow sleeve shaft connecting them at their centre. The other shaft is mounted in bearings adapted to the other extremities of these levers. The sleeve shaft, with its levers, shafts, and saws, is mounted on a stationary shaft or bolt at such a distance below the table of the machine that the upper saw projects to the required extent. A small pulley is mounted on each of these saw shafts, so that the driving strap will always drive the upper one whilst the lower one will remain stationary; thus, by rocking or turning this apparatus on the stationary shaft as its centre of motion, either one of the saws can be brought into work.—Patent completed.

2031 J. STIRK and H. BYCROFT. *Improvements in refrigerators for cooling worts and other liquids, which improvements are also applicable to condensers used in distillation.* Dated July 11, 1867.

Here the patentees employ a series of flat tubes, between which the wort to be cooled passes, the said wort pursuing a zig-zag course from side to side of the case, or over and under each tube alternately; but instead of joining the said flat tubes together, they make each tube independent of the others. The tubes are separately fixed in the case, and communicate at one end by means of short pipes with a supply pipe which supplies them with water, and at bottom with an exit pipe, by which the water passes out of the tubes. To effectually employ the cooling power of the water, each of the flat tubes has a series of horizontal divisions by which the tube is divided into a series of zig-zag spaces, through which the cooling water has to make a tortuous passage, and by which it effectually absorbs the heat of the wort in contact with the outsides of the tubes. In consequence of the tubes being independent of one another, as described, they may be very readily removed from the case for cleaning or repair, and in case of repair, the removal of one or more of the tubes does not interfere with the action of the others, so that the refrigerator may be maintained in action while it is undergoing repair.—Patent completed.

2032 J. B. FRASER. *New or improved machinery to be employed in the manufacture of watches and chronometers.* Dated July 11, 1867.

This invention consists, first, in the arrangement and combination of parts of machinery for making the top and bottom plates of watches and chronometers—that is to say, the plates in which the pivots or axes of the wheel work; and, second, in the arrangement or combination of certain other parts of machinery for depthing, marking, and drilling the holes in the top and bottom plates in which the pivots or axes of the wheels work.—Patent completed.

2033 J. S. HENDERSON and J. MACINTOSH. *Improvements in the manufacture of cylindrical metallic cases, and in the machinery or apparatus employed therefor.* Dated July 11, 1867.

This invention consists in bending sheets of tinned iron plate to the required shape on cylinders, and in effectually soldering them whilst in the cylinders.—Patent completed.

2334 J. H. JOHNSON. *Improvements in the manufacture of refined sugar.* (A communication.) Dated July 11, 1867.

This invention relates to what may be termed the primary process in the manufacture of refined sugar, namely, to the melting or dissolving, and consists of a mode of converting sugar of one quality into solutions of different qualities, to be used in the manufacture of such classes of refined sugar as the peculiar quality of the solution or syrup employed is best adapted for. We cannot quote the details of the method.—Patent completed.

2035 J. H. JOHNSON. *Improvements in boots and shoes* (A communication.) Dated July 11, 1867.

This invention relates to certain improvements in boots and shoes, and has for its object the supporting or holding up the "shank" or "waist" of the soles of boots and shoes. In carrying out this invention it is proposed to combine a tempered steel blade spring with a plate or strip of untempered steel, or other suitable metal, the steel spring being secured at its centre by a rivet which passes through the metal strip, leaving the ends of the spring free to play upon the surface of the plate or strip when deflected by the bending of the sole. This combined plate and spring is inserted into the interior of the sole at the "shank" or waist, and secured at the end: by nails or pegs introduced through holes made for that purpose in the ends of the metal plate. The plate being of untempered steel, or of flexible metal, may be shaped to the sole without liability to fracture.—Patent completed.

2036 K. J. WINSLOW. *An improved method of conveying the rotary motion to axles of steam engines, and all machines and carriages where cranks are used.* Dated July 11, 1867.

This invention consists of a method of turning axles by means of two connecting rods acting on two ratchets hung upon movable bars, which bars have the same centre of motion as the axle to be turned. These ratchets work as ordinary ratchets upon a cogged or roughened wheel fixed on the axle. The connecting rods are forced backwards and forwards by the piston or other motive rod, and the ratchets being thus alternately lifted and depressed, act in the direction of the wheel, and communicate the required motion. By a simple contrivance by stops attached to the movable bars or otherwise the ratchets are made to act in the opposite direction and the reverse movement is communicated to the axle.—Patent abandoned.

2037 B. HUNT. *Improvements in the construction of bearings for machinery, agricultural implements, and carriages.* Dated July 11, 1867.

This invention has for its object to construct wooden bearings which will not wear oval, but will wear in an uniform manner. The bearings are constructed of wood with the end way of the grain placed at right angles to the axis of the running shaft, so as to receive the friction of the journals. On either side of the journal of the shaft there are two or more pieces of wood of the exact diameter of the journal, and hollowed out to fit, and above and under these two hollowed-out pieces is or are placed one or more other pieces of wood, by which the two hollowed out-pieces are held in position. Into one or both of these upper and under pieces is dovetailed a smaller piece of wood, so placed that the end of the grain may be presented to the journal.—Patent abandoned.

2038 W. E. NEWTON. *Improvements in the construction of the permanent way of railways.* (A communication.) Dated July 11, 1867.

This invention consists in effecting the rigid coupling together the ends of the rails by means of side plates or braces rigidly clamped to the rails, without the use of any bolts or other appliances, which penetrate and thereby weaken the stock of the rails.—Patent abandoned

2039 J. S. BURKE and B. BURLEIGH. *Improvements in the construction of sub-aqueous works and foundations.* Dated July 11, 1867.

The plan of operation is as follows:—The inventors construct a pontoon or floating vessel of steel, iron, wood, &c., having a bottom of any required form. The pontoon is to be worked by steam power, or otherwise, and to be provided with screw propellers and apparatus for guiding and fixing in position, and with pumps for air and water pressure, and all other necessary apparatus. They then construct in a dry dock a casing of wood or metal of such form as may be required for a section of the work or foundation of the work to be erected. The said casing is then filled with brickwork, masonry, or concrete. The water is then let into the dock, and the pontoon is floated immediately over the casing, to which it is lowered by the admission of water, or by the action of the tide, and then securely fastened, either by bolts, chains, slings, &c. The pontoon is so constructed that, when emptied of the water, it shall have sufficient floating power to lift the casing and its contents together, and float them into their permanent position.—Patent abandoned.

2040 E. HOHENBRUCK. *Improvements in breech-loading firearms.* Dated July 11, 1867.

This invention is not described apart from the drawings. —Patent completed.

2041 R. A. KENNEDY. *Improvements in doors and windows, and fastenings for the same.* Dated July 12, 1867.

This invention is chiefly applicable to the windows generally known as "French windows," and it consists in making the sashes so that they can be raised on their hinges above the bottom bead forming part of the frame. —Patent abandoned.

2042 J. NELSON. *Improvements in the casting of hollow and other firebars.* Dated July 12, 1867.

This invention consists in casting hollow and other fire bars in chills, and more especially the casting of the bars used in Juke's revolving furnace. By casting flat bars in "chills" or moulds of cast iron, or other metal, made in two or more pieces, the metal, when poured into the moulds, receives a sudden chill, which makes the casting harder and more durable.—Patent abandoned.

2043 J. B. E. G. PERRIN. *An improved smoke-consuming apparatus.* Dated July 12, 1867.

This apparatus consists of a cast-iron steam chest with flanges, and with an elbow pipe for the reception of the tube in communication with the generator. In the interior of the chest is a bronze pipe, round at the top, and conical at the bottom, which terminates in a flange by which it is bolted to that of the steam chest. A second pipe of brass, outside the above-mentioned one, and perfectly concentric with it, and furnished with a flange, is bolted thereby to that of the steam chest at the opposite end to that to which the bronze pipe is attached. A copper domed case covers these pipes, and is likewise bolted in conjunction with the brass pipe by means of its flange to that of the steam chest. In this outer covering or case, and on either side thereof, are two orifices for the admission and exit of a current of water which circulates in the space comprised between the case and the last named or brass tube, to prevent the apparatus from burning. At the top of the dome thirty small tie-pieces or screw-cut tubes are fixed, fifteen of which connect the semi-conical pipe with the case, and the remaining fifteen put the latter in communication with the brass pipe. This machine is fixed on the fire box; the suction of air in the semi-conical pipe is naturally produced by the drawing of the fire, and, escaping through the fifteen small tubes which connect the said pipe with the case or cover, mixes with the steam escaping from the other fifteen tubes communicating with the brass pipe and with the generator. By these means a mixture of steam and gas is produced of an uniform pressure, sufficient to produce the consumption of smoke.—Patent abandoned.

2044 E. H. BERNIER. *Improvements in safety apparatus for raising and lowering persons and weights in mines, applicable to other purposes.* Dated July 12, 1867.

We cannot here give space to the details of this invention.—Patent completed.

2045 F. WILKINS. *Improvements in apparatus for producing or increasing the light or heat from carbonized atmospheric air, gas, or gaseous mixtures, by the use of hydrocarbons oils, spirits, or other inflammable liquids or any mixture thereof* Dated July 12, 1867.

This invention is not described apart from the drawings —Patent completed.

2046 J. HARGREAVES. *Improvements in the manufacture of steel and soft iron from cast iron.* Dated July 12, 1867.

The patentee claims, first, the partial removal of the impurities of cast iron by the use of currents of air, together with the subsequent use of the said partially purified cast iron with oxidizing salts to complete the conversion of the cast iron into steel or soft iron, substantially as described. Second, the use of steel slag to effect the removal of the impurities contained in cast iron, substantially as described. Third, the use of iron heated by currents of air, with or without steel slag, substantially as described, for the manufacture of steel and soft iron by subsequent treatment with oxidizing salts.—Patent completed.

2047 W. B. HAIGH. *Improvements in machinery for tenoning wood.* Dated July 12, 1867.

This invention is not described apart from the drawings. —Patent completed.

2048 J. KELLETT. *Improvements in or applicable to steam boiler and other furnaces for the combustion or prevention of smoke, and economizing fuel.* Dated July 12, 1867.

This invention consists in constructing and applying to furnaces a cellular or hollow bridge behind the ordinary bridge. This bridge is open at the bottom, and the top is formed into gratings, or a series of openings, and (by preference) with the top or upper surface undulated or corrugated, and sloping towards the flame bed. The interior is divided by a series of vertical ribs or partitions, thus forming cells or passages for air which is admitted through the ash pit through an opening under the ordinary bridge provided with a door or flap for regulating the quantity to be admitted. Air passing through this bridge becomes heated by contact with the metal, and combining or mixing with the unconsumed products of combustion from the furnace, they become ignited thereby.—Patent abandoned.

2049 G. SINCLAIR. *Improvements in steam boilers and furnaces.* Dated July 12, 1867.

This boiler is constructed with two semicircular parts placed one above the other, connected together by vertical tubes. The front part, however, that is to say, the whole length of the furnace or firebox part, is of a cylindrical form wherein the patentee constructs one or two round furnaces, such front part being attached to the main part by two round or oval tubes, one at the top and the other at the bottom. He also adopts and uses two large tubes placed at the back end of the boiler for causing a circulation of the water in the boiler.—Patent completed.

2050 C. T. HIGGINBOTHAM. *An improved arrangement or construction of furnaces to be used for preventing smoke and effecting economy of fuel.* Dated July 12, 1867.

This invention consists in using firebars having a hollow web, or partly hollow and partly tubular web, which bars may or may not also have, in addition to the hollow or tubular web, certain lateral openings through which air may pass into the overlying stratum of fuel.—Patent abandoned.

2051 J. H. JOHNSON. *Improvements in apparatus for cutting or mincing meat, vegetables, and other substances.* (A communication.) Dated July 12, 1867.

The patentee claims, first, imparting to the cutter of mincing machines a chopping as well as a draw-cutting motion for more effectually cutting or dividing the substances to be operated upon, as described. Second, the arrangement of machinery for effecting a chopping as

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well as a draw-cutting motion of the cutter of mincing machines, as described. Third, the construction and arrangement of machinery for imparting a continuous or an intermittent rotatory motion to the receptacle containing the substance to be minced, whilst such substances are being operated upon, substantially as described. Fourth, the general combination and arrangement of apparatus for cutting or mincing meat, vegetables, and other like substances, as described.—Patent completed.

2052 A. M. CLARK. *Improvements in the construction of lifeboats, and in detaching tackle for boats.* (A communication.) Dated July 12, 1867.

This invention consists, first, in applying a removable and replacable inflated cover to and over the hold of a lifeboat, and supplying the interior with fresh and removing the foul air from the enclosed space through a hollow and divided shaft or mast, so that the lifeboat cannot have any water thrown into it, and, consequently, cannot sink. Second, in combining with the detaching apparatus of a boat, whether arranged at or over the sides or centre of the boat, a bail, bar, or other crosspiece extending to and connected with the sides of the boat, so as to act as a brace against the tendency of the boat to tip when hastily or unevenly loaded.—Patent completed.

2053 J. PASFIELD. *Improvements in safety or relief valves.* Dated July 12, 1867.

This invention consists in a mode of constructing safety or relief valves, whereby they are made very sensitive to variations of pressure, and great facility is afforded for the rapid escape of surplus steam, air, or gas.—Patent abandoned.

2054 D. M. HENDERSON. *Improvements in the framing of lighthouse lanterns, and of the optical apparatus of lighthouses.* Dated July 12, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

2055 A. E. HERRMANN. *An improved compound to be used for igniting fires.* (A communication.) Dated July 12, 1867.

This invention relates to the manufacture of an article moulded from a plastic compound of inflammable substances, the object being to produce an efficient fire kindler at a comparatively small cost. To this end, two mixtures, which may be designated A and B, are prepared separately and then combined by mixing together equal parts of the two. The compound thus produced is placed in moulds and heated, and it is then by pressure formed into cakes. To produce mixture A, to any given quantity of pulverized coal and pulverized charcoal (either or both), coal tar and resin are added in the proportion (say) of one-half (more or less) by weight, and stirred or pugged to form a homogeneous mass. To this mixture are added small proportions of mineral wax, known as ozokerite, and of nitrate, acetate, chromate, or sesquioxide of lead, or other product that will give off oxygen for quickening and maintaining combustion. In mixture B the same substances are used with the exception of coal and charcoal dust, for which sawdust is substituted.—Patent abandoned.

2056 G. T. BOUSFIELD. *Improvements in the manufacture of corsets.* (A communication.) Dated July 12, 1867.

This invention consists in constructing corsets of raw or partially tanned hide or parchment, which is drawn, when in a moist condition, over models or frames of such portions of a human figure as it is desirable to copy, and allowed to dry and harden in contact with the moulds or forms.—Patent abandoned.

2057 J. LAING. *An improvement in fastening wood to iron, applicable in securing the planking of composite ships to the iron frame.* Dated July 12, 1867.

When ordinary screw bolts and nuts are used to fasten a wooden planking to an iron frame, it is difficult to obtain sound and secure work, because the holes punched in the iron frame are taper, and, therefore, the bolt touches the frame only on a line of inappreciable width, even assuming that the hole is punched exactly of the proper size; hence the rigidity of the structure depends mainly on the nip of the nut against the frame. According to this invention the patentee employs nuts having a thin and somewhat taper ferrule formed on them on the under side, and this as the nut is screwed on enters the upper end of the taper hole, and when the nut is screwed home becomes jammed and ground into it so as effectually to fill the taper hole around the bolt.—Patent completed.

2058 E. B. BIGELOW. *Improvements in power looms.* Dated July 12, 1867.

We cannot here give space to the details of this invention.—Patent completed.

2059 P. M. A. LAURENT. *A certain improvement in nautical compasses.* Dated July 13, 1867.

Here the patentee obtains the stability of magnetic needles and compass cards by loading them with weights placed as far as possible from the point of suspension, and, on the other hand, he obtains more sensitiveness by loading the compass cards or needles with weights as near the centre as possible.—Patent completed.

2060 R. SIMS and J. PREST. *Certain improvements in agricultural apparatus, called horse rakes.* Dated July 13, 1867.

This invention consists, first, in so constructing and arranging the apparatus that the "lifting bar" of the rake shall be above the teeth of the rake, by which the hay is prevented from lodging on the bar and becoming scattered behind the rake where the ground should be clear, and the trouble of disengaging the hay from the bar is also avoided. Second, the invention is designed to allow a portion of the teeth to fall into hollows when passing over uneven ground. This is effected by means of joints on the "rake bar," and the employment of a counterbalance weight which assists in more readily releasing the rake when full from the load of hay it gathers.—Patent abandoned.

2061 J. WALKER. *Improvements in the manufacture of clips or spring bears for railway and other carriages, and in machinery or apparatus to be employed therein.* Dated July 13, 1867.

We cannot here give space to the details of this invention.—Patent completed.

2062 W. DRURY and C. WESTRUP. *Improvements in the means of indicating numbers and names on doors of private houses.* Dated July 13, 1867.

Here the patentees cast the head of a street door knocker, which is usually of solid metal, with a round, oval, or other shaped opening, and in the back of this opening they insert a ground or other glass tablet, having thereon the number of the house inscribed. An aperture of similar form is also made through the door immediately behind the tablet in the knocker head. In this manner the number may be readily discerned on the transparent tablet from the street at all times, and especially at night, by the light of the hall or passage lamp, or from other source.—Patent completed.

2063 T. BERNEY. *Improvements in apparatus for bending bars and plates of metal, and for forming and working metal, and in the converting, for purposes of this invention, of apparatus already in use.* Dated July 13, 1867.

An extension of time for completing this patent having been petitioned for, the documents relating to the invention cannot at present be seen.

2064 H. BELL. *Improvements in heel tips and toe tips for boots and shoes.* Dated July 13, 1867.

Here the inventor gives to the iron or metal, of which the tips are made, a less thickness at that part which forms the inner edge of the tip than that part which forms the outer portion of the tip, and he makes the holes for attaching the tip in the thin part.—Patent abandoned.

2065 H. FLETCHER. *Improvements in apparatus for the manufacture of artificial fuel, which apparatus may also be employed for other purposes.* Dated July 13, 1867.

The object of this invention is to construct an apparatus for drying and heating coal, and mixing the coal with pitch simultaneously; or the coal may be first heated and dried, and subsequently mixed with pitch in another operation. The adhesive substance may be farina or silicate of soda, where heat is not required, and the apparatus acts only as a mixer.—Patent completed.

2066 H. DUKE. *Improvements in apparatus for reefing and furling ships' square sails.* Dated July 13, 1867.

This invention relates to various improved arrangements and combinations of parts for facilitating the performance of the operations of reefing and furling ships' square sails from the deck, when such sails are so connected that they can be made to rotate and wind on or off, or furl or unfurl the sail, whenever required. We cannot here produce the details of the invention.—Patent completed.

2067 E. T. HUGHES. *An hydraulic self-acting vent peg.* (A communication.) Dated July 13, 1867.

This invention is not described apart from the drawings. —Patent completed.

2068 J. C. RAMSDEN. *Improvements in reeds and healds used in weaving.* Dated July 13, 1867.

This invention consists, first, of special means for manufacturing the reeds used in looms for weaving; and, second, in certain improvements in lapping the stones or shafts upon which the healds or heddles are put when used in weaving.—Patent abandoned.

2069 J. SCOTT. *Improvements in fire-escapes, the same being applicable to other useful purposes.* Dated July 13, 1867.

This invention has reference to two former patents, dated respectively October 31, 1866 (No. 2816), and April 18, 1867 (No. 1159). The specification of the invention is too elaborate to be quoted here at sufficient length for an intelligible abstract.—Patent abandoned.

2070 J. G. TONGUE. *Improvements in the construction of instruments or apparatus for ruling parallel, angular, and curved lines.* (A communication.) Dated July 13, 1867.

This invention relates, first, to the construction of an instrument or apparatus termed a "micrographic" rule. The instrument consists of two rules of wood, metal, &c., connected at or near their extremities by jointed arms, which are connected together at the joints by a rod or link which retains the arms opposite to each other. Upon or near the middle of one of the parts of the rule a suitably divided transverse bar is mounted, and this bar moves on a guidepiece fixed on the other rule. It is by the aid of this divided bar that the distance is determined that one of the rules moves in regard to the other. The equal parallel distances required may be exactly obtained by means of a small movable sliding piece which can be fixed when desired upon the divided bar by a thumbscrew, and the sliding piece is brought against the connecting rod or link previously described when one of the rules is moved away from the other, consequently limiting the distance that the other rule can move. It is evident that this distance will be changed by altering the position of the sliding piece. Other forms of stops for arresting the movement of the rule may be employed for the above purpose. Guides are placed at the extremities of the two rules to render their parallelism more perfect. In addition to the instrument previously described, apparatus may be combined therewith (or made separate therefrom) for ruling angular and curved lines, each instrument being termed a "micographic geniographe."—Patent abandoned.

2071 J. L. NORTON. *Improvements in apparatus for drying grain seeds, malt, spent hops, brewers' and distillers' grains, hops, wool, rags, and any other materials.* Dated July 13, 1867.

The first part of this invention consists of a cylinder with a steam casing or jacket around it, and it may be made to revolve or remain stationary. The patentee prefers it stationary. When the cylinder is caused to revolve, it has a series of shelves fixed inside, which take up the material to be dried, and allow it to fall in showers, and a backward or forward movement is given to the material by its falling against directing plates. The directing plates may be either fixed to a shaft in the centre of the cylinder, or they may be arranged on the shelves which carry the material. The cylinder is driven from the outside with suitable gearing, and it runs on friction rollers. The material is fed in at one end of the cylinder and delivered out at the opposite end.—Patent completed.

2072 I. BAGGS. *Improvements in the construction of washing-basins and other utensils for holding liquids.* Dated July 15, 1867.

This invention consists in the application of a syphon to washing basins and other utensils for holding liquids, whereby their contents are either retained or discharged at pleasure by merely effecting an alteration of the level of the liquid.—Patent abandoned.

2073 T. WRIGLEY. *Certain improvements in pulley and chain gearing to be employed for lifting or traction purposes, for moving fire-bars in furnaces, or for driving mechanism.* Dated July 15, 1867.

The patentee claims the employment and use of pulleys, constructed as described, in combination with chains as constituting positive or non-slipping gearing, for lifting, traction, driving, or other similar uses; and, second, the application and use of firebars in furnaces attached together by endless chains and moved by such arrangement of pulleys and links in which the pins of the links constitute part of the firebars, as described.—Patent completed.

2074 G. BOEHM. *The combination of a bottle and compass.* Dated July 15, 1867.

Here a flat-sided bottle, preferably of about the contour of a watch, is taken, and a compass card and needle are inserted therein (during the making of the bottle or otherwise) and are arranged so as to face one of the flat sides of the bottle. Sand or other material is then put into the bottle, which is stopped in the ordinary manner, and which may be ornamented as desired.—Patent abandoned.

2075 F. D. NUTTALL. *Improvements in the construction of furnaces employed in the manufacture of glass.* Dated July 15, 1867.

The main objects of this invention are, first, to economize fuel; second, to obtain any desired temperature for heating or fusing; third, to render the most important parts of glassmakers' furnaces more durable. The tank is made of fireclay bricks or blocks, or of fireclay or pots in any ordinary way, and is supported on pillars or walls with space between. These pillars or walls and spaces constitute the "cave." The firegrate or fuel chamber is formed at the side of the tank, preferably at some distance therefrom, in such manner that only a limited supply of oxygen is admitted to or amongst the fuel. The gaseous product of the partial or slow combustion of the fuel induced in this way passes along a flue, and when just over the tank, or before it reaches it, heated air is admitted, and intense combustion thereby induced. The volume of heated air admitted determines the temperature in the tank and flues. The heated air is taken from the "cave," when it is raised in temperature by radiation, or from pipes which are passed through or over the firegrate or fuel chamber.—Patent completed.

2076 J. M. HETHERINGTON and R. W. PITFIELD. *Improvements in machinery for preparing and spinning or doubling cotton and other fibrous materials.* Dated July 15, 1867.

In reference to carding engines the patentees claim, first, causing the triggers to revolve in two or more planes, and mounting the parts against which they act so that they may be brought into any of those planes. Second, in reference to those flats which are mounted on endless chains or bands, they claim adapting a strip to one flat, which strip overlaps an adjacent flap. In reference to the mule they claim, first, bringing the adjustments described to one side of the headstock. Second, stopping the spindles by the direct action of a cam on the twist shaft upon the band of the brake. Third, in reference to the change motions taking the weight required for effecting such changes from the carriage puts on when running in, they claim the adjustable roller mounted on a lever attached to the carriage. Lastly, they claim the general combination of parts described.—Patent completed.

2077 J. BRIERE. *A continuous self-acting condenser, being an improved boiler feeding apparatus.* Dated July 15 1867.

The law which governs this invention is the equilibrium of liquids. The apparatus, filled with water placed above the level of the water of the boilers, allows its contents to flow through, the equilibrium of pressure established by steam coming from the boiler that has to be fed, the level of the water being regulated by the level of the steam pipe.—Patent abandoned.

2078 A. B. IBBOTSON. *Improvements in the means or mode of ventilating the interior of railway and other carriages, cabins and holds of ships, and other enclosed spaces.* (A communication.) Dated July 15, 1867.

The patentee claims, first, the use and combination of a screw ventilator with a fan made self-acting by the atmospheric current produced by the motion of railway or other carriages or vehicles, or ships or other floating vessels, for ventilating the interior thereof by the eduction of the air or vapour therein at or near the lowest level (or other part) thereof. Second, the use and combination of a screw ventilator with a fan made self acting by the force of the air in motion for ventilating stationary enclosed spaces by the eduction of the air or vapour therein at or near the lowest level (or other part) thereof. Third, the use and combination of a screw with a fan for the same or similar ventilations or purposes, the screw or fan being driven as described, or otherwise, by pneumatic or other power, and the motion of the screw being faster or slower than that of the fan, or equal thereto or therewith.—Patent completed.

2079 T. REDWOOD. *Improvements in the preservation of meat and animal substances.* Dated July 15, 1867.

We cannot here give space to the details of this invention.—Patent completed.

2080 J. T. SKINNER. *Improvements in apparatus for facilitating communication between the guard and the passengers in a railway train.* Dated July 15, 1867.

In order that the guard may be able to pass safely along a railway train whilst in motion, the inventor fixes on the side of each of the carriages, just over the tops of the doors, a horizontal bar, by preference of tubular form, and connects these bars together from end to end of the train by connecting pieces of wood, which are conveniently arranged to enter the ends of the tubular fixed bars. On the continuous guide so obtained, a small frame mounted on wheels or friction pulleys is able to traverse, and this is connected by a strap, or otherwise, to the person of the guard, who, thus supported, is able to walk with perfect security along foot boards on the carriages.—Patent abandoned.

2081 J. FLEMING. *Improvements in apparatus for drawing or raising beer, and other malt liquors, to a higher level than that of the cask.* Dated July 15, 1867.

The patentee claims the adoption of compressed air as a means of raising beer and other malt or spirituous liquors from the lower to the higher level.—Patent completed.

2082 F. B. VALLANCE. *Improvements in lamps for burning hydrocarbon, alcohol, and other spirits, animal and vegetable oils, and other inflammable liquids.* (A communication.) Dated July 16, 1867.

The patentee claims, first, the division of the chamber of lamps for burning hydrocarbon, essential and mineral oils, alcohol, ether, turpentine, and other spirits, animal and vegetable oils, and other inflammable liquids, into two or more distinct compartments by means of a partition or partitions, one compartment, or set of compartments, forming the reservoirs which are cut off entirely from direct communication with the external air by means of the interposition of the hollow or vaporization chamber or chambers and the partition or partitions.

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Second, the construction of the partitions, which are made either of metal (in such case having an aperture in which is closely fitted a supply wick of some meshy or porous material which will cause capillary action) or the construction of the partition and wick of one material including such action; or the construction of the partition of perforated plates having granulated, filamentary, or porous material between them. Third, providing partitions when necessary with self-closing spring valves, or a self-closing spring valve, thereby preventing the accidental escape of the liquid whilst such escape being rendered impossible. Fourth, the substitution of a conical or taper fit for the top or cover of the lamp, thereby dispensing with the screwing of the same as is now necessitated.—Patent completed.

2083 H. G. DUNN. *A new apparatus and method for the saving of life and property from fire.* Dated July 16, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

2084 J. FRASER. *Improvements in machinery for printing consecutive numbers.* Dated July 16, 1867.

The object of this invention is to provide machinery or a machine by which sheets of consecutively numbered tickets, cheques, or forms can be printed without removing the sheet of paper or tissue from the machine. This is effected by printing line after line of numbers the full width of the sheet from the top downwards.—Patent abandoned.

2085 G. W. HAYES. *Improvements in machinery for making paper.* Dated July 16, 1867.

This invention is confined to that portion of paper-making machinery called the strainers or knotters, which machinery varies in construction, and this invention is applicable to all such as receive the supply of pulp on the upper surface of the plates. In the manufacture of paper it is found that the uniformity of the paper is interfered with by the accumulation of knots and impurities on the surface of the knotter plate; when the surface of the plate has just been cleared and free from knots and impurities, more pulp passes through it than was passing before the plate was so cleared, and a corresponding variation in the thickness of the paper occurs. Now, according to this invention, the patentee divides the surface of the knotter plate by suitable partitions, so as to form a comparatively narrow zig-zag channel over its surface, along which the pulp has to flow until it gets through the plate. The supply of pulp being introduced on to the surface of the knotter plate at one end of this zig-zag channel, a current will be found sufficient to carry the knots and other impurities which are too large to go through the opening of the knotter plate to the further end of this zig-zag channel, when they will be deposited, and whence they can be removed at leisure, leaving the greater portion of the plates free for the passage of the finer portions of the pulp, and, consequently, allowing a flow through the clear portion of the knotter plates of a practically uniform quantity.—Patent completed.

2086 J. MANNOCK. *Improvements in scrapers for cleaning boiler tubes.* Dated July 16, 1867.

This invention refers more especially to tubes arranged vertically in the flue for heating the feed water. The scrapers are formed in two or more segments, which segments are carried in a suitable cup or holder encircling loosely the tube to be cleaned; the bottom of the cup or holder is formed with an inclined surface, and the under side of the scraper is formed with a corresponding incline; by these means the segments of which the scraper is formed will at all times be in contact with the surface of the tube, the weight of the scrapers tending at all times to keep them in action. The segments may be formed with any suitable scraping edges, and the cup or holder for containing them may have holes formed in its under-side to prevent choking.—Patent completed.

2087 W. M'ANDREW. *Improvements in machinery for ginning cotton.* (A communication.) Dated July 16, 1867.

The patentee claims combining with a ginning roller and doctor or fixed blade a beater bar with beaters or teeth upon it, such bar moving to and fro in a direction parallel to the axis of the ginning roller, as described.—Patent completed.

2088 T. PIRIE. *Improvements in agricultural implements.* Dated July 16, 1867.

In carrying out this invention the greater part of the weight of the implement is supported or carried upon wheels so that the sole and side plates are dispensed with, by which means the great friction attendant upon the sole and side plates is avoided to such an extent that a pair of horses can draw the improved plough cutting two furrows at once of uniform depth and breadth for about the same expenditure of energy required to draw a plough as hitherto constructed cutting only one furrow at a time. The cutters and mould-boards are jointed to an angular framework, so that they can be shifted in position to cut any required breadth of furrow by means of adjusting screws; the wheels are also jointed thereto by means of movable levers, so that the plough may be raised or lowered and guided in the required course. These levers are again provided with screws for adjusting them in the shortest time without the necessity of stopping the horses. The axle of the leading wheel of the plough is attached to another lever, so that when the lever is raised by the attendant, the wheel can be set inwards or outwards, as may be necessary, and when adjusted the lever is again lowered for securing the joint. The leading wheel runs in the bottom of a previously cut furrow, whilst a wheel on the opposite side of the plough carries or supports that side, and a hind wheel is attached to a movable mould-board, the position of the hind wheel and leading wheels regulating the depth of the furrow.—Patent completed.

2089 H. A. BONNEVILLE. *Improvements in the permanent way of railroads.* (A communication.) Dated July 16, 1867.

This invention is not described apart from the drawings. —Patent completed.

2090 H. A. BONNEVILLE. *Improvements in brushes.* (A communication.) Dated July 16, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

2091 T. W. R. WEBSTER. *Loading any number, description, or size of cartridges used in breech-loading guns, with safety, rapidity, and precision, and with any charge, variable at pleasure.* Dated July 17, 1867.

This invention is not described apart from the drawings. —Patent completed.

2092 T. ARCHER, JUN. *Improvements in machinery or apparatus for crushing and pulverizing ores, stones, and other hard substances.* Dated July 17, 1867.

The patentee claims the combination of parts consisting of a roller with a squeezer having curved acting faces, such roller and squeezer being driven by suitable gearing, so as to impart a revolving motion to the roller, and at the same time a short and powerful vibratory motion to the lever and squeezer, as described.—Patent completed.

2093 C. M. TATE. *Improvements in button fastenings, for attaching buttons or ornaments to garments.* Dated July 17, 1867.

This invention is not described apart from the drawings.—Patent completed.

2094 G. WEEDON. *Improvements in knife cleaning machines.* Dated July 17, 1867.

This invention relates to reciprocating machines, and consists in certain arrangements for holding the knives whilst they are being cleaned, for reversing or turning them over from one side to the other, and in a novel form of construction of brush. The details of the invention are too voluminous to be produced here.—Patent completed.

2095 J. SCHOFIELD and J. C. DAWSON. *Improved means and apparatus for malting or drying barley, part of which means and apparatus is also applicable to other purposes.* Dated July 17, 1867.

Here the inventors place under the dryhouse floor one or more series of layers or coils of pipes. These pipes they heat by means of steam supplied from a steam boiler, causing such steam to circulate rapidly through the pipes, and thus heat the atmosphere surrounding them and passing through the dryhouse floor, where the barley to be malted is laid.—Patent abandoned.

2096 A. DE SMET. *Improvements in means of communicating motion to the spindles of spinning, roving, doubling, twisting, winding, and other similar machines.* Dated July 17, 1867.

The patentee claims a mode of communicating motion to the spindles of spinning, roving, doubling, twisting, winding, and other similar machines, by means of friction wheels or rollers, substantially as described.—Patent completed.

2097 J. SLATER. *Improvements in steam generators and condensers.* Dated July 17, 1867.

Instead of the circular flues now used in Cornish and other boilers, the inventor inserts square or rectangular flues filled with rows of tubes, which rows are made to cross each other at angles, whereby a greater quantity of the most efficient heat-absorbing tube surface will be presented to the current of the flames than is effected by any other arrangement of tubes.—Patent abandoned.

2098 G. H. DAW. *Improvements in cartridge pouches or carriers, and also in rifle sights.* (A communication.) Dated July 17, 1867.

Here the patentee employs a flexible pipe of leather, &c., connected at its two ends with a metal mouthpiece. This mouthpiece consists of a central tube, having upon it on opposite sides two short branches inclining upwards, and to these branches the ends of the flexible pipe are adapted. Within the central tube is another tube with an opening on one side, which, by turning the interior tube partly round, can be brought to correspond with one or other of the branches of the outer tube. The lower end of the interior tube projects from the outer tube, and has jointed to it on opposite sides two lever catches. On the outside of this tube, over these catches, is a slide, also of a tubular form, with projections upon it, which, by moving the slide on its tube, may be brought in contact with the lever catches on one or other side of these centres or axes, so as to cause them to rock thereon. There is a helical spring which tends constantly to draw the slide upwards, and then the upper ends of the catches project within the tube, but when the slide is drawn down the catches are caused to tip on these centres, and the upper ends of the catches are withdrawn, whilst the lower are caused to project into the tube. The apparatus is worn like a cross belt over one shoulder with the mouthpiece by the side of the wearer. The cartridges, which are supposed to be those of a breech-loading arm with flanges at the back, are filled into the flexible pipe through openings left for the purpose, and they tend to descend by their own weight towards the mouthpiece, and on the side on which the said opening of the interior tube corresponds with the branch forming a continuation of the flexible pipe, the lowest cartridge passes down into the interior tube until its flange is caught by the upper ends of the lever catches, and it is there held until by moving the slide down the upper ends of the lever catches are drawn back, and the cartridge then falls until its flange comes against the lower ends of the same catches, where it is held until the slide is allowed to rise by the action of its spring; and then, the lower ends of the lever catches being drawn back, this cartridge falls out into the hand of the operator, whilst the cartridge next above descends until its flange is stopped by the upper ends of the lever catches, which now again project, and so this cartridge is held ready to be discharged when the slide is next moved. When one side of the flexible pipe is discharged, the inner tube is turned half round to bring its opening to correspond with the branch with which the other side of the flexible pipe is in connection.—Patent completed.

2099 S. C. LISTER. *Consuming smoke, economizing fuel, and generating steam.* Dated July 17, 1867.

The first of these improvements consists in admitting the steam, or steam and air, at the bridge, and in order to mix it properly with the gases in the furnace the inventor prefers to blow the steam and air through a number of tubes (pierced with holes) in the flue. Secondly, in forcing a current of air, or air and steam, through hollow grate bars pierced with holes at intervals, so as to blow the fire with air or air and steam combined.—Patent abandoned.

2100 J. H. JOHNSON. *Improvements in the treatment and purification of oils.* (A communication.) Dated July 17, 1867.

Here the oil (such as colza or other oils) is placed in a boiler, and to it is added gradually a solution of a caustic alkali, such, for example, as soda; the two are then well agitated, and after thorough incorporation has been effected, the temperature is gradually raised to about 200deg. Fah., taking care not to exceed by many degrees this point. By the application of heat, the coagulated impurities concrete and subside, and their separation may be effected by filtration or otherwise, and the oil, after having been allowed to cool, is filtered in the ordinary manner, and is then ready for the market.—Patent abandoned.

2102 C. KLUG. *An improvement in the preparation of chocolate and cocoa.* Dated July 17, 1867.

This invention consists in the application of malt, barley, and salep in the manufacture of chocolate or cocoa. These ingredients may be employed in the form of paste, flour, cakes, or tablets.—Patent abandoned.

2103 W. R. LAKE. *Improvements in looms for weaving.* (A communication.) Dated July 17, 1867.

This invention relates to a mode of controlling the operations of the picker staffs, which are connected or disconnected from their operative devices by the action of the shuttle upon the shuttle box binders. The latter are forced outward by the shuttle when the same is in the box, and form the medium through which the suspension or action of the picking is made to depend upon the presence of the shuttle in or its absence from the box. The patentee prefers to arrange the controlling or governing mechanism so that the picking on each side of the loom is stopped by the presence of the shuttle in the shuttle box on the opposite side of the loom. When this arrangement is adopted the accidental meeting of the shuttles on the race is prevented, as the picking on both sides of the loom is stopped by the presence of a shuttle in each shuttle box. —Patent completed.

2104 N. J. O. STUBBER. *Improvements in the mode of treating flax, hemp, and other fibrous plants for the purposes of spinning.* Dated July 18, 1867.

Here, when the flax or other fibres are cut to the lengths required for spinning, the inventor passes them under or between a heavy corrugated or grooved metal roller, the raised or convexed ribs of which work into the hollow or concave ribs of a metal roller of less diameter, for the purpose of crushing or breaking the straw or woody substances of the plants containing the fibres. By this process the fibres are released, and can be taken direct to the ordinary carding engines, and be worked, cleansed, cottonized, and brought to any state of fineness without being scutched, hand dressed, or hackled.—Patent abandoned.

2106 A. MORTON. *Improvements in the lateral action or induction of fluids, and in the apparatus or mechanism employed therefor.* Dated July 18, 1867.

This invention consists, mainly, in the construction and arrangement of apparatus by which certain currents of either elastic or liquid fluids, or of gases, may communicate a simultaneous motion to other such fluids or gases by their lateral action or induction through a tube, increasing in area in a certain ratio to the diminishing pressure of the escaping or acting fluid, and the objects and advantages to be gained by the use of the invention are its application to steam engines and "injectors." We cannot here give the details.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated November 2, 1867.

3086 W. E. Gedge, Wellington-street, Strand. An improved hat cover. (A communication.)

Dated December 5, 1867.

3460 S. L. Worth, Oxford-street, brush manufacturer. Improvements in step-chairs, ladders, and steps.

Dated January 20, 1868.

192 T. G. F. Dolby, Old Town, Clapham, manufacturing goldsmith. Improvements in feeding bottles.

Dated January 21, 1868.

203 E. Thomas, Cardiff-street, Aberdare, miners' safety lamp manufacturer. An improvement in the construction of miners' safety lamps, in such a manner as to enable petroleum or other mineral oils to be consumed therein, and for other purposes.

225 J. F. Spencer, Sunderland, engineer. Improvements in regulating and working the valves of steam and other engines.

217 W. E. Newton, Chancery-lane. Improvements in rotary, steam, and other engines. (A communication.)

Dated January 22, 1868.

225 C. E. Brooman, Fleet-street, City, patent agent. A new or improved mode of producing a colouring matter. (A communication.)

227 C. E. Brooman, Fleet-street, City, patent agent. A new or improved mode of extracting colouring matter from madder. (A communication.)

Dated January 23, 1868.

243 J. Goulding, Tong-street, Dudley Hill, Bradford. Improvements in looms for weaving.

Dated January 25, 1868.

262 J. and T. A. Boyd, Glasgow, engineers. Improvements in winding machines and in pirns or yarn holders and shuttles, a part of which improvements is also applicable to other machines requiring varying motions.

270 A. M'Dougall, London, manufacturing chemist. Improvements in apparatus for burning, calcining, or roasting, sulphur, ores, and other materials.

Dated January 28, 1868.

291 C. E. Brooman, Fleet-street, City, patent agent. Improvements in the manufacture of candles. (A communication.)

292 G. N. Sanders, Rue de Seze, Paris. Improved apparatus for regulating and increasing artificial light produced by the combustion of gas, oil, petroleum, and other volatile oils.

294 A. Pickering, York, printer. Improvements in machinery for cutting out, stamping, and embossing lozenges, jujubes, and various articles of fancy confectionery, and other articles, from soft or plastic substances or materials.

296 W. R. Lake, Southampton-buildings, Chancery-lane. An improved pavement. (A communication.)

298 J. Brown, Stockton-upon-Tees. Improvements in machinery for cutting or slicing wood, tobacco, or other fibrous substances.

300 A. C. Pilliner, civil engineer, and J. C. Hill, ironmaster, Oakfield Works, Newport. Improvements in machinery for obtaining motive power, applicable also to measuring, raising, exhausting, forcing, and compressing fluids.

303 W. H. Richardson, Glasgow, and W. Beardmore, Parkhead Lanarkshire. An improved process to be used in the manufacture of iron and steel, and improvements in the apparatus or means to be employed therefor.

304 W. Marsh, jun., Leicester, hire, ironfounder. Improvements in lasts for boots and shoes.

Dated January 29, 1868.

314 C. Riley, Whetstone, machine proprietor. An improved combined threshing machine frame.

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316 W. E. Newton, Chancery-lane. Improvements in self-acting brakes for carriages. (A communication.)
318 J. H. Johnson, Lincoln's Inn-fields. Improvements in disintegrating, scouring, and cleansing raw wool and woollen fabrics. (A communication.)
319 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in furnaces or ovens for roasting ores. (A communication.)

Dated January 30, 1868.

320 B. Dobson, machine maker, W. Slater, manager, and R. Halliwell, foreman, Bolton. Improvements in machines for spinniug and doubling.
321 J. Radcliffe, Durham. Improvements in the manufacture of puddled iron and steel into finished bars, plates, or other forms.
322 J. Grimes, Leicestershire, engineer. Improvements in machinery or apparatus employed in the preparation or manufacture of the bottoms or soles and heels of boots and shoes.
323 H. Aland, Richard-street, Roupell-street, Lambeth, ironfounder. Improvements in rotary blowing fans for producing blast for furnaces and other purposes, which improvements may also be applied to air and gas exhausters.
324 M. A. Hamilton, Southampton-buildings, Chancery-lane. An improved apparatus for cutting bread, vegetables, and other substances.
325 W. Hartnell and S. Guthrie, Lincolnshire, engineers. Improvements in, or applicable to, steam and other motive engines, and to engines or apparatus for raising and forcing fluids or feeding steam boilers.
327 T. Rowan, Glasgow, chemist. Improvements in removing impurities, such as sulphur and phosphorus, from iron and other ores, and from coal.
328 B. Hayne, Mitre Tavern, Broadwall, Blackfriars-road. Improvements in the mode of connecting beer engine pipes with their taps.
329 W. E. Newton, Chancery-lane. Improvements in window sun blinds. (A communication.)
332 J. Thompson, Aldersgate-street. Improvements in feeding bottles for invalids and infants.
333 A. M. Clark, Chancery-lane. Improvements in adjustable wrenches. (A communication.)

Dated January 31, 1868.

334 C. H. Adames, Birmingham. Improvements in the manufacture of portable metal buckets or pails and tubs.
335 E. Fleet, East-street, Walworth, mineral water manufacturer. Improvements in apparatus for the manufacture of aerated liquids.
336 J. Walker, Beeston, near Leeds, mechanic, and J. Hudson, Bowling, near Bradford, beer seller. Improvements in machinery for turning and cutting wood and other substances.
337 J. H. Johnson, Lincoln's Inn-fields. Improvements in steam engines. (A communication.)
340 H. Chapman, Westminster Chambers, Westminster, civil engineer. Improvements in bolts, nuts, and washers.
341 J. Mitchell, jun., and G. T. Graham, Dundee, manufacturers. Improvements in apparatus for marking or cutting woven fabrics into lengths such as are required for making sacks.
342 E. Bolton, Warrington, Lancashire. Certain improvements in the manufacture of gunpowder and similar explosive compounds.
343 G. L. Scott, Manchester, engineer. Improvements in apparatus for steering ships.
344 S. E. Howell, Sheffield, engineer. Improvements in suspension bridges.
345 J. Livesey, Victoria Chambers, Westminster, engineer. An improved material that may be used as a substitute for glass.
346 J. Frame, Glasgow, engineer. Improvements in transmitting motive power, and in mechanism or apparatus employed therefor.
347 A. M. Clark, Chancery-lane. Improvements in steam engines, and in parts connected therewith. (A communication.)
348 G. Clarke, Southwell House, Lower Heath, Hampstead. Improvements in fire-escapes.

Dated February 1, 1868.

349 G. Moulton, Manchester, engineer. Improvements in pentagraph engraving machines, employed in the engraving of cylindrical or other surfaces.
350 J. V. Jones and G. J. Williams, Birmingham, manufacturers. Improvements in the manufacture of metallic tubes.
351 R. C. Smith, Edinburgh. Improvements in the arrangement or construction of sinks or similar apparatus.
352 H. Aitken, Falkirk. Improvements in treating iron ores or ironstones for the purpose of obtaining products therefrom, and in the means employed therefor; also improvements in the ovens or draw kilns for carbonizing iron ores or ironstones.
354 A. M. Clark, Chancery-lane. Improvements in the mode of utilizing and increasing the lighting power of gases and inflammable vapours, and in apparatus connected therewith. (A communication.)
355 D. Murray, York Chambers, Adelphi, Strand. Improvements in coverings for the head, mouth, and neck.

Dated February 3, 1868.

357 C. E. Brooman, Fleet-street, City, patent agent. Improvements in steam and water valves, cocks, and faucets. (A communication.)
358 B. Ford, Middlesborough-on-Tees, engineer. Improvements in hot air stoves for blast furnaces in the manufacture of iron.
359 J. Tolson, Dalton, Huddersfield, manufacturer. Improvements in means and apparatus for cleaning the cards of carding engines.
360 J. and W. Weems, Johnstone, Renfrew, engineers. Improvements in machinery for heating and drying grain, and other vegetable products, fabrics, fibrous materials, and other substances.
361 M. A. Wilson, Victoria-road, Kensington. Improvements in spring and other mattresses, couches, and cushions.
362 J. Combe and J. Barbour, Belfast. Improvements in machinery for hackling and scutching flax and other fibrous substances.
363 J. M. Domenech, engineer, and F. P. Jonte, cabinet maker, Rue Gaillon, Paris. Improvements in combined photographic apparatus for outdoor operations.
364 J. H. Johnson, Lincoln's Inn-fields. Improvements in the treatment of bones. (A communication.)
365 J. West, Raglan-road, Plumstead. An improved method of, and composition for, preventing the formation of scale in steam boilers.
366 C. Richardson, Gracechurch-street, City. Improvements in looms for weaving.
367 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in leggings or gaiters, and other like articles. (A communication.)
368 H. B. Wright, Albany-street, Regent's Park, dressing case maker. Improvements in apparatus for sweeping chimneys.
370 W. Wallis, boot manufacturer, and G. Mant, Inland Revenue officer, Birmingham. Improvements in stands or supports for lasts used in the manufacture of boots and shoes.

Dated February 4, 1868.

372 R. A. Jones, Aylesbury. An improved warming and ventilating vessel or apparatus, applicable to stoves and other heat suppliers.
373 E. Grether, Manchester, merchant, and M. Bailey, Huddersfield, india-rubber manufacturer. Improvements in machinery for cutting discs or washers of india-rubber and other substances.
374 J. Lewis, engineer, R. Alston, manager, and E. Alston, pawnbroker, Preston, Lancashire. Improvements in movable firebars.
375 L. Desens, Charing Cross, engineer. Improvements in the construction of miners' lamps.
376 J. Dewar, Kirkcaldy, doctor of medicine. Improvements in preserving animal substances for use as food.
377 R. Morton, Cambridge Lodge Villas, Hackney, engineer. Improvements in refrigerators or apparatus for cooling liquids, parts of which improvements are also applicable to distillation, surface condensation, and heating air for blast furnaces or other purposes.
378 E. A. Morgan, Paisley, thread manufacturer. Improvements in apparatus for spinning or twisting.
380 T. Cook, Penfold-terrace, Peckham, mechanical engineer. Improvements in raising or forcing liquids from casks, barrels, and other vessels or receptacles.
382 T. Scott and R. Mowat, Edinburgh. Improvements in lamps for burning paraffin and other hydrocarbon oils.
384 J. Webster, College-street, Chelsea. An improvement in the means of preventing incrustation in steam boilers and other vessels.
386 J. Pettman, Mounty-terrace, Eglinton-road, Plumstead. Improvements in percussion fuzes suitable for projectiles to be fired from rifled ordnance.

Dated February 5, 1868.

388 R. D. M'Kellen, Manchester. Certain improvements in machinery or apparatus to be employed in the manufacture of cotton and other balls.
390 R. J. Jones, Blue Pits, near Rochdale, timber merchant. Improvements in machinery for manufacturing clog soles, clog blocks, patten boards, and similar articles, and cutting welts.
392 M. P. W. Boulton, Tew Park, Oxfordshire. Improvements in propulsion and in aerial locomotion, and in apparatus connected therewith, parts of which are applicable to projectiles and to boilers.
394 W. E. Newton, Chancery-lane. Improvements in mowing and reaping machines. (A communication.)
396 H. Moore, manufacturer, and J. Hamilton, machinist, Aston, Staffordshire. Improvements in the construction of furniture expanders, and in machinery to be used in making the same, which machinery is also applicable to other manufactures.
398 J. Hay, Glasgow. A new method of roughing horses, and of constructing horse shoes.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated February 8, 1868.

436 J. A. Nicholson, Adelaide-place, London Bridge, ship owner. Improvements in water-closets, commodes, chamber and toilet utensils, and other articles in earthenware or glass, and in the mode or means of securing stoppers, corks, and other movable parts or fittings therein or thereto, also in protecting the bearing or supporting surfaces thereof.
442 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in split spikes. (A communication.)
443 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in railway switches, and in adjusting and signalling devices for the same. (A communication.)

Dated February 10, 1868.

444 W. B. Adams, Woodstock Lodge, Blackheath. Improvements in heating and welding metals in various forms, applicable to forts, vessels, buildings, and other structures and uses.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," February 18, 1868.

2805 W. Low and J. Treadwell. Riveting the soles of boots.
2808 W. R. Lake. Machinery for making bolts. (A communication.)
2813 J. Smith. Moulding metal.
2822 J. H. Brown. Utilizing refuse animal matters.
2834 R. Reid and E. H. Craigie. Mattresses.
2840 W. Potts. Gaseliers.
2849 A. F. Hobhouse. Propelling vessels. (A communication.)
2850 W. R. Lake. Bunging barrels. (A communication.)
2855 E. Haigh. Hats.
2857 J. C. Wilson. Steam boilers.
2861 A. Helwig. Feed-water apparatus.
2870 R. F. Bare and J. Thompson. Conduction of fluids.
2872 H. A. Dufrene. Decorticating rice. (A communication.)
2878 B. Nicoll. Construction of buildings.
2889 M. A. F. Mennons. Transmitting signals. (A communication.)
2891 H. A. Bonneville. Threading needles. (A communication.)
2894 T. H. Baker and T. Woodroffe. Treating sewage.
2896 W. R. Lake. Construction of railways. (A communication.)
2903 E. Gessner. Fulling machines.
2904 W. E. Newton. Preparation of wood. (A communication.)
2910 E. Shaw. Hoods for perambulators.
2914 L. Hamel. Clipping figured nett.
2916 T. Bell and J. Richardson. Decorticating rice.
2924 H. Sharp and F. W. Webb. Smiths' anvils.
2942 A. F. Jalourеau and C. L. Lardy. Telegraphic cables.
2945 F. Adkins. Manufacture of hoes.
2955 J. Hunter. Permanent way of railways.
2958 C. Duncombe. Charging cartridge cases.
3036 M. Henry. Balloons. (A communication.)
3091 T. B. Cutts and F. W. Brooksbank. Manufacture of lace.
3150 R. Robinson. Manufacture of filtering paper.
3362 J. M'Farlane and G. Barker. Permanent way of railways.
3539 W. Richards. Firearms.
3561 J. H. Kidd. Battrice cloth.
3651 M. J. Rice. Heading nails.
21 J. Cox. Fastenings for sleeve links.
92 J. Lewtas. Blinds.
98 J. G. Tongue. Sewing books. (A communication.)
109 J. G. Tongue. Sizing carpets. (A communication.)
153 G. E. Reading. Busk fasteners.
161 S. and E. Burrows. Employing waste steam.
212 W. J. Coleman. Manufacturing beer finings.
257 T. L. G. Bell. Preparing oxide of iron.
278 G. Kellogg. Hats. (A communication.)
285 W. Tranter. Firearms.
299 R. J. Moser. Bellows. (A communication.)
307 W. Snell. Fireproof safes. (A communication.)
308 W. Snell. Fireproof powder magazine. (A communication.)
321 J. Radcliffe. Manufacture of puddled iron.
342 E. Bolton. Manufacture of gunpowder.
388 R. D. M'Kellen. Manufacturing cotton balls.
442 W. R. Lake. Split spikes. (A communication.)
443 W. R. Lake. Railway switches. (A communication.)
444 W. B. Adams. Welding metals.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed February 14, 1868.

2355 J. Day and W. Dorber
2358 R. Joseph
2367 M. Frow
2371 W. W. Pocok
2373 W. R. Goulty
2378 C. E. Brooman
2391 C. E. Hall
2410 J. G. Marshall
2511 W. H. Kitson
2537 D. Payne
2565 J. Whittome
2575 J. Davies
2749 T. Weston
3346 W. R. Lake
3500 W. R. Lake

Sealed February 18, 1868.

2374 T. Tunstill
2386 H. Cridland
2387 A. S. Stocker
2390 W. Bostock
2392 W. Thomas
2393 J. Robinson and J. Smith
2394 G. Luyckx
2395 C. W. Siemens
2397 J. Goucher
2398 J. M. Napier
2399 J. Mangnall
2400 T. Widdowson
2404 S. Lynes
2405 R. King, J. Lowden, and W. Gartside
2409 J. and F. J. Jones
2412 T. W. Lawson
2423 G. Allibon and E Wilson
2424 J. and J. Cash, jun.
2427 J. Hanson
2433 F. J. Cleaver
2447 J. E. Boyce and R. Harrington
2460 A. Stewart
2471 A. M. Clarke
2501 W. Weldon
2516 J. S. Henderson and J. Macintosh
3095 W. Day
3322 S. Amphlet and J. B. Fenby
3471 S. Goldstein
3526 J. R. Baillie
3 W. R. Lake

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

384 D. H. Barber
387 C. Atherton and A. H. Renton
401 R. W. Thomson
402 L. H. G. Ehrhardt
404 W. Adams
408 E. J. C. Welch
416 R. J. Jones
432 M. Lane
436 G. T. Humphris
437 R. H. Emerson
443 E. B. Wilson
450 J. Thompson
451 R. Smith
452 R. Hill and R. Tushingham
469 J. Graham
473 J. G. N. Alleyne
507 S. Whitfield
508 W. S. Mappin
510 J. G. Hughes
816 L. A. Leins

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

399 J. H. Johnson

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending February 15, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1807	2 8	1939	1 0	1978	0 4	1992	0 8	2014	0 4	2039	0 4
1839	1 6	1944	0 10	1979	0 4	1994	0 4	2017	0 4	2043	0 4
1898	0 8	1949	0 6	1980	0 4	1995	0 4	2018	0 10	2046	0 4
1915	1 4	1955	1 10	1981	0 4	1996	0 4	2019	0 8	2048	0 4
1916	0 10	1960	0 8	1982	0 6	1998	0 4	2021	0 8	2049	1 4
1917	2 6	1962	0 8	1983	0 4	1999	0 4	2025	0 4	2050	0 4
1925	1 10	1963	0 8	1984	0 4	2001	0 10	2026	0 4	2053	0 4
1926	1 4	1966	0 6	1985	0 4	2003	0 4	2029	0 4	2054	0 10
1927	1 10	1971	1 4	1987	0 4	2005	0 6	2034	0 4	2055	0 4
1934	0 8	1972	0 8	1988	0 4	2006	0 4	2036	0 4	2056	0 4
1935	1 0	1975	0 4	1989	0 4	2009	0 4	2037	0 4	2057	0 8
1937	1 4	1976	1 0	1990	0 4	2010	0 4	2038	0 4	2059	0 8
1938	0 8	1977	0 4	1991	0 4	2012	0 4				

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, FEBRUARY 28, 1868.

THE UPPER COAL FIELDS OF PORT NATAL.

WE have never been among the alarmists with regard to the exhaustion of our coal fields, although, of course, we have not held that they are inexhaustible. Our belief has been that there are other fields to be discovered and wrought to aid in economizing our supply, which will naturally become more expensive as the workings get deeper. Then, again, we have the aid of mechanical appliances which are now being developed to promote the economic production of coal. Besides, we can't bring ourselves to think that Providence would leave the world to cold and darkness for half the year. Long before our coal begins to fail, we shall have discovered something to take its place, if needs be. Indeed, agencies are at work all around us tending in this direction, and if the means are not yet perfect, it may be only because the end is not imminent. We may be sure that man's necessities and requirements will be supplied—no matter in what form—from the earth, so long as the earth is able to sustain him. The human race will never die of cold, nor grope about in darkness, for want of the means to produce heat and light. In support of the first provision which we have stated we believe Nature to have made in undiscovered supplies, we have only to refer to the continental coal mines represented in the Paris Exhibition. It is surprising to find how enormously the local supply of coal on the Continent has increased of late years. In Prussia, especially, the quantity mined yearly far exceeds previous belief. It is also worthy of note that, although much of this coal is of an inferior quality, yet the ingenuity of Prussian, French and Belgian engineers has devised means and appliances to obviate its peculiarities, and to turn it to good account.

Bearing very forcibly upon this point—forming, indeed, a remarkable corroboration of our views—is the news which has recently reached us from Port Natal, of the discovery of vast fields of excellent coal in the upper districts of the colony. The importance of this cannot be over-estimated, especially as the quality is all that can be desired. It is an event which has given all Natal a new problem to discuss, and a new field of operation, which promises much for the future welfare and greatness of the colony. We believe that, up to the present time, nothing like a full or trustworthy description of these coal fields has appeared. It would seem, in fact, that a considerable amount of ignorance exists with regard to the physical conditions of the country in this locality. This deficiency is amply made good in the last number of the "Natal Mercury," which comes to hand teeming with information upon the all-absorbing topic. The facts have been supplied by authoritative and careful observers, and are as interesting as they are voluminous and important. From them we learn that Natal at its north-western extremity runs up into a triangular corner, a line drawn across which would mark the extent and situation of the county of Newcastle. On the north-west this division is bounded by the Kahlamba Mountains, a link in that chain of hills, beginning with the Mokattum, near Cairo, and ending with Table Mountain, at Cape Town, which traverses the eastern coast of Africa. In the gullies and streams at the base of this range seams of coal of various thickness crop out, and are in common use by such inhabitants as reside there. A spur of hills is, however, thrown out from the central chain, and runs in an easterly direction many miles until, towards the eastern angle of the county, it spreads into a large rolling plateau, known as the Plateau of the Biggarsberg. Upon the top of this table land no coal has been found, for the reason that it is covered with a bed of trap or basalt about 80ft. thick.

We here come to a singular feature in connection with the geology of this district. One of the principal scientific reasons which has been urged against the existence of coal in Natal has been the presumed fact that the formation of most of the hills belonged to the earlier periods, and that in accordance with the observations and conclusions of science made in other countries it was impossible to find coal among the primary rocks. Nor has coal been so found in Natal, so that geological conclusions remain undisturbed. The coal seams in this division are almost invariably found in sandstone—not the harder old red sandstone found nearer the coast, but a softer and newer formation. The distinguishing feature is that this bed of sandstone is frequently overlaid by a stratum of trap or basaltic rock of an assumed average thickness of about 80ft. This is found not only on the top of the plateau of the Biggarsberg, already mentioned, but also on the top of the many detached hills around, as well as on the top of the Kahlamba. The Platberg, near Harrismith, a township just over the western border of Natal, in the Orange Free State, situated on the top of the Kahlamba, affords an admirable index to the geological structure of the surrounding country. This mountain is a detached mass behind the town, rising to a height of somewhere about 1,400ft., and presenting in the cliffs that form its side a perfect exposure of strata. It is crested, as usual, with about 80ft. of basalt or trap, but beneath is at least 900ft. of sandstone, that depth being all that the eye can see. This is the common character of the lower district of Newcastle. The theory has been hazarded that this deposition of trap is the result of some gigantic power working at a remote distance, and pouring down over these lands this super-stratum of igneous rock. It has also been believed to result from volcanic action, but the fact that the stratification of the country has been found to lie with rare evenness and regularity forbids this conclusion.

We have already observed that coal has been long used by those who reside near the outcropping seams, of which there are a great number. In the southern extremity of the county, and to the north of the Highlands of the Biggarsberg, two or three seams open up. One of these is 3ft. thick, and another of about the same thickness crops out at a point a mile or more off and 500ft. higher up, thus leading to the inference that a large bed of coal exists there. The coal with which the late trials were made in Natal were obtained from the lower seam. The system of mining at present adopted is as simple as it possibly can be. The bed of coal forms the bottom of a stream, and the coal is picked and loaded into waggons which stand upon the mineral itself. The coal previously used has simply been that which Nature has revealed to man; the sweeping of rains and torrents down the hill sides has gradually washed away the upper stratum of sandstone, and laid bare the coal. Besides the seams to which we have alluded, four others have been found in the bed of the same stream. The gullies descend the hill-side in steps, and it is in these successive steps, rising one beyond and above the other, that the coal becomes visible. In some places the seam has been traced for a length of more than forty yards. Where not already washed bare, a loamy soil lies over the beds, and when this is once removed there is nothing to hinder the working of the coal. Another seam is reported in the vicinity of those already mentioned, and which is 8ft. in thickness. Twelve miles distant, with the spur of the Biggarsberg intervening and bisecting the country, the coal crops out again on the farm of another resident, where the seam is about 7ft. thick, another being found about four miles further. Turning westward, into a drier locality, where there are but few streams, no outcrops of any importance have as yet been found, although beyond that again, amongst the roots of the Kahlamba, the seams reappear.

So far the extent and richness of the Newcastle coal fields; let us now turn to the next important question of the quality of the products. There appear to be several varieties of coal, some containing sulphur, some yielding clinker, and others giving a large percentage of ash, and these facts have led to adverse opinions being pronounced upon the broad question. But admitting these diversities, it seems equally clear that large quantities of excellent coal do really exist. The coal which has been unfavourably reported upon ought certainly not to be taken as a criterion of quality, inasmuch as it has been taken from the beds of streams, having been acted upon by the sun and rain perhaps for centuries. From the trials made in the colony, it appears that Natal coal possesses qualities which are not found in English coal, to which they render it in some respects superior. Thus, for instance, some of the coal tried emitted intense heat and lasted a long time, leaving but a very small residuum in the shape of ash. A remarkable instance of the heat-giving properties of the coal is given. The district abounds in nodular limestone, large beds of which, 3ft. or 4ft. thick, may be seen in places. A farmer on whose land the coal crops out was recommended to burn these for lime. He did so, but the heat of the fire was so great that the limestones were fused, and another attempt had to be made. Maritzburg blacksmiths, with scarcely one exception, prefer Natal to English coal.

We have seen that there are vast fields of the mineral, and that, by proper selection, it is to be had of excellent quality; it now therefore only remains to look at its extraction and transport. In both these respects we have every facility offered, and the most favourable circumstances presented. Found as the coal is on the surface, in the beds of streams, rising terrace-like one above another, some of the costliest branches of mining enterprise will be avoided, and for many a year it will not be necessary to sink shafts to deep levels. Had the upper surface of trap to be penetrated the extraction would be a far more difficult and expensive matter, but as it is the seams can be entered and worked laterally from the sides of hills where they are found. We can hardly conceive circumstances more favourable to the rapid and easy development of a coal mine. Then with regard to the conveyance, it appears that the country has been fully surveyed in several directions as far as Maritzburg, and it is estimated that a line of railway—the only available form of transport—can be constructed for half a million. This amount would be less were it not for the hill country, but it may be made for less if the Mont Cenis system be adopted. Beyond Maritzburg the country is very easy, presenting no difficulties whatever. Such a railway would not be merely a mineral line: it would form the central highway of the colony. It would traverse a country where cereals can be grown, where sheep and cattle thrive, and where other capabilities yet undeveloped exist, and would thus command a considerable goods and passenger traffic. Besides, there are two large states beyond Natal, the producing powers of which are only checked by the difficulties of transport. They also possess large mineral resources, so that the prospects of a railway are exceedingly good.

Hitherto we have looked at the question of the Natal coal fields from a local stand-point

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only, but, viewing it in a more general light, its importance is vastly increased. The discovery of coal is made just where the world's commerce and national interests so much need it. We are at immense expense in supplying our eastern possessions, our Abyssinian and other expeditions, and our fleet, with coal exported from our own shores. Here, at Natal, half-way to the east and the Antipodes, are coal fields waiting to be worked and utilized, and although the coal is at present found some distance up the country, there is a probability that it may yet be discovered nearer the port. Black shale, slightly bituminous, is common, and there is an outcrop of coal on the sea shore at Umhlali, thirty-five miles north of Durban, so that it is reasonable to hope for such a discovery. In the meantime, the colony undoubtedly possesses large and easily accessible deposits of excellent coal in the upper portion. Seeing the vast importance of the question to England, we would suggest her hearty co-operation in the development of this mineral wealth. Government should set on foot a thorough survey of the coal fields, and such further steps should be taken as may be necessary to promote the speedy realization of one of the greatest advantages we could possess. This discovery of coal is a matter upon which we heartily congratulate the Natalians, for we are bound to believe that it will, if acted upon with promptitude and vigour, subserve the highest interests of the colony.

DOCKYARDS OF THE MEDITERRANEAN.

IN resuming this interesting and instructive subject, we would observe that, in addition to ships of war and royal yachts, the workshops of the Mediterranean have materially assisted in furnishing a supply of vessels to commercial navigation, including a large number of paddle and screw steamers. Les Messageries Imperiales, and other French, Italian, Spanish, and Russian companies, have drawn frequently upon its resources. Among the numerous examples of that class of shipbuilding devoted to the interests of peace, must be noticed the steam transports specially designed for bringing to the shores of the parent country, the valuable mineral ores obtained in the neighbouring colony of Algeria. These transports, which are built for "The General Steam Transport Company," are, as may be expected from the nature of the duties they have to perform, exceedingly solidly constructed. They can carry 1,500 tons of ore, and yet reach a speed of nearly nine knots per hour. Their length over all is 230ft., and their breadth a little over 30ft. The nominal horse-power is 120, and the consumption of coal 1,250lb. per hour. Nine of these boats were turned out of the port, in the short space of fifteen months. Marine engines upon a large scale are also made upon these premises, those for the armour-plated frigate, "Marengo," belonging to the French navy, being the most remarkable. The nominal force is 950-horse power, and there are three cylinders, into the centre one of which, the steam is first introduced, whence it passes into the other two. By this arrangement a great economy is effected in the item of fuel, and the power so obtained is very uniform. A similar engine was fitted to the Prussian frigate, the "Frederic Carl." This vessel is plated all over; she has a length of 335ft., and a breadth from out to out of 55ft. Her armament consists of fourteen broadside guns of large bore, and two others upon deck. The hull is divided into five water-tight compartments; the teak backing is a foot thick, the plates connected to it are 5in. in thickness, and the cost was a little under a quarter of a million sterling. At La Seyne was manufactured some of the machinery employed at the present works in connection with the piercing of the Isthmus of Suez. That used for the purpose of excavating is termed an "elevator," and consists of a small iron bridge supported on an incline, towards the centre, by a truck running upon rails laid upon the bank, and at the lower end by a bridge floating on the canal. The bridge carries another truck, which can be manœuvred so as to readily receive the loaded skips from the dredge. It then mounts the incline of the bridge, taking the skips with it to the upper end, and empties them where the contents are required to form the slope. Steam is the motive power employed, and the average amount of stuff raised and tipped per hour is 250 cubic yards. This quantity, moreover, is raised to a height of nearly 40ft., and transported along a distance of 150ft., which will afford some idea of the work done by the machinery. The "elevators" are used only for raising and transporting dry stuff. When the material is freely saturated with water, other apparatus, somewhat similar in design, are put in action. The main agent is a dredge carrying a number of buckets upon an endless chain, and which are made of wrought iron. These dredges can raise 150 tons of stuff per hour, and empty them either into barges lying alongside for the purpose, or into long iron troughs specially constructed for the purpose, measuring upwards of 220ft. in length, and carried upon a bridge. In order to assist the process of emptying the stuff into these "couloirs," as they are named, a current of water is caused, by means of pumps, to act continually upon their sides, and wash down the semi-fluid mud.

With that regard which all foreign manufacturing and industrial companies display for the social welfare, moral condition, and sanitary prosperity of their employés, the directors and managers of the establishment at La Seyne, have founded four institutions for the benefit of the workmen. They comprise a relief club for the sick, founded before the formation of the company, and having for its object the gratuitous supply of medicine. and medical attendance to those who are incapacitated from work by illness. To ensure this aid in time of sickness the workman contributes when in full work a small proportion of his pay to the general fund, and can only obtain the benefits of the institution by so doing. An ambulance capable of containing twenty-four beds, was fitted up and put on service, during a time when the cholera attacked the employés at La Seyne with a considerable degree of violence. During three days, when the epidemic was at its height, the workmen fell down in convulsions upon the quays and elsewhere. This portable hospital was found to be so valuable, that after the cessation of the calamity, it was retained as a kind of supplementary infirmary to the establishment. About two years ago, the Company built a large commons room, where food could be purchased either in the bulk or by the meal, as might be desirable. Upwards of 900 men can dine at a time in this hall. The whole of the arrangements of this department is under the management of a certain number of "les sœurs de charité" who reside upon the premises. A free school for adult workmen is opened in the town, and the course includes reading, writing, grammar, arithmetic, geometry, algebra, and drawing. Five professors are charged with the entire superintendence of the school, and their efforts are rewarded by an annual attendance of nearly 400 scholars. The dockyards of Marseilles, Menpetti, Arence, and La Jetée are provided with similar advantages, towards promoting the advance of technical education, a subject almost totally neglected in our own county, the result of the neglect of which is becoming daily more apparent. We see ourselves competed with, supplanted, and totally distanced in those very branches of manufacture and industry, which we had for so long a period learned to regard exclusively as our own. The most sanguine person cannot but admit that the monopoly we once possessed in certain branches of constructive art is gone for ever, and that in all of them, we only now share with other nations, which we at one time scarcely dreamed of as competitors, but which we are now forced to acknowledge are neck and neck with us, in the eternal race for wealth, prosperity, and commercial pre-eminence.

RESUMPTION OF STORM SIGNALS.

A LATELY issued Parliamentary paper relative to storm warnings contains the correspondence between the Board of Trade and the Meteorological Committee which led to the resumption of the signals. So far back as July, the Committee had in contemplation a scheme of signals for weather reports, and they suggested that the Board of Trade should present to each station a complete set of signal shapes and gear, having themselves no funds available for the preliminary outfit of the stations. The Board replied that they had not funds at their disposal for the purchase of new signals, but that they would hand over to each station the signals, gear, &c., supplied under the direction of Admiral Fitzroy. In October, Sir F. D. H. Elphinstone addressed the Board of Trade on the subject. "When," he says, "these forecasts"

Were first established, they were received by the maritime community with incredulity and distrust; but gradually a different opinion gained ground: the wonderful accuracy of these prognostications led to a general reliance on their truth; and latterly, those who had been loudest in their disbelief were foremost in availing themselves of the caution they afforded. Wrecks are due to a variety of causes; first, to unseaworthy ships; second, to defective ground tackle; third, to collisions; and fourth, to the stranding of vessels which are caught, on a lee shore, in positions from which they find it impossible to extricate themselves. For the first cause no cure can be found but stringent surveys, and throwing the responsibility for loss of life and cargo on those who send such vessels to sea. It seems inconsistent that railway companies should be held responsible for the safety of passengers and goods, while others escape from the consequences of management far more reckless than any conduct that ever goes before a jury in case of accidents by railway. That this view is not unreasonable will be seen by reference to the number of shipwrecks which occur from no apparent cause whatever, but which clearly denote a state of total unseaworthiness in the vessels lost. The second cause has been much mitigated by the operation of the Bill for testing chains and anchors, which I introduced into the House of Commons in 1860, and which became law in 1865, after experiencing much difficulty and opposition. It is to the third and fourth causes of wreck that the warnings originated by Admiral Fitzroy especially apply.

By far the largest portion of wrecks which take place in Great Britain are on the east coast, and the storm warnings were of the most importance at the coal ports of the north. From these harbours large fleets of deeply-laden vessels, often ill-found and under-manned, are continually putting to sea. The prevailing winds in these islands are from S.W. to N.W., but the sudden shifts of wind in the winter months from N.W. to E. and E.S.E. are the circumstances which often endanger the safety of large fleets. For example, ships leaving the Tyne with the wind at W. or N.W. of moderate force, naturally keep under the land, and endeavour to round Flamboro' Head at a distance of three to four miles; they then have a clear sea before them till they make the coast of Norfolk; but while they are quietly making their way to the southward, a violent storm from the east may be working its way across the North Sea, which will reach them before they can clear the Yorkshire land, and strew the coast with their wrecks.

This is no extravagant or unusual case; it was unfortunately of periodical occurrence, until Admiral Fitzroy's warnings gave timely notice of the approach of such sudden changes, and enabled precautions to be taken which were the means of saving much life and property. The discussions on the subject last Session left the impression on my mind that the authorities considered Admiral Fitzroy's warnings to be couched in more positive language than the information at his command warranted him to assume; be that as it may, his forecasts, though probably they owed some of their authority to his own experience and sagacity, had proved so generally correct, and were so extensively believed in and acted upon, that it was much regretted by practical men, as well as by men of science, that they had been discontinued.

In forwarding a copy of this address to the Meteorological Committee, the Board of Trade inquired whether they were prepared to issue cautionary notices of storms, and, if so, of what description, on what basis, and

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on what terms. The Committee replied to the effect that a system of weather telegraphy had been approved by them, and that the specimen signals would be tested, for a short time, at one or more of our chief ports before being issued to the public. These signals consist of a semaphore similar in principle to a railway signal post. Until the new system of signals in preparation by the Committee is complete, they propose to use the drum as a cautionary signal to indicate the existence of a gale. The basis on which such notices were to be issued would be the study of the daily weather reports, as the self-recording observatories were not yet at work. We do not believe it possible that the Committee will ever obtain any data from these observatories which can be turned to immediate practical account in forecasting atmospheric disturbances. The recording agent being photography, the records cannot be consulted at any time previous to the removal of the paper and the fixing process, and data available for storm prediction are of little value when a day or two old. As to the terms of issuing the signals, the Committee suggested that the entire cost of transmission of messages should be defrayed by the Meteorological Office. The Committee signified their readiness to issue such notices as soon as arrangements could be made for hoisting the signal. Such a signal, said they, would be simply of a warning nature, and without conveying the impression that the storm would necessarily strike the port where it was hoisted, would imply that extra caution in navigation was requisite.

The plain meaning of this is that it is not intended to forecast gales, but simply to announce them. Probably, General Sabine, in his presidential address to the Royal Society, on the 30th of November, 1867, accurately described what the Meteorological Committee intended to do when he said—"The Committee are prepared to convey, free of cost, telegraphic intelligence of the existence of any serious atmospherical disturbance which may have come to their knowledge, to all ports to which it appears to them that such information would be of importance. Such a telegram may be, for example:—'Storm from west at Penzance and south coast.' On the receipt of such a message, the local authorities are expected to hoist a drum as a general warning, on seeing which masters of vessels or other interested persons may learn by inquiry at the local office (or by other arrangements) the precise nature of the information received, together with any additional particulars which may have been transmitted from the central office. It is clearly understood by all parties that any telegraphic message of a warning nature (like the example here mentioned) is merely meant to imply that there is a serious atmospherical disturbance existing along a certain region of coast, and consequently that there is, or may be, danger impending in other districts. The telegraphic messages, which are now limited to a notice of 'existing facts,' are obviously capable of extension hereafter, in proportion as the basis upon which sound meteorological anticipations may rest shall be enlarged; and this we may reasonably hope for, as one of the fruits of the establishment and action of the 'Land Meteorological Observatories.'"

According to the circular issued by the Board of Trade in December the following are the conditions on which these notices of serious atmospherical disturbances on the coasts or in the vicinity of the British Isles will be issued:—

They will be forwarded in each case as soon as information of the atmospherical disturbance shall have been received at the Meteorological Office, and the ports or fishing stations to which they are to be sent will be determined by the Board of Trade. When the list of places to which notices may be sent has been determined by the Board of Trade, it will rest with the Meteorological Committee, in each case of atmospheric disturbance, to send notices to all or any of those places, as the circumstances of the particular case may appear to the Meteorological Office to be advisable. When a telegraphic notice of atmospherical disturbance is received at one of the places named on the Board of Trade list, its receipt is to be made public by hoisting one of the late Admiral Fitzroy's drums, and the drum is to remain hoisted for thirty-six hours after the receipt of the telegraph message containing the notice.

One telegraphic notice implies that the drum is to remain hoisted for thirty-six hours, and no longer. Should the Meteorological Committee think it necessary that a drum should remain hoisted for more than thirty-six hours in any case, they will send messages to that effect, and continue them from day to day so long as it appears desirable, or until the storm shall have abated. If the authorities at any port or fishing station wish to receive intelligence of atmospherical disturbances, and will undertake to hoist the drum, subject to the conditions named, and subject to such regulations or directions as may from time to time be issued by the Meteorological Office, an application should be addressed to the Secretary to the Meteorological Committee, 2, Parliament-street, Westminster, S.W., in order that the necessary steps may be taken to place the name of the station on the Board of Trade list, and to provide the flagstaff and drum.

It is to be understood that where the place or station can pay for a flagstaff and drum they will be expected to do so, if a staff and drum are not already provided; and that where it is made to appear to the Board of Trade that no staff and drum are provided, and that the place is too poor to bear the expense, then the cost will be defrayed by the Meteorological Office, with the sanction of the Board of Trade. But in all cases, whether the first cost of the flagstaff and drum are or are not borne by the local authorities, the local authorities must undertake to bear all subsequent charges connected with the hoisting of the signal, and the maintenance of the signal apparatus. The only subsequent expense that will be defrayed by the Meteorological Office will be the charge for transmission of the notices of atmospherical disturbances.

It thus appears that the signal cone and lamps employed by Admiral Fitzroy are to be dispensed with. We are of opinion that the "cone point up" and the "cone point down" should have been the signals resumed in preference to the drum, and we should think that they must be adopted eventually unless something equally simple will answer the purpose better. When only a few hours' warning can be given towards night time, as must occur occasionally, the lamps would be useful as night signals, at least at the most frequented and exposed ports; on this account they should not be withdrawn where the local authorities are disposed to incur the expense of using them. We consider the present arrangement as temporary, and an easily available means for the Committee to furnish to the maritime community without unnecessary delay notice of weather likely to affect navigation.

The coast guard are to check these warnings by observation, and their Controller General has been expressly informed by Mr. Gray, the Assistant Secretary to the Board of Trade, that although the Meteorological Committee have, to a certain extent, adopted one of Admiral Fitzroy's signals (the drum), they have only done so as a temporary measure; and the signal, when now hoisted under the direction of the Committee, has a far more limited signification than the signals hoisted by the late Admiral Fitzroy.

Admiral Fitzroy's signals professed to give a warning of the direction, as well as the force, of an approaching storm, whilst the signal drum now to be hoisted is only intended to convey information that there is an atmospherical disturbance somewhere which possibly may reach the place where the signal is hoisted, and the knowledge of which is likely to be of use to the mariners and fishermen of that part of the coast. As the new system only announces existing facts in an extremely indefinite way, without committing itself to any consequent results, it appears rather difficult to imagine how it can be checked or where the necessity for a check lies. The truth is—and this is especially apparent in this correspondence—that the affair is without a guiding and a directing mind. Several heads are in the work, and the code of action is not yet accurately drawn up. No one can regret that it is so, because it certainly is not desirable that the system should rely upon one person's experience. Possibly we may arrive at such general aptitude that every man may be his own weather prophet.

THE GOVERNMENT AND THE TELEGRAPH.

A QUESTION at the present moment occupying the minds of a great many—particularly those in any way connected with the various telegraph companies—is that of the Government and the telegraph. The subject has now for some time been discussed, and the action of the Government surmised; but beyond the usual notice from the Parliamentary agents, and a few words from Mr. Ward Hunt that the bill would soon be placed before the House, we have no information of the bill nor knowledge of its details. Papers have been read upon the subject, pamphlets and articles written, some in favour of and some against the Government, but the fact remains the same: it is the intention of the Government to assume the control of our existing private telegraph systems, and to convert them into one service under State management. To enable them to do so a bill will shortly be brought before Parliament giving the necessary details. Into this bill we do not at present wish to enter, but in the meantime will confine our attention to the question, Will this transfer benefit the public and the State?

First, let us glance at the position of some of the telegraph companies, and note some of the anomalies of the existing system. Our present telegraph service is conducted by several telegraph companies, who formerly, one and all, opposed each other—in good railway style—reduced their rates, and so on, until seeing their folly, they mutually agreed to a revision of tariff, charging similar amounts to the same places, and agreeing not to trespass on each other's strongholds, the consequence being that whatever company we chose to send a message by to any place, the charge would be the same, although perhaps the speed by one line would be greater than by the other. At the present time there are very few important towns in the United Kingdom that are not served by more than one company, who probably have each more than one station in the same town, the quantity of offices depending of course upon the size of the town.

The various companies now consist of the Electric and International, the Submarine, British and Irish Magnetic, United Kingdom, and the London District Telegraph Companies, the two former possessing numerous cables to the Continent, and through these all our continental traffic pass. In addition to the above, we find several private railway telegraphs, the principal of which are the South-Eastern and the London, Chatham, and Dover, kept exclusively under their own management. With the exception of the districts supplied by the two last-mentioned companies, there is hardly a place (except in Ireland) served by the many companies without it also being served by the old-established company, the Electric and International. We may, therefore, take it as a general fact that north of London every important town has more than one telegraphic service, but under different management. Presuming we want to send a message, say, from the north—Edinburgh to Ramsgate, or any place on the Chatham and Dover or South-Eastern lines, we have the choice of sending it by two companies as far as London, where their responsibility ceases; it there (the message being paid through rates) is sent out like an ordinary received message, and delivered to the proper railway company, signed for, and is sent forward again in the same manner as before; if anything goes wrong, it is usually the case of the "two stools," and the claimant gets nothing. There is one important point for telegraph business, and that is the Stock Exchange,

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which is supplied with offices inside and stations outside, belonging to the various companies, in quantities. One naturally remarks, What a waste of money, rent, furniture, and staff, when one office would do all that is required; and so it is throughout the kingdom. How many places are there not with rival offices next door to each other? What do the public gain? Nay, do they not lose in having to pay extra for messages to allow of the extra offices being kept up? In London, we have a company called the London and Provincial Telegraph, who will take messages for anywhere, the company being originally formed for supplying London and the suburbs. They do so at the rate of one shilling per message (it was formerly sixpence). Close to many of the stations the Electric Company will send messages for sixpence!

Now, presuming the whole system were purchased by the Government, and worked by them under one management, what would be the result? The first would, as a result of one management, be the retirement of the chairmen and directors of the various companies. And it strikes us most forcibly that the principal opposition we have heard to the scheme has been from this quarter—witness certain rather strong language used at a late half-yearly meeting—for will not their occupation be gone? As a natural result, the expensive administrative staff maintained by each company will not be required, the multiplicity of stations can be dispensed with, and stations placed in the various towns at points where they are actually wanted, where they will be of the greatest use. The ultimate point to arrive at in this transfer will be the serving the public with telegraph stations wherever there are postal stations. This will, we have no hesitation in saying, be the result of establishing the two systems under one management. And will not the public gain thereby? The principal advantages accruing to the public may be stated, that messages will everywhere be under one control, that in consequence of the existing rivalry (necessitating a needless number of offices) being done away with, the expense of messages will be less; that there being more wires available to the same place by this fusion the speed will be accelerated; that the system of telegraphy will, by reason of its cheapness, be extended generally to all classes.

It has been contended that the Government will spoil what is now well managed. We have no particular fault to find with the present management of the telegraph companies, but we most certainly think that an administration which has brought our postal system to so high a state of excellence, is thoroughly competent to undertake and successfully carry out the scheme of uniting the whole together, especially when we consider that in the present change we should only lose the services of the Board, whilst the staff would remain as they are now. If they have been instrumental in efficiently serving the company, surely they will also be so in serving the Government. If the present expensive system of telegraphy can be worked so well as to produce to the shareholders a return of handsome dividends, why should it not when worked under one management at a greatly reduced scale of message charges, produce some revenue to the Government? Almost invariably the decrease in the tariff has produced a very large increase in the number of messages. Were the Government to take the control, the messages might then be so reduced as to bring it within the reach of many, who now, except in cases of the direst necessity, cannot use it from its expense. There are numerous arguments in favour of the scheme, and but few against it that have any reason in them. For ourselves, we are convinced of the incalculable advantage such a scheme will be not only to each and all of us, but to the State, and we trust to see the time when every village, town, or place provided with a post-office will be equally provided with a telegraph office. Our space will not admit of our entering into any of the details or principal features of the scheme. We are content for the present to express our approval of the objects of the bill, leaving the discussion of the question of details to a future time.

PHOTOGRAPHY.

THE CHEMICAL ACTION OF LIGHT—REGISTRATION OF THE CHEMICAL INTENSITY OF THE RAYS OF THE SUN—ARTIFICIAL LIGHTS IN PHOTOGRAPHY—A NOVEL ACTINOMETER.

LAST Saturday afternoon, Professor Roscoe, F.R.S., of Manchester, performed at the Royal Institution some good experiments illustrating the action of the chemical rays of light upon some descriptions of common matter. In the first experiment he employed a bulb of very thin glass, about the size of a hen's egg, which had been filled in the dark or in yellow light with a mixture of pure hydrogen and chlorine gases. The gases were produced by the decomposition of hydrochloric acid by the voltaic current, the first portions of gas coming over being allowed to escape, but the remainder being passed into a string of excessively thin glass bulbs connected by fine tubes. After the bulbs were thus filled the connecting tubes were carefully sealed and separated in the middle by the aid of as little heat as possible from a Bunsen's burner. Although great care may be taken, a few of the bulbs are liable to explode during the sealing process. The bulbs, when filled with the mixed gases, are then kept from light in a box, and may thus be preserved for any length of time, as long as no chemical rays of light can get at them. A bulb thus prepared was placed in a four-sided lantern. Of these sides one was made of red and the other of blue glass, and the room was darkened at the time of the insertion of the bulb, and also during the whole of the experiment. Professor Roscoe having covered up with a cloth all the sides of the lantern except the one composed of red glass, placed a long stoppered glass jar filled with nitric oxide and bisulphide of carbon vapour in front of the exposed side of the lantern, and on applying a burning match to the mouth of the long bottle a brilliant flash of pale blue light, rich in chemical rays, was the result. But as red glass absorbs such rays, none could get through to the glass bulb in the lantern, which consequently remained uninjured. A second jar of the mixed vapours was next fired in front of the blue glass side of the lantern, and as blue glass transmits the chemical rays, the union of the hydrogen and chlorine was the result, and the bulb burst with a loud explosion.

A pure yet very bright yellow light is often desired by photographers when working with very sensitive chemicals. In his next experiment, Professor Roscoe used a very pure yellow light, produced in a very simple and inexpensive manner. Two little pieces of platinum wire, each ending in a little loop only about one-sixth of an inch in diameter, were pushed into the flame of a Bunsen's burner, and held there by a suitable stand. The Bunsen's flame contained so much common air that it gave no light of its own whilst burning. A small lump of carbonate of soda having been placed in each of the little platinum loops, the latter were pushed into the colourless flame, where the soda fused, and at once caused the flame to throw out an intensely yellow light. A fused drop of carbonate of soda will last in such a flame for a considerable time, hanging in the platinum loop like a pellucid drop of water. Such is one of the best means of producing a pure monochromatic flame.

The lecturer having made these arrangements, then exhibited the development of a photograph to the audience in a very neat manner. A magic lantern, with an oxy-calcium burner, was made to throw a disc of light upon the screen, which disc was made red in colour by the insertion of a sheet of red glass immediately in front of the condenser of the lantern. Professor Roscoe had the gas-lights of the Institution carefully turned down, then by yellow light he coated a glass plate with collodion, and excited it in the nitrate bath. Then a negative was placed in front of the prepared wet plate, and kept from touching it by means of a few folds of blotting paper at each side, between the two plates, which were thus separated to the extent of a small fraction of an inch. The negative was next exposed for five seconds to the light of a flame of common gas, placed about twelve inches off. A developer was then applied to the prepared plate, which with great speed was at once placed in the lantern, in front of the red glass. At first nothing appeared, but in a few seconds the picture was seen gradually growing and intensifying upon the screen. Professor Roscoe stated that nothing is known of the nature of the invisible image formed upon the film by light, but if he were to "read up" recent investigations on the subject he might discover that more is known of what light does in the film than he at present supposes to be the fact.

Except an intensely brilliant yellow light be desired upon the plate, there is no necessity to employ a monochromatic flame. The lights in the roof of the Institution might have been left alight, turned down just enough to permit the lecturer to work with ease, and there would not have been the slightest danger of fogging or failure from this cause. The chemical action of light diminishes as "the square of the distance," and at a few yards from the flame of a candle or common gas, any photographer may work with impunity, though certainly it requires some courage to do so for the first time, with the knowledge that such light acts vigorously upon his plates at small distances.

For about a year the daily registration of the chemical intensity of daylight was performed by Dr. Balfour Stewart, F.R.S., superintendent of the observatory of the British Association at Kew. The method of registration was designed by Professor Roscoe. By his plan, a strip of standard photographic paper, very carefully prepared, was exposed for a measured time to the rays of the sun, and then the depth of colour it thereby acquired was compared with a permanent strip of similar photographic paper, tinted throughout its length to various depths by the action of light. The plan is obviously imperfect, but is the best at present known, for the registration of variations in the chemical activity of light is anything but an easy task. Observations were thus made three or four times a day at Kew by Mr. Baker, one of the assistants, and a few facts as to the variations in the chemical action of light at different times of the day and year were thus obtained. But as changes in chemical activity vary with every passing cloud, as well as from other causes, three or four observations a day gave a very meagre array of facts, and the work has been discontinued. It is, however, in contemplation to renew the registration once more in all the observatories now partly under the control of the Meteorological Department of the Board of Trade, if continuous self-registering apparatus can be made, and such apparatus Professor Roscoe is said now to be devising.

An instrument which will show every passing change in the chemical action of daylight, in the same tangible way that a barometer shows changes in atmospheric pressure, would be a great boon both to photographers and meteorologists. A plan of this kind has just been mooted by Mr. W. H. Harrison, whereby a magnetic needle will swing to and fro with the changes in the chemical activity of daylight, and the design will shortly be tried in practice. The principle is readily explained. Parallel rays of light from the sky or sun are freed as much as possible from the heat rays of the spectrum, by passing through one glass trough filled with solution of alum and a second trough filled with ammonio-sulphate of copper. The parallel rays are then received on the face of a common large glass lens, which condenses them upon one end of a thermo-electric pile, which pile is placed in the centre of a closed box, a "chamber of constant temperature." A galvanometer is attached in the usual way, to register any changes in the intensity of the chemical rays thus falling upon one end of the pile. The intensity of light from the northern sky is that which photographers most want to be able to measure, for the direct light of the sun is never used in portraiture, and not always in landscape photography. The chief objection to the mode of measurement just stated is that it is difficult to fix a value at different times upon the deflections of the galvanometer, for so many circumstances tend to set up changes in the magnetism of the needle. Yet one step will be accomplished when a needle is made to move with the changes in the chemical activity of light, and when that is done it will be the business of the electrician to reduce the deflections to a constant value. Such a task is not insurmountable, as proved by the elegant devices invented by electricians to test for faults in submarine cables, and to secure constant and reliable results.

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NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

A NEW METHOD OF MAKING WHITE LEAD—A BLACK ANILINE DYE FOR WOOLLEN CLOTH—A MODE OF TESTING STEAM BOILERS—THE SEPARATION OF OLEINE FROM STEARINE, &C.—LOUVEL'S SYSTEM OF STORING CORN AND FLOUR.

SEVERAL processes have been devised for producing white lead in less time than is required by the old Dutch process still followed in the manufacture of the best article. They have resulted, however, for the most part, in comparative failures. The pigment produced by precipitation has in general a crystalline character which seriously interferes with its covering property, and thus deteriorates its value. A process has recently been devised by M. A. Girard which is perhaps superior to most of the new modes of manufacturing white lead. Metallic lead is, in the first place, granulated. It is then placed in a barrel (which must be made of beech or hornbeam wood, not oak), with one-fourth its weight of pure water. The barrel is placed on an axis, so that it can be made to rotate at about thirty or forty turns a minute, and arrangements are made so that a current of air can be forced through at the same time. After rotating for about two hours almost all the lead will be found oxidised; and now a current of carbonic acid is substituted for the air, and the rotation continued for four or five hours longer. After this time nearly all the lead will be found converted into the hydrated carbonate, the true white lead, which can be separated by decantation from any of the metal unacted on, and washed and dried. The product so made, we are inclined to believe, will be as good as that produced by the old process.

We recently gave a process for a black aniline marking ink which attracted some attention. To-day we find a process for dyeing wool black by means of an aniline compound. The yarn or cloth is first submitted for an hour to a bath composed of 1 litre (two pints) of water; 5 grammes (75grs.) of bichromate of potash; 3 grammes (46grs.) of sulphate of copper, and 2 grammes (31grs.) of sulphuric acid. The bath must be used at nearly a boiling heat. After this the cloth or yarns are well washed, and then plunged in a solution of oxalate of aniline of 1 or 2deg. Beaumé (sp. gr. 1·007 to 1·014). They are said thus to be dyed of a beautiful solid black, which will have the advantage of resisting all the agents that usually discharge or alter the colour of black cloth. This process, if it answers well, and, since it is the invention of M. Persoz, we are bound to regard it with favour, will be a great gain to the dyers of black cloth. Some extra brilliancy, it is said, may be given by rinsing the cloth in a bath of cream of tartar solution, with a little sulphuric acid, washing again, and soaping.

Steam boilers are weakened by long working, and the owners are uncertain as to what pressure they can resist. Few are possessed of a hydraulic pump by which they can be tested; but Mr. Robinson, an American engineer, gives a method by which a boiler can be tested by any working engineer. He completely fills the boiler with water up to the throttle and safety valves, and makes everything tight, leaving only the pressure gauge open. He then puts a fire under; the water slowly expands, and the pressure is of course shown on the gauge. If there is a weak place, it will give way long before the water reaches the boiling temperature, and no sudden or dangerous explosion will happen. If no rupture take place, the pressure shown on the gauge will teach up to what point the boiler may be safely worked. Engineers will, no doubt, give us their opinion of this mode of testing an old boiler.

Bourgougnon gives a process by which he says oleine may be easily separated from the solid fatty acids without the liberation of any oleic acid, as usually happens in the processes ordinarily followed. We give it for what it may be worth, without expressing any opinion on its merits. The tallow is first melted with an equal weight of water, and the mixture is warmed with 10 per cent. of strong ammonia. In this way a thick emulsion is obtained, which is heated to a boiling temperature, to get rid of the ammonia and drive off the water. The residue is then submitted to pressure, by which the oleine is perfectly separated, and the solid acids left harder than usual.

We mentioned some months ago Dr. Louvel's system of preserving corn and flour in air-tight cylinders. Two of these cylinders were placed in a boiler house at the French Exposition, and remained there four months. At the bottom of one of these cylinders was put some mildewed and decomposing lentils and above twenty sacks of wet wheat. In the other was put some good fresh flour, with some that had been three years in store at Vincennes, and had also been to London and back, and was necessarily not in good condition. These cylinders were opened a short time ago and the contents examined. The wheat in the one was found dry and in good condition, the mildew not having spread from the decaying lentils. The flour was also in an excellent state. Dr. Louvel mentions that he has contrived some cheaper utensils, but we fear the difficulty of getting and maintaining a vacuum in large vessels will be an obstacle to the general application of his system, valuable as it undoubtedly is.

Parliamentary Notes.

THE Banda and Kirwee prize money still continues to give trouble. Only last Friday, in the House of Commons, Mr. Neville-Grenville was obliged to ask the Secretary of State for India why the officers and men of the Royal Regiment of Artillery, who served at the capture of Banda and Kirwee in 1858, had not yet received any portion of their shares of the prize money granted them by royal warrant, although the rest of the troops, both of Her Majesty, and the late East India Company, had received a first and second instalment.

Sir S. Northcote said the reason was that the prize roll of the troops referred to in the question of the hon. member had not been received in this country by the Prize Committee, although it had twice lately been expressly called for. A satisfactory reason, perhaps, to the Secretary of State for India, but, certainly, far from satisfactory to the captors of Banda and Kirwee. It is a shame that the necessity for Mr. Neville-Grenville's question has been allowed to arise.

On Monday, Mr. Ewart moved for leave to bring in a bill to introduce into this country the metric system of weights and measures. As Mr. Cave offered no opposition to the motion, leave was given, and the bill was subsequently brought in and read a first time.

At the same sitting of the House the question of the unsatisfactory condition of telegraphic communication with India was brought before the members by Captain Vivian. This led to an apologetic defence by Sir S. Northcote, who, in reply to the noble captain, admitted that the telegraphic communication between this country and India was certainly not all that could be desired, but he did not think it could be described as very unsatisfactory. He believed the average rates of transmission of messages from India during the first twenty days of February was, viâ Russia, three days and nine hours; viâ Turkey, three days and eleven hours; and that in the last week of February it was, viâ Russia, two days and twenty-two hours; while individual messages had occasionally been received on the day of despatch, both viâ Russia and Turkey, and frequently on the day following the day of despatch. He might observe, with regard to the existing line of communication, that steps were being taken which would, he hoped, improve those lines. Turkey and England had recently been admitted to the telegraphic convention of Paris, and the effect of this would be that greater rapidity of communication would be secured. Moreover, the concession which had recently been obtained by Messrs. Siemens and Company, for a line by Russia and Persia, would probably improve the communication by that route; but, nevertheless, it would be a great advantage to this country if another line of communication could be obtained viâ the Red Sea. This had received the attention of the Council of India, and also of the Imperial Government, neither of whom thought it would be right in the present state of submarine telegraphy to burden the revenues by giving any guarantee or subsidy. They would be glad to give any assistance in the way of a survey or otherwise to a private company which should construct the line, but no company had at present been found willing to undertake the matter. It was thought desirable when the Abyssinian expedition was projected, to construct a line to Massowah or Annesley Bay, or whatever port would be fixed upon as the port of debarcation; but this was abandoned when it was found that the line could not be laid in time to be of much practical use. He had received on the previous day a very full private letter from Sir Robert Napier, who said that the only way in which telegraphic communication could be satisfactorily opened would be by a submarine cable down the Red Sea, which he recommended as being, in his opinion, desirable on the ground that it would be so much on the road to India. Sir Robert further said that such a line would be of use to the expedition, if it were prolonged, but he said—and this was a most satisfactory point in his letter—he had the utmost confidence that the expedition would be completed in the present season. Therefore, Sir Robert Napier did not press the matter in connection with the expedition, but chiefly as offering the advantage of a direct Red Sea line connecting this country with India; and as he (Sir S. Northcote) had already said, her Majesty's Government would not be justified in encouraging such line by guarantee or subsidy, but would be very glad to see it established by private enterprise.

The Turks, it appears, have been wanting to have a little British experience imported into the conduct of their naval affairs. So they asked us to recommend them an officer up to the work of naval organization, and we promised them one. While we are fulfilling our promise and securing it well with red tape, another naval officer steps in on his own account, and secures the post. Very uncomfortable for officer No. 1—very disappointing, too. So he rushes into Parliament, through Captain Mackinnon, from whose question and Lord Stanley's reply we gather the facts of the case. Captain Mackinnon asked if it was true that Commodore Sir William Wiseman, R.N. (naval officer No. 1), was appointed some months ago by the Admiralty to proceed to Constantinople to assist in the organization of the Turkish fleet, and if that appointment had been approved by the Secretary of State to the Turkish Government; and if it was true that this officer was not now to proceed to Turkey in consequence of another British officer (No. 2) of the Royal Navy having accepted the appointment without the sanction of the Government; and what steps the Government had taken to recall this officer, to allow Sir William Wiseman to take up the duties he was appointed to last summer.

In reply, Lord Stanley stated that in May last year the Turkish Government expressed a wish that a British naval officer of rank should be selected to act as member of a council on naval affairs—a kind of Turkish Board of Admiralty—which was lately established at Constantinople. The British Government saw no objection in principle to this proposition, Turkey being at peace with all nations, and Sir William Wiseman was selected by the Admiralty for the post, but the Government thought it better that the appointment should remain in abeyance until the termination of the Cretan war. That war, though on a very reduced scale, still continued, and therefore the appointment had not been carried out. In December last it was reported at the Foreign Office that Captain Hobart, of the British navy, was about to enter the Turkish service. He (Lord Stanley) communicated with the Admiralty upon the subject, and Captain Hobart was informed that in the event of his taking service with the Porte without the consent of his own Government, he could not remain in the English navy. A letter was shortly after received from Captain Hobart, stating that he had accepted office as a member of the Turkish Admiralty Board, and offering, in consequence, to resign his commission in Her Majesty's service. That resignation had, he understood, been accepted; but no communication had been received at the Foreign Office in reference to the subject. He might add, in conclusion, that the appointment being of a civil, and not a military character, Captain Hobart did not, by accepting it, violate the laws of his country. Rather a hard case for Sir William, but there appears to be no help for it, and he must bear his disappointment as best he may. Government must look out for something for him in another direction.

A very important question has been asked by Mr. Candlish, who wished to know whether, during the present season, the Secretary of State for the Home Department intended to introduce a bill to prevent the pollution of rivers; or, if he did not intend to legislate on the whole subject, if he would introduce a bill to prevent solids being deposited in rivers.

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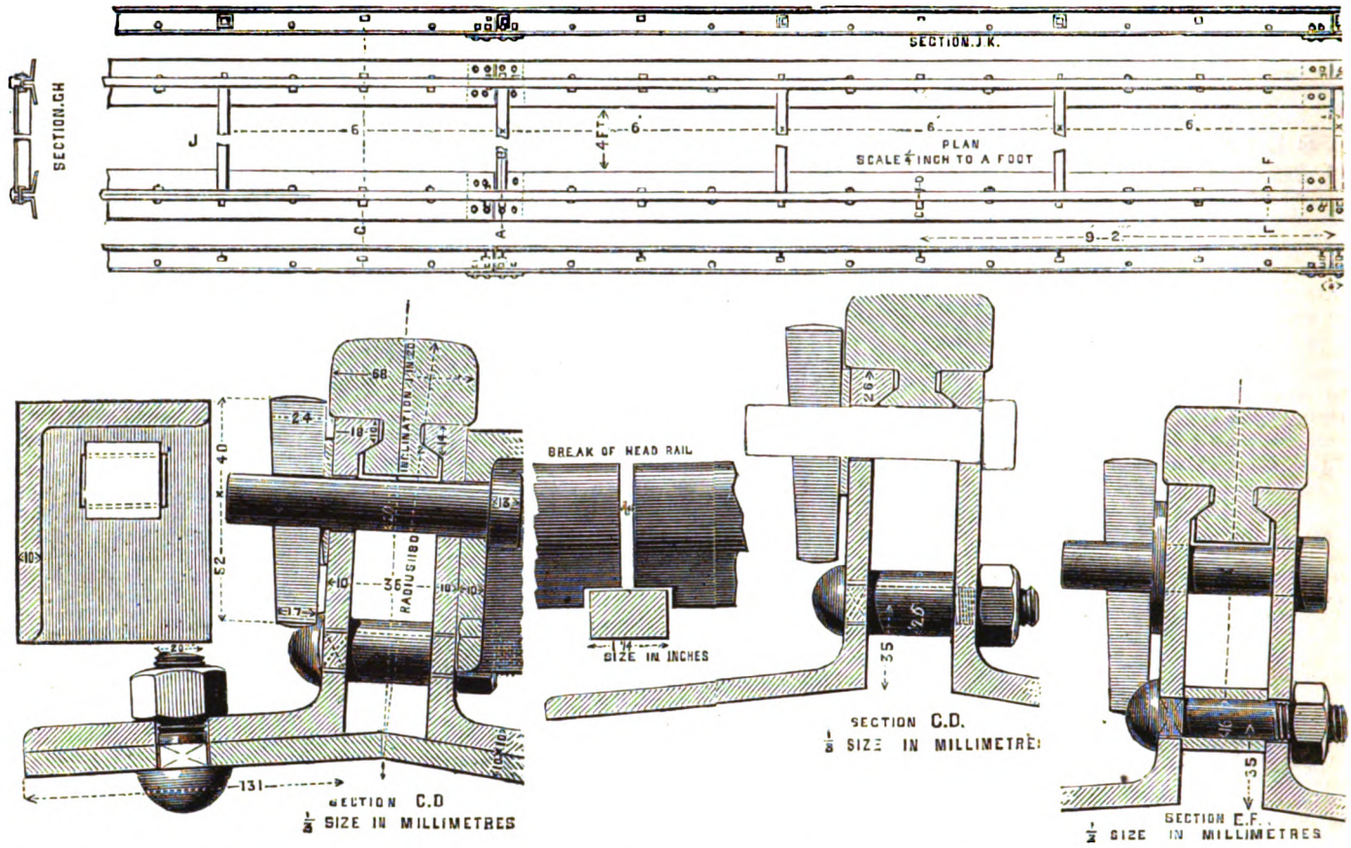
ROCHUSSEN'S PERMANENT WAY, BRUNSWICK RAILWAY.

CONSTRUCTED BY THE HOERDER IRON AND STEEL COMPANY, WESTPHALIA.



Mr. G. Hardy was not prepared to legislate upon this question during the present session, as he did not think the inquiry had been sufficiently completed. He intended to move for the appointment of a new commission of inquiry into the subject. Unquestionably, the sooner the whole subject is inquired into and legislated upon the better; all our rivers, with, perhaps, the exception of the Thames, are nothing better than sewers, not merely from the deposit of actual sewage matter in them, but from numerous other sources of pollution. Gasworks, various manufacturing and industrial establishments, mills of all kinds, and numerous other works, discharge millions of gallons of refuse into the nearest stream, utterly regardless of the finny inhabitants, or the more serious contingency of the death of those residing on its banks.

ROCHUSSEN'S PERMANENT WAY.

IN the accompanying engraving we illustrate the permanent way laid on a length of twelve English miles of the Brunswick Railway, a portion of the main line between Cologne and Berlin, on other sections of which very similar forms of iron permanent way, also made by the Hoerder Company, have been in use for the last two years. Our engraving shows the latest development of a system deserving the most serious attention from engineers, if for no other reason, then because of the excellent results which have followed on its adoption by continental railway companies. The special features of difference between this way and forms embodying the same principles previously used, consist in the shape of the steel head-rail, which, by means of a grooved web, is securely held by corresponding ribs in the angle bars, and tightened up by bolts, passing not through but under the rail-head, and tapered cotters, no nuts and screws being used for this purpose. The great advantages secured by this arrangement are that no holes require to be made in the steel—it is well known that steel will not bear punching, while drilling is a tedious and costly operation—and, secondly, that the line can be put down with little trouble, as it is not necessary to make the holes in the web-plates correspond not only with each other but with those of the rail-head. The renewal of the rail-head is therefore easily effected, and it is possible under all circumstances to turn the head end for end when the inner side is worn, which cannot be done without making fresh bolt-holes when the bolts pass through the steel rail; the angle bars resting on the ballast offer continuous support, which is, in our opinion, essential to safety in the use of any steel rail, and are held in gauge by angle iron cross-pieces placed at intervals of 6ft. The ballast is well boxed up between the angle bars up to the level of the cross-bars. The piece over this track is very easy, although the line does not lack rigidity.

In the event of a rail breaking on this system no harm would be likely to ensue; indeed, if the head were cut up into 2ft. lengths, the track, although it would lose something in rigidity, would still be practically safe, and even though the train came on a portion of the line from which a portion of the rail had been inadvertently removed, as in the case of the Staplehurst accident, it is probable that it would still keep the track, running on the longitudinal angle bearers. In such a system as this lies the best hope of those who advocate the use of steel rails. In this way, and in this way only, it is possible to use a steel table of great hardness without the smallest risk, and the scantling of the steel is so much reduced as compared with that of an ordinary rail that its high price would not perhaps be severely felt even by impecunious railway companies. As to cost, it will suffice to state that the Hoerder Works were paid for the track all round £15 per ton, or, say, £3,000 per mile; but in England we have reason to believe that it could be supplied at a far more moderate rate, say, £12 10s. per ton. A few hundred miles of track at this rate would afford excellent times just now for some of our rolling mills. This kind of track has been extensively tested on the Continent for some years, and with very favourable results, especially on the Brunswick Railway. The dimensions will all be found on the engraving in millimetres. We may add that the system has been patented by Mr. T. A. Rochussen, of Abchurch-lane, a gentleman whose name is well known in connection with the steel industry of the Continent.

A DISCOVERY of coal on the estate of Earl Manners, near Trowbridge, is reported. Boring operations are to be commenced with the view of testing the extent of the seam.

ON THE DRYING OF STEAM BY WIRE-DRAWING, AND ON ITS LIQUEFACTION BY EXPANSIVE WORKING.*

BY W. J. MACQUORN RANKINE, C.E., LL.D., F.B.SS. L. and E.

1. Free Expansion of a Perfect Gas.—One of the fundamental facts of the science of thermodynamics is the fact ascertained by Joule, that when a perfect gas expands without performing external work, its temperature does not fall. It is only when external work is done (as in driving a piston) that a fall of temperature takes place, being caused by the disappearance of a quantity of heat equivalent to the work done.

2. Free Expansion of an Imperfect Gas.—When an imperfect gas expands without performing external work there is a small fall of temperature due to the disappearance of heat in performing internal work—that is, in overcoming cohesion. That fall of temperature has been determined for various gases at different pressures and temperatures by the experiments of Joule and Thomson; but it is a very small fraction of the fall of temperature which takes place when external work is done, as in driving a piston.

3. Free Expansion of a Saturated Vapour.—When a saturated vapour expands without performing external work (as when steam is throttled or wire-drawn), the fall of temperature is greater than in the case of an imperfect gas which is not in the state of saturation, because of the comparative greatness of the internal work done in overcoming cohesion in a saturated vapour; but still that fall is not nearly so great as when external work is done; and it is not so great as the fall of the boiling point corresponding to the diminution of pressure: the consequence of which is that dry saturated vapour by being wiredrawn becomes superheated—in other words, its temperature after the wire-drawing, although lower than the previous temperature, is higher than the boiling point corresponding to the diminished pressure.†

4. Drying of Moist Vapour by Wiredrawing.—If the vapour which is wiredrawn carries with it some liquid in the state of spray, either the whole or part of that

* From "The Engineer."

† The figure of the expansion curve for the free expansion of saturated vapour is investigated at the end of a paper of mine on "Thermodynamics" in the "Philosophical Transactions" for 1854.

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quantity of heat which would otherwise superheat the wiredrawn vapour will be employed instead in evaporating that spray. The proportion borne to the whole weight of fluid discharged by the greatest weight of spray which can thus be evaporated, so as to leave the vapour dry though saturated after being wiredrawn, may be found to an approximation close enough for most practical purposes as follows:—Divide the difference between the values of the total heat of evaporation of the fluid at the pressures before and after wiredrawing respectively by the latent heat of evaporation at the higher of those two pressures.*

5. Approximate Rule for Steam.—As a roughly approximate rule for practical purposes in the case of steam:—find, by the use of tables or of a formula, the fall of the boiling point corresponding to the fall of pressure: divide that fall of temperature by 3000 for Fahrenheit's scale, or multiply it by 0·0006 for the Centigrade scale: the result will be the proportion of spray which the wiredrawing is capable of drying up in each unit of weight of steam. For example, suppose the following to be the absolute pressures before and after wiredrawing in lbs. on the square inch:—Before, 100lb. above the atmosphere, or about 115 absolute: after, the atmospheric pressure, or about 15 absolute. The corresponding boiling points are:—

Before.....	338 deg. Fah.	170 deg. Cent.
After	212 „	100 „
Fall.....	126 deg. Fah.	= 70 deg. Cent.;

and the proportion of spray per unit of weight of steam which the operation of wiredrawing is capable of drying up is

$$\frac{126}{3000} = 0{\cdot}0006 \times 70 = 0{\cdot}042,$$

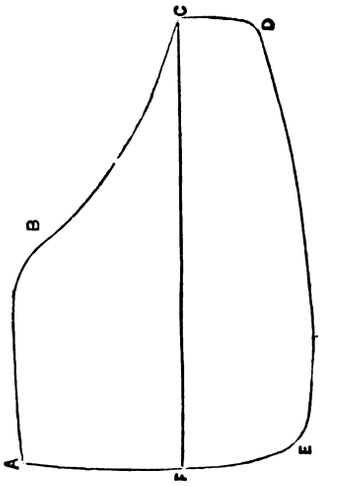
or 4·2 per cent.

6. Liquefaction of a Vapour by Expansive Working in a Non-Conducting Cylinder.—If any vapour existed whose total heat of evaporation did not vary with the boiling point, and if that vapour were employed in a state of saturation to drive a piston by its expansion in a non-conducting cylinder, the disappearance of heat during the expansive working would cause the liquefaction of a part of that vapour whose proportionate weight could be calculated exactly by dividing a quantity of heat equivalent to the work done by expansion, by the total heat of evaporation. But the total heat of evaporation of every known vapour diminishes when the boiling point is lowered; therefore, the quantity of vapour which would be liquefied by a given expansion, if the total heat of evaporation were constant, has to be diminished by subtracting from it the quantity of spray which would be dried up if the same quantity of vapour underwent the same fall of pressure by being wiredrawn without doing external work; and the remainder is the quantity of vapour actually liquefied. The following is an example for steam, the calculations being made in round numbers, as minute accuracy is unnecessary.

Pressures in pounds on the square inch: at beginning of expansion, absolute	115
At end of expansion, absolute ...	29
Rate of expansion about	3·67
Work done by the expansion per pound of steam, about	84,000ft.-lbs.
Mechanical equivalent of an unit of evaporation at pressures between the above limits, about	730,000ft.-lbs.
Proportion of steam which would be liquefied if the total heat of evaporation were constant $\frac{84{,}000}{730{,}000}$ = ...	0·115 nearly.
Subtract proportion of spray which would be dried up by wiredrawing with the same limits of pressure; fall of temperature 90· Fah. $\frac{90}{3000}$ =	0·300
Proportion of steam liquefied in a non-conducting cylinder...	0·085 nearly.

7. Peculiarities of Certain Fluids.—It thus appears that the liquefaction of a vapour through expansive working in a non-conducting cylinder is due to the difference between two quantities of heat; that which disappears in driving the piston by expansion, and that which is, so to speak, set free by the fall of the total heat of evaporation. The formulæ relating to this subject, which were published independently by Clausius and myself in 1850,* show that for every fluid there is a temperature at which those two quantities become equal; so that it is only below that temperature that vapour is liquefied by expansive working; while above it expansive working as well as wiredrawing is accompanied by superheatiug, owing to the first of the two quantities of heat becoming less than the second. It was for some time supposed that the temperature at which liquefaction by expansive working disappears was for all known fluids high above all temperatures which commonly occur in practice; and such is, indeed, the case for steam; but Mr. G. A. Hirn afterwards showed that there are some fluids for which this temperature is comparatively low, and that amongst them is ether.

8. Approximate Rule for the Liquefaction of Steam Working Expansively in a Non-Conducting Cylinder.—The exact formulæ for the liquefaction of vapours through expansive working are too complex for ordinary use in practice; but by computing several different cases in detail I have found that the following very simple rule (now, I believe, first published) is sufficiently near the truth for all practical purposes. In the figure let A B C D E



represent the indicator-diagram of a steam engine. Through the point C, corresponding to the end of the expansion, draw a straight line of uniform pressure C F. Calculate the quantity of work represented by the part A B C F of the diagram, which lies above the line of final pressure C F. Then the weight of steam liquefied will be approximately one pound for every 1,000,000ft.-lb. of work represented by A B C F, or one kilogramme for every 300,000 kilogrammetres of work represented by A B C F. If the work represented by A B C F in a given time be reduced to indicated horse-power the above rule is equivalent to 2lb.= 0·9 kilogramme of steam liquefied per hour for each indicated horse-power represented by the part of the diagram above the line of final pressure. For example, let the initial absolute pressure be 60lb. on the square inch, and the rate of expansion 4; so that for ordinary practical purposes it is sufficiently accurate to take, for the final absolute pressure, 15lb. on the square inch, and for the mean excess of the absolute pressure during the stroke above the final pressure (represented in the diagram by the mean height of the line A B F above the line C F.)

$$\frac{60 \times \text{hyp. log. } 4}{4} = 60 \times 0{\cdot}3466 = 20{\cdot}8\text{lb.}$$

on the square inch nearly. Let the area of the piston be 800 square inches, and its mean velocity 250ft. per minute. Then the work per minute corresponding to the part A B C F of the diagram will be

$8{\cdot}20 \times 800 \times 250 = 4{,}160{,}000$ft.-lbs. per minute; so that the rate of liquefaction of the steam in a non-conducting cylinder, as found by the first form of the rule, will be 4·16lb. per minute, or nearly 250lb. per hour. The quantity of work per minute calculated above is equivalent to 126 indicated horse-power which gives, by the second form of the rule, 252lb. of water condensed per hour.

9. Effect of Spray in the Steam when Admitted.—The preceding calculations are based on the supposition that the steam when admitted, though saturated, is dry. Should there be liquid spray in the steam when admitted, the heat given out by that spray as the temperature falls during the expansion will to a certain extent diminish the quantity of steam liquefied. The theory of this has been fully investigated by Clausius and Zeuner. In such cases as those to which the present communication refers, it may be sufficient to state, as a rough approximation, that the presence of one per cent. of spray in the steam when first admitted, diminishes the quantity of steam subsequently liquefied during the expansion by about one-eightieth part of its amount. For example, the presence of one per cent. of spray in the steam when admitted, in the case computed in article 8, would diminish the subsequent additional liquefaction per hour by about 3lb. A large proportion of spray would be required in order to make an effect of this kind sensible.

10. Effect of a Conducting Cylinder.—If a conducting cylinder is unclothed, it of course causes part of the steam to become liquid simply by carrying off heat to the air outside, and this effect is increased indirectly by the liquefaction through expansive working; because moist steam is a better conductor of heat than dry steam, and parts with its heat more rapidly to any neighbouring conducting substance which is at a lower temperature. This effect may be prevented by clothing the cylinder with a sufficient thickness of a substance which resists the conduction of heat. But there are other effects of the conducting power of the cylinder, when not steam-jacketed, which are not prevented by a non-conducting clothing. One of these is, that the metal of the cylinder, assuming temperatures intermediate between those of the steam at the beginning and at the end of the expansion, abstracts heat from the steam during its admission, and during the early part of the expansion, and gives heat back to the steam during the later part of this expansion; and that, consequently, the liquefaction due to the expansive working does not take place wholly during the expansion, but partly during the admission of the steam. This effect is shown by the flattening of the expansive curve B C in the indicator diagram; and also by the expenditure of a greater weight of steam than that corresponding to the volume at the pressure of admission as indicated by the length of the line A B; and it is unfavourable to economy; for the proportion borne by that additional expenditure of steam to the whole expenditure is much greater than the proportionate increase of work due to the flattening of the expansion curve. It is evident, indeed, from ordinary indicator diagrams, that the quantity of steam liquefied during the early part of the stroke is often greater than the quantity due to the expansive working, and that a partial re-evaporation takes place towards the end of the stroke. Another effect of the conducting power of an unjacketed cylinder is, that if there is liquid water present in that cylinder at the end of the stroke, part of that water may, by abstracting heat from the cylinder, be distilled away into the condenser, thus lowering the temperature of the metal of the cylinder below the final temperature of the expansion; so that an additional quantity of steam is condensed during its admission in raising the temperature of the metal again, and a certain quantity of heat passes at every stroke from the boiler through the cylinder to the condenser without contributing to the performance of work. Those effects of the conducting power of the cylinder in combination with the spontaneous liquefaction of steam due to expansive working are very fully discussed in two papers (the first by myself, the second by Mr. James Brownlee) in the "Transactions" of the Institution of Engineers in Scotland for 1861-2.

11. Use of a Steam-Jacket, and of Moderate Superheating.—The liquefaction of steam by expansive working is not of itself a cause of waste of heat or power; and in a non-conducting cylinder (if such a thing were possible) it would have no

* The following is the algebraical investigation of the rules given in the text:—Let the latent heat of evaporation of the fluid be denoted, before being wiredrawn by L, and after having been wiredrawn by L^1; let c be the specific heat of the liquid, t and t^1 the boiling points corresponding to the pressures before and after being wiredrawn respectively, and s the fraction of the whole weight of fluid discharged, which is in the state of spray before wiredrawing, and whose value is supposed to be so adjusted that the vapour, after being wiredrawn, though still saturated, is dry. Then, from the condition that no external work is done, there follows this equation:—

$$L^1 = c\,(t - t^1) + (1 \ldots s)\,L; \quad \ldots\ldots \quad (1)$$

and, consequently,

$$s = \frac{L - L^1 + c\,(t - t^1)}{L}; \quad \ldots\ldots \quad (2)$$

In the case of steam, we have $L - L^1 + c\,(t - t^1) = 0{\cdot}3\,(t - t^1)$ ordinary thermal units nearly: and for a rough approximation, we may take L = 900 British thermal units or 500 French thermal units; consequently, for steam, we have nearly

$$s = \frac{t - t^1 \text{ Fah.}}{3000} = 0{\cdot}0006\,(t - t^1) \text{ Cent.} \quad \ldots \quad (3)$$

* "Transactions of the Royal Society of Edinburgh" for 1850, vol. xx.; Poggendorff's Annalen, 1850: see also "A Manual of the Steam Engine and other Prime Movers," pp. 395-6.

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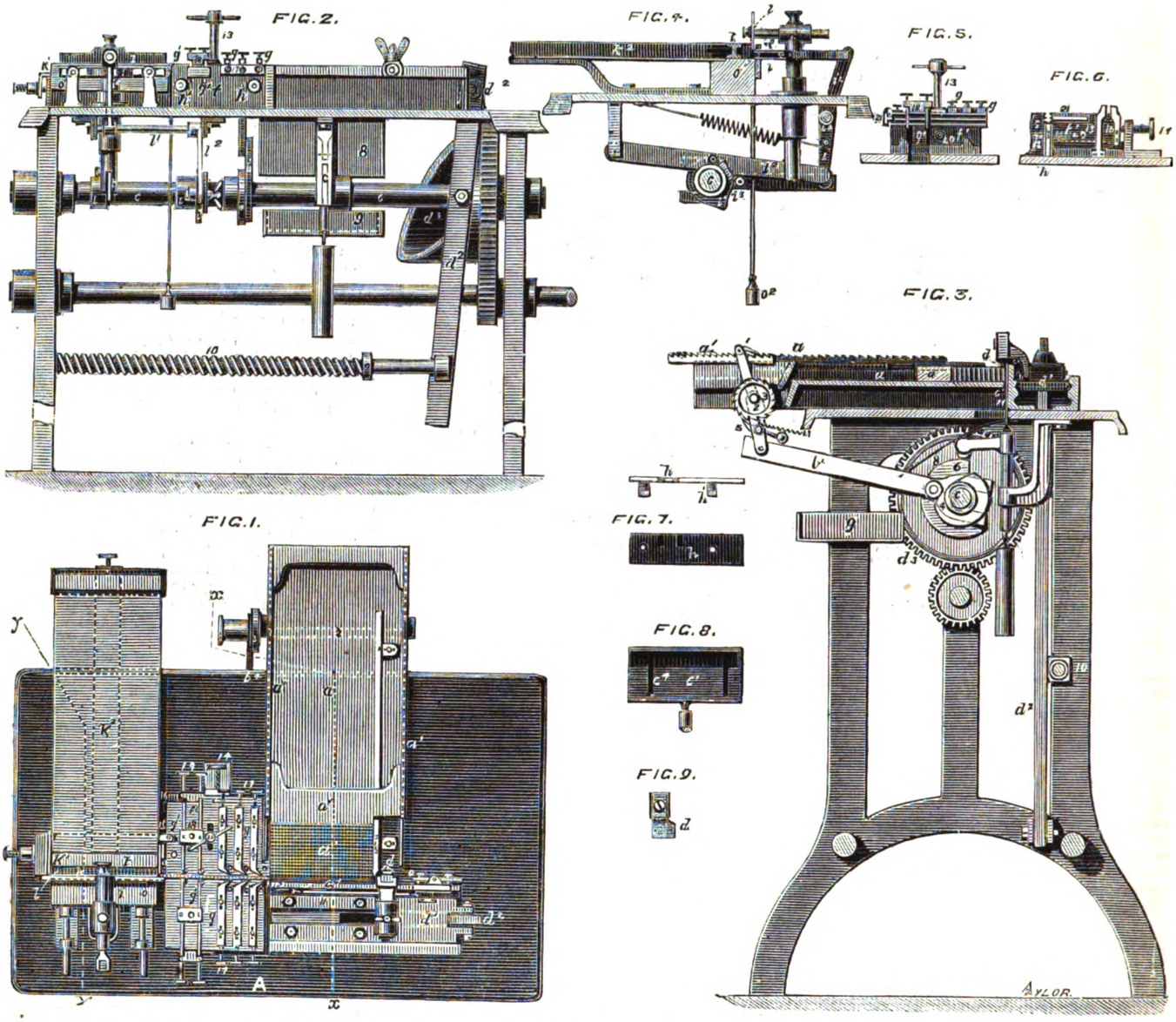
MACHINE FOR DRESSING TYPE.

BY MR. P. WELCH.



effect on the economy of the engine. When work is done by expansion, heat must necessarily disappear; and the disappearance of that heat must necessarily take effect in producing fall of temperature, or liquefaction, or both. The bad economy of engines in which much steam is liquefied in the cylinder is owing to the fact that the presence of liquid water amongst steam increases its conducting power, and makes it give out heat rapidly to the metal of the cylinder, as explained in the preceding article. A steam-jacket supplied from the boiler prevents the liquefaction of the steam which works expansively in the cylinder, through the liquefaction of an approximately equal quantity in the jacket: the quantity of steam liquefied is about the same; but the liquid water, instead of being formed in the cylinder, where it is mischievous, is formed in the jacket, where it does no harm; and instead of going to the condenser, and carrying off heat, it is returned to the boiler. The first effect of a moderate amount of superheating is the same with that of a jacket; the superheated steam on entering the cylinder raises the temperature of the metal to an extent sufficient to prevent the formation of liquid water, at all events in such a quantity as would be sensibly prejudicial to economy.

12. Bearing of the Preceding Principles upon Questions as to the Priming of Boilers.—From what has been stated it may be concluded, on the one hand, that the discharge of dry steam from a safety valve or other opening in a boiler does not conclusively prove that the steam inside the boiler is dry, but only that the proportion of spray mingled with it is not greater than can be dried up by the wire-drawing; and, on the other hand, that the discharge of liquid water from the cylinder of a steam-engine affords no proof whatsoever that the boiler primes.

W. J. M. R.

Glasgow University, February 17.

MACHINE FOR DRESSING TYPE.

THE process of dressing printing type, although quickly performed by those engaged in the work, from mechanical habit, is nevertheless one that is open to the improvement machinery always affords over any manual operation. In our engraving we represent a type-dressing machine which has been invented and recently patented in England by Mr. Patrick Welch, of New York. Fig. 1 is a plan of the machine. Fig. 2 is an elevation at the side A of fig. 1, the legs of the frame being broken off. Fig. 3 is a vertical cross section at the line x x, fig. 1. Fig. 4 is a partial section at the line y y. Fig. 5 is an elevation of the face of one of the cutter blocks. Fig. 6 is a side view of the cutter blocks and gauge for determining the thickness to which the types are rubbed or dressed. Fig. 7 is a plan and elevation of the bridge over which the types pass when between the cutters. Fig. 8 is an elevation of the slide that delivers the slices or rules that keep the lines of type separate. Fig. 9 is a face view of the pusher, its axis being shown by dotted lines. The types are set up in line and placed in column in a galley a, and between the lines metal rules or slices are introduced, The column of type is moved up by a sliding frame a^1 at the proper time, as one line at a time is conveyed away and passed through the cutters to dress it. The frame a^1 is operated on by pawls 1 1, on arms from a cross shaft 2; 3 is a ratchet wheel that is loose on shaft 2, but clamped by friction plates on its side, and b^1 is a bar vibrated by the cam 4 on the main shaft c, and acts by a pawl 5 on the wheel 3 to cause the pawls 1 1 to move the column of type forward into the machine the width of one line.

The lines of types only being carried off endwise through the cutters it is necessary to dispose of the rules between the respective lines; to effect this a recess is formed in the sliding plate c^1 into which the rule or slice passes as the line of types comes against the face of that plate c^1. After the line of types has been carried off, this sliding plate c^1 is carried down below the bottom of the galley a by the weight c^2 and cam 6 on c, and stationary inclines 7 acting through slots c^4 (figs. 3 and 8) in c^1 throw the slice out of the recess upon an incline 8, down which it slides into a receptacle 9. In order to move the lines of types along, a pusher d is mounted on a slide d^1, and moved at the proper time by the lever d^2, cam d^3, and spring 10. The pusher is a movable piece of metal that may be changed to accommodate thick or thin type, and the device that connects the pusher and slide is a rock shaft with a screw clamp, so that the edge of the pusher can be set at an inclination to accommodate the inclination there may be in the type at the end of the line resulting from the projecting burrs at the bases of the letters, keeping the bodies of the types slightly apart at the letter ends.

The follower e is drawn in behind the pusher by the the spring 11, and by its thin ends holds up the next rule and line of types. A small friction spring at 12 holds up the last type in the line of types as the pusher leaves it on going back to allow another line of types to come up to the face of the sliding plate c^1. The blocks f and f^1 carry the cutters; the block f is stationary, and the block f^1 movable nearer to or farther from the block f, according to the width of the lines of type to be dressed. The screw 13, in a slot in the block f^1, is employed to hold the same

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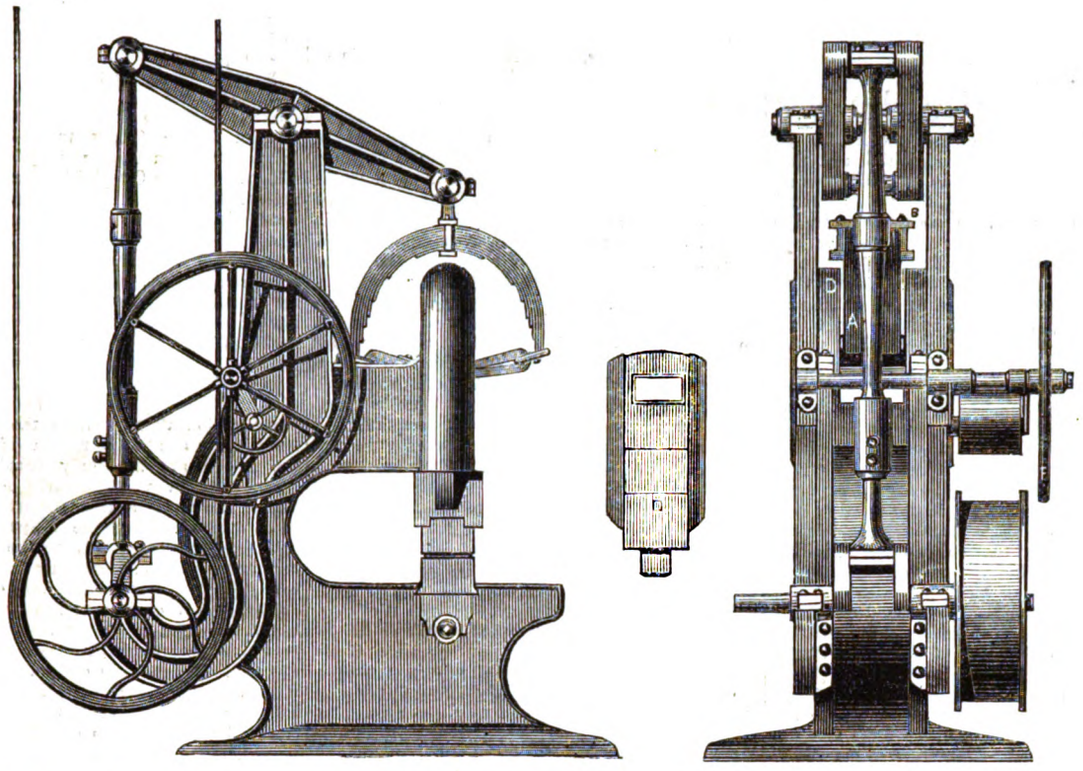
DEAD STROKE POWER HAMMER.

BY MESSRS. SHAW AND JUSTICE, NEW YORK.



firmly after the adjustment has been effected by the screw 14, and 15 is a standing gauge on the bed of the machine, and 16 a similar gauge on the block f^1 (fig. 6), between which a type of the standard width of the dressed type is introduced to aid in adjusting the block f^1.

The blocks f and f^1 carry the pairs of cutters $g\ g\ g$ and $g^1\ g^1$; the cutters g are made with bevelled ends (figs. 1 and 5), and only act to cut off the projecting metal at the base of the letter; these cutters are adjusted by the screws 17. The cutters g^1 act like plane irons upon the entire sides of the body of the types to true the same, making the types uniform in thickness and parallel sided as the line of types is pushed through between the cutters. The cutters g^1 are held down by the clamps 18 that may be turned around to allow of the cutters being removed for sharpening, and screws 19 are provided for adjusting such cutters g^1. The screws also pass through clamps g^2 that have to be turned around to facilitate the removal of the cutters.

The line of types in passing through the channel between the blocks f and f^1 rest upon a bridge h (figs. 6 and 7) is formed with side notches at the parts where the cutters g^1 stand, so that the cutters can project slightly below the bridge, and the bridge at these points is only left the thickness of the thinnest type or space to be rubbed, so that the cutters can be adjusted thereto. This bridge is adjustable by the screws h^1, so that it shall stand midway below the channel whatever may be the width of type that is being dressed. A spring 20 (figs. 5 and 6), is employed to push the block f^1 into contact with the adjusting screw 14, as that may be moved, and thus facilitate adjustment.

The surface of the blocks f and f^1 are made of steel and ribbed, as seen in figs. 5 and 6, so as to lessen friction on the sides of the types as they are forced through the channel. The types are received line by line as they are rubbed into a galley k that has an adjustable side k^1 to accommodate the length of line, and the side 21 is made also adjustable that it may be set at an inclination if the projections at the top and bottom of the letter make the line of types wider at the top than at the bottom. The side k^1 is also fitted with a spring that it may yield if an extra type accidentally is in the line. The whole column of type in the galley k is pushed along by pushers i operated by the cam i^1 and lever i^2, the rule l being at that time lifted by the cam l^1 and lever l^2. This gives the necessary opening for the next line of types to come in, but before the pushers i draw back the rule l descends to hold up the types in the galley k, and the position of this rule l can be adjusted according to the width of the line of types and the movement of the pushers i determined by adjusting the roller i^3. The lever i^2 is made in two parts, each part attached to the shaft i^4, the shaft i^4 forming the fulcrum of the lever.

A block o is set to slide in a groove in the fence o^1 that forms a continuation of the face of the block f, and from this block o a cord passes over a pulley to the weight o^2, so that the first type in the advancing line of types will be held up as the line is pushed into this galley k, and this block is drawn back by its weight o^2 as soon as the line of types has been pushed away from the fence o^1 into the galley. A movable galley k^2 extends from the galley k, the thin sides of this galley k^2 setting behind springs at the edges of k, so that the types cannot become wedged in passing into the galley. The advancing end of the column of types in the galley k or k^2 is held up by a sliding block t. By dividing up the column of types in the galley k^2 into square sections, and then introducing rules so as to separate the types into lines, they may be run through the machine a second time to dress the other sides of the body of the types, the cutters being adjusted accordingly.

DEAD-STROKE POWER HAMMER.

WE illustrate, in the accompanying engraving, a hammer, of American invention, which has been found to give satisfaction to most of the firms who have tried it. The inventors intend it to supersede the trip hammer. The first working model, with a 60lb. head, has been in use for some time past in Philadelphia—principally in drawing down the ends of railway spring blades. The hammer consists of a framework of cast iron about 5ft. by 6ft. 8in. by 10ft. 8in. high. The weight of the hammer is 1000lb., or nearly half a ton, suspended from the spring A, which is attached to the end B, of a beam worked by the crank shaft which is driven by a belt pulley. F is a wheel for tightening the belt, so as to regulate the speed at which the hammer works. The inventors say that it must not be supposed that the power obtained from this hammer is due to the momentum of the ram merely; the principal agent is the elastic force of the steel bow spring, a force that is proved by bracing its extreme points so as to prevent any flexibility, when it will be found that with all the velocity given to the ram, no power can be obtained from it other than that of an accelerated drop or dead fall. Absolute tests prove that a weight of 2500lb. must be exerted to compress the spring usually attached to a 100lb. hammer, to enable it to reach the maximum point of deflection when driven at its regular speed. By this it will be seen that the increase of force over the mere weight of the ram itself is greatly in excess of that of any hammer known, while the power used is economized in about the same proportion. The machine gives a dead blow, and works with a considerable saving of power as compared wtth ordinary drop hammers.

SOCIETY OF ENGINEERS.

(Concluded from page 149).

THE ATRATO AND TRUANDO LINE.

IN 1853, R. G. Jameson, M.D., of New York, explored the tract of country between the Jurador and the Salaqui, but found the dividing ridge to be 1,063ft. high and 30 miles in width. Immediately afterwards he explored the country a little south of it, from the Atrato and Truando to the Paracuchichi. A survey of the latter route was then made in 1854, 1855, and 1866 by Messrs Kennish, Nelson, Rude, and Jameson, at the expense of F. M. Kelley, Esq., of New York, by whom their survey was published.*

In 1857, the United States' Government sent the schooner "Varina" with a commission, consisting of Lieutenant T. Augustus Craven, U.S.N., hydrographer; Lieutenant (now Brigadier-general) Nathaniel Michler, U.S., Topographical Engineers; John de la Camp, Esq., geodetic surveyor; W. H. W. Campbell, Esq., astronomer and meteorologist; Arthur Schott, Esq., botanist and geologist; Theodore Gill, Esq., zoologist, and a number of assistants, by whom, in seven months, a detailed survey of the line was made. Lieutenant Craven published his report separately.† The reports of the other gentlemen are bound together in a volume, which is decidedly the best survey that ever appeared of any part of Central America or the Isthmus.‡ It is accompanied by a large volume of plans§ of extraordinary accuracy and minuteness. In future, no engineer should undertake the examination of any part of the Isthmus without having studied those two works. Before this expedition went out, the author applied to Mr. Toucey, the Secretary of the Navy, requesting that the engineer might be commissioned to survey the Darien route after he should have completed his examination of the Atrato line, and offered to go out, at his own expense, to join the expedition, for the purpose of acting as guide across Darien. But Mr. Toucey, in reply, stated that the survey would be limited to the Atrato line. He then forwarded a number of documents, containing information that might be useful, through Mr. Dallas, the American Minister, who, in a note to him, says:—"These interesting and important documents will be forwarded by me to the United States by the steamer 'Asia,' which leaves Liverpool to-

* Kelley, F. M. On the Junction of the Atlantic and Pacific, 1856.

† Craven, Lieutenant T. Augustus, U.S.N., Report to the Secretary of the Navy, Washington, 1858.

‡ Michler. Reports, Interoceanic Canal. Darien Senate. Ex Doc. 9. 2nd Session, 36th Congress, U.S., 1861. Do. do. P lates, 1861.

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morrow." It may not be irrelevant to state that, before Messrs. Kennish, Nelson, and Rude, who were Manx men and United States' citizens, went on their first expedition to the Atrato, the author, being then on his way to Darien for the third time, met them at Carthagena, and informed them that the valley of the Atrato, from the source to the mouth of the river, had been examined, in separate portions, by T. C. Vincent, Esq., of New Park-street, Southwark, and Don Juan de Dios Ulloa, a Granadian engineer and native of Quibdò, that he also had examined the mouths of the Atrato and the Cordillera south of Point Garachinè, and that the result of their observations had led them all to the same conclusion, namely, that there was no practicable line for a ship canal between the Atrato and the Pacific. The same opinion had been expressed by Dr. Robert Key, a Scotchman, who had been a surgeon-major in St. Martin's Army of Liberation in Peru, and had afterwards settled in Quibdò, where he resided for thirty years, practising *por el amor de Dios*, and maintaining his family by bartering goods for gold-dust. Nevertheless, they sailed for the Atrato, and, on entering it, their vessel, the "Stella," was wrecked in the Cano Coquito, where its hull was still visible in 1858. They returned to Carthagena to get another boat, and the author had the pleasure of spending many evenings in their company before he started for Darien.

The line surveyed was from the mouth of the Cano Coquito, up the Atrato due south, to the mouth of the Truando—75¼ miles—and up the latter, for a distance of thirty-six miles, to the confluence of the Nerqua, the course being S.W. The line then follows the valley of the Nerqua for thirteen miles, to the foot of the falls of the Hingador. The latter descends from the dividing ridge by a series of cataracts, one of which is 180ft. in height and 40ft. in width. Here the scenery is superb and enchanting to the lover of the picturesque, but very depressing to the spirits of a canal projector, as, besides the great Salto, there are many smaller ones, of 20ft. et infra. The dividing ridge has an elevation of 947·44ft. above the sea. This ridge and a little table-land being crossed, the sources of the Chuparador are reached, and, following down this river to the foot of the mountains, the line crosses the Chupipi, and then follows the Totumia to the Paracuchichi, which falls into the Pacific between Cape Marzo and Punta Ardita.

From a point about three miles above the mouth of Cano Coquito the Atrato is navigable for the largest vessels up to the confluence of the Truando with it. At Boca de Sucio, a little below that point, the height of the Atrato was found to be 25·73ft. above that of Cano Coquito. At the confluence, the Atrato is 350 yards wide and 50ft. deep. The Trunado passes through an alluvial plain, and across two deep lagoons before entering the Atrato. Its average depth is 14ft., but near the junction of the Nerqua with it there are several falls. This river would require to be deepened for its whole length, and the falls should be avoided by a tunnel of 1,000ft. From the tunnel a canal should be cut, on solid ground, along the valley of the Nerqua to the Hingador. From thence a tunnel, 12,250ft., or about 2½ miles, would be required. From the Pacific entrance of the tunnel an open cut, eight miles in length, to the mouth of the Paracuchichi, would complete the communication.

The line would then consist of :—

	Miles.		Feet.
Navigation of the Atrato...	75	...	1,320
" Truando	36	...	...
Tunnel	...	...	1,000
Canal	13	...	...
Tunnel	2	...	1,690
Canal	8	...	...
	134	...	4,010

The following is the estimate of Lieutenant Michler and Mr. De la Camp, who give all the calculations upon which it is based very minutely :—

	Cubic yards.	At per cubic yard.	Cost in dollars.
Earth excavation	75,258,100	33 cents.	24,835,173
Rock cutting.....	43,183,300	1 doll. 50 c.	64,774,950
Tunnel	5,598,000	2 dolls. 50 c.	13,995,000
Total	104,049,400		103,605,123

Some other works bring the totals to 151,300,100 cubic yards of excavation, and 134,450,154 dollars, or £28,010,448 15s. This estimate is very little higher than that given by Dr. Jameson, some years before, in a letter to the "New York Herald."

So far for the engineering work. But the hydrographic survey, by Lieutenant Craven, shows that the subaqueous excavation would be by far the most difficult and expensive part of the work. The bar at the mouth of the Paracuchichi is dry at low water, and Kelley's Inlet, inside of it, has only a few feet of water. Humboldt's Bay, the Puerto Quemado of Pizarro, immediately south of the Paracuchichi, is an open roadstead. A harbour would, therefore, have to be made on the Pacific. But even more formidable difficulties occur at the mouth of the Atrato. The sand-bank off the mouth of the Cano Coquito should be removed. The bar at its mouth, one mile in length, should be dredged from a depth of 3ft. or 4ft. to that of 30ft. Its channel should be deepened for the length of 4.546 yards, from the bar up, from an average depth of 9ft. to that of 30ft. The difficulty of these operations would be greatly enhanced by their peculiar unhealthiness; for it is well known that the most deadly work in the tropics is the disturbance of mud in places where fresh and salt water meet. Even the negroes of Demerara, Essequibo, and Berbice, which are the lowest swamps in the world—the empoldered or trenched and dammed land of the plantations being several feet below the level of the sea—would not stand it. They dread, above all things, the job of removing the drift-mud that sometimes blocks up the Kokert doors, through which the surplus water of the canal is let off at low water—and with good reason—for they generally get the ague after it.

The following letter gives the results of Lieut. Craven's survey :—

"Bound Brook, New Jersey, August 3, 1858.

"DEAR SIR,—I received your communication of January, while on my return from the Atrato. I arrived in the United States early in May, having made a thorough examination of the route by the Atrato, Truando, Nerqua, and Totumia rivers. The entire distance across is 134 miles, which I twice traversed with the parties under my command. My preliminary report was made to the United States' Senate on the 17th of May, and has appeared in our papers generally. I suppose, therefore, you have seen it. I do not say that the construction of the canal is an impossibility; but its cost will be immensely beyond the views of this age. My detailed report is not made out, but I believe that my estimates will reach some 500,000,000 dollars with fifty years of labour. In a matter of such consequence to the world, it is very important that a practicable route be discovered. If nothing better offer, we must cut through the Isthmus at Panama.—Yours truly,

"T. AUGUSTUS CRAVEN.

"Dr. Cullen, 302, Strand, London."

The author saw Craven afterwards on board the United States' frigate "Tuscarora," of which he was captain, and in which, it is deeply to be regretted, he was lost, and he said that the idea of opening a canal by way of the Atrato had been abandoned.

The table-land at the summit of the ridge is composed of trappean or metamorphosed schistose rock, covered by broken secondary and tertiary strata. The Divide is composed of alluvion underlaid with recent layers of loam, sand, semi-rock, and conglomerate. At the foot of the great fall of the Hingador there are thermal springs; and in the valley of the Nerqua, there is one of the temperature of 107 deg. Fah. The principal palms are known by the native names of Milpesos (1,000 dollars), Chontaduro, Pihiguai, Hipihapa (of which the Panama hats are made), Palmiche, Coroso, Puertorico, Quitasol, Palma Amarga, and Murapo. They appear to belong to the genera Bactris, Martinezia, Areca, Aiphanes, and Carludovicea. There is a bread-fruit tree, called Membrillo, which probably belongs to the order of Lecythidaceæ. The greater part of the region of the lagoons is covered with a thick gramineous vegetation, interspersed with water plants, mostly Alismaceæ, Polygonaceæ, Pontederiaceæ, &c., &c. Gramalote (Panicum glaucum) is abundant, and is the favourite food of the manati, or sea cow. Lichens, Jungermanniaceæ, Lycopodiaceæ, and a whole host of parasitic suckers in the shape of Orchidaceæ, Bromeliaceæ, Filices, Aroideæ, &c., overspread the district. Amongst the trees are the water-loving Cecropia peltata, which bears the vernacular name of Guarumo; an Inga with eatable pods (Guamo); a mimomaceous tree with a graceful umbellate crown, and the Trementin, a grave forester with a conical base, whose trunk does not send off any branches until it reaches 80ft. or 100ft. in height. Mr. Gill mentions among the Gnawers, the Cavybara, the Agouti, and several species of Sciuridæ; amongst the birds several species of Scansores, Rasores, Columbidæ, Conirostres, and Grallatores. Of the fishes he has written at very great length.

The population is very small indeed. The Truando is totally uninhabited. On the Nerqua, a mulatto, named Domingo, and two or three families were the only inhabitants. There they met an Indian family travelling, and there is from thence an Indian trail across the Cordillera. On the Chupipi there are a few families; and at Paracuchichi mouth there are twelve houses inhabited by samboes and negroes from Panama, and a few Jamaica men, who are described as ex-pirates, thieves, wreckers, and sharpers. They demanded most exorbitant prices for conveying the baggage of the expedition across the Cordillera. Some of these people make trips in bongos to Panama, which is 165 miles N.W. They generally call in, on the way, at Garachiné village, eighty miles distant. This population had only been ten years settled there. With the exception of a few families at the mouth of the Jurador, the above are the only inhabitants in the country which was formerly called Biruquete and is the most southern part of Darien, extending from Garachiné Point to Cape Marzo, and from the Cordillera to the Pacific. About twenty years ago it constituted a district under a corregidor and was called the corregimiento of Jurador, but of late it has been entirely neglected. It used to be the resort of Cimarrones, or runaway slaves and fugitive criminals from Panama. It was this coast that Pizarro visited when searching for Peru, and it was from the wrong application of the name of the Biru (called by Pizarro Rio de Hambre, or river of famine, and now Rio Jurador), that the name Peru was derived. On the Biru was the village, the inhabitants of which he called Pueblo Quemado, or burnt people. The Biru had been visited some time before by Vasco Nunez, and then by Andagoya, and Almagro called there in pursuit of Pizarro.

The following are the principal points of which Mr. Campbell fixed the positions :—

	Lat. N.			Long. W.		
	deg.	min.	sec.	deg.	min.	sec.
Turbo, on the E. side of the Gulf of Darien, nearly due E. of Cano Coquito	8	4	56·2	76	41	50·7
Boca de Sucio, a little below the Truando mouth	7	26	16·6	77	5	40·5
Paracuchichi mouth ...	7	2	59·6	77	40	25·35

The thermometer during December, 1857, ranged from 79deg. to 83deg. from sunrise to sunset.

THE PALLISER GUN.

IT is agreeable news to hear that the success of the efforts of the Ordnance Select Committee to provide the country with cheap guns, in order to arm as rapidly as possible the forts and batteries at home and in the colonies with rifled cannon, promises to be complete. A cast-iron 32-pounder, converted by Sir W. Armstrong and Co. for the Victoria Government, on Major Palliser's plan, fired some seventy-six heavy charges at Shoeburyness, as much, we—"Army and Navy Gazette"—believe, as 16lb. of powder and 80lb. shot. The gun was afterwards condemned by the Woolwich authorities, and submitted by the Ordnance Select Committee to the trying test of 2,000 rounds of service charges. It has just completed its task, having got through 2,076 rounds without injury, beyond a few scratches in the b ore to the depth of one-tenth of an inch. This result is a proof of the extraordinary pitch of excellence to which the Elswick Ordnance Company have brought their coiled barrels. It is stated, indeed, that their converted 68-pounders have been firing battering charges at Shoeburyness usually allotted to much heavier ordnance. Colonel Clarke's strengthened carriage answers admirably, one of the converted 68-pounders having fired 100 rounds from it with 22lb. of powder and 115lb. shot. Nothing could be better than the way the carriage behaved. Altogether the country is to be congratulated on the results of the efforts of General Lefroy and the officers of the Ordnance Select Committee. We hear that their report will soon be printed and laid on the table of the House.

A PICTURE attributed to Murillo has just been discovered in the church of Villaharta, in the province of Cordova.

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HÆMATITE IRON ORE IN SCOTLAND.

THE presence of ironstone in the volcanic rocks which form the greater part of the Garleton Hills has long been suspected, but its abundant existence and richness have only very recently been demonstrated. The important discovery was made by a local farmer, Mr. Aitcheson, of West Garleton, who in turning the soil was struck with the frequency with which the plough brought fragments of ironstone to the surface, as if broken off from larger masses beneath. Knowing something of the value of the ore, he recommended the proprietor of the land, Sir T. B. Hepburn, of Smeaton, to make a systematic examination of the hill to test the character of the underlying rocks. Mr. Robb, a local geologist, strongly urged that the ground should be at once examined. This was done, and after breaking ground without success at several points, the search was at length rewarded by the workmen coming on veins of hæmatite iron of the richest and most valuable character. The vein, where at present struck, crosses the hill in a slanting direction from the south-east to the north-west, and has been traced nearly along the whole breadth of the hill, a distance of some four or five hundred yards. In some places the ore is met with in small boulders, interspersed with the ordinary trap rock of the hill, and in others it is met with in a solid mass of as yet unknown depth. This occurs on the crest of the slope, the iron being within 5in. or 6in. of the surface, and penetrating downwards in a solid bed. At present the workmen have uncovered this section of the vein to the depth of 7ft., without any appearance of its termination; and as veins of a similar character are in all probability to be met with in immediate proximity, there cannot fail to be many thousand tons of ore. Hæmatite iron has nowhere else been found in Scotland, the well-known blackband being the only description of the ore hitherto met north of the Tweed.

THE "WATERWITCH."

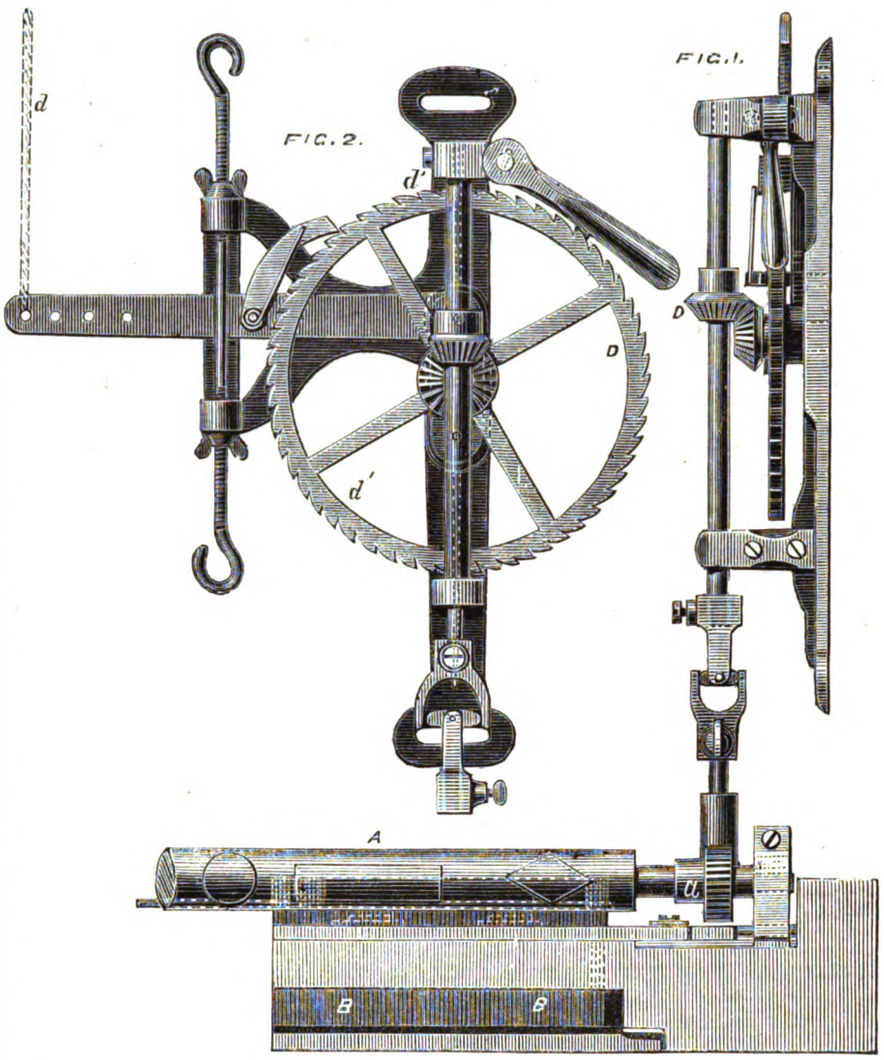
THE alterations to the hydraulic propelled gun-vessel "Waterwitch" having been completed, the ship has been put through trials of her machinery and speed prior to sailing on a competitive Channel cruise with the twin screw gun-vessel "Viper." The trial of the ship's engines gave highly satisfactory results. In her trial of speed over the measured mile in Stoke's Bay, her draught of water being 11ft. 2in. forward, and 11ft. 9in. aft, or a mean draught of 11ft. 5½, the mean of six runs over the mile with full boiler power gave the ship a speed of 8·880 knots per hour, with an indicated power by the engines of 785 horse. Four runs with half-boiler power gave the ship a speed of seven knots per hour, with an indicated power by the engines of 370 horse. The engines fully sustained their reputation for development of power, smoothness of motion, and general efficiency. Any further trials of speed made with the ship should be made with experimental alterations in the blades of the turbine, or water-wheel, or in the trials of a different form of wheel. The engines of the ship, as the driving power of the wheel, are reported to be perfect.

STEAM FIRE ENGINE FOR SHIPLEY.

THE Local Board of Shipley has purchased one of Merryweather and Sons' medium size steam fire engines of the same pattern as the engine "L'Imperatrice," one of those for which this firm was awarded the only gold medal given to any description of fire engines at the late Paris Exhibition. The engine is one well suited to the hilly districts of Yorkshire, its weight being but 31cwt. and its power equal to four or five large size hand fire engines, as it discharges over 400 gallons per minute; it is of the makers' horizontal long-stroke single-cylinder pattern, with a steam cylinder 8in. diameter, and double-acting pump 6¾in. diameter, with 18in. stroke of steam and pump pistons. At the various tests made at Shipley it has given excellent results, discharging water to a height of 170ft., raising steam from cold water to a pressure of 100lb. per square inch in less than ten minutes. The engine is so arranged that steam can be got up and the fire attended to *en route*, and to carry nine or ten firemen and a sufficient quantity of coals; it also has a powerful brake to be used when descending hills. The celebrated mills of Saltaire are in the Shipley district.

APPARATUS FOR THE MANUFACTURE OF WATERED FABRICS.

BY M. TAVERNIER.



APPARATUS FOR THE MANUFACTURE OF WATERED FABRICS.

IN the watering of silk there are two processes employed to produce the fabrics which are known as the moire antique and French watered silk. The first is distinguished by the varied appearance and irregularity of the grain of the fabric produced after weaving by rolling and folding; and especially by the aid of great pressure, which crushes the fabric, so to speak, and fixes the pattern. The designs obtained by this mode of watering formed at hazard by the folds of the fabric, although bearing a general resemblance as regards their formation, cannot be easily reproduced at the will of the operator. The French watering resembles moire antique in so far as the twisting of the grain after weaving is concerned, except that it is produced by strong tensile force applied longitudinally, which reverses the grain in passing over different points, considerable pressure being then applied to flatten or fix the design so produced. This kind of watering produces designs which, if not identical, at least succeed each other in an almost regular manner in straight patterns. These two kinds of water are remarkable for monotonous uniformity of tone and effect, and can only be obtained by stretching or weakening the fabrics more or less, the grain being not only wrenched but drawn in opposite directions.

To obviate this, and in order to produce effects which may be predetermined by the manufacturer, instead of being as now imperfect and governed by chance, M. Cesar Tavernier, of 29, Boulevart St. Martin, Paris, has invented the machine represented in the accompanying engraving, and which has been recently patented in England. This invention insures the production of the most varied watered designs which may be simple, such as squares, lozenge shaped, round, oval, or it may be flowers or ornaments, and arabesque designs of a more complicated nature, which are determined by the taste and skill of the artist, these designs being capable of reproduction as often as desired. This is effected by causing the threads during the weaving of the fabric to produce at certain points only of the fabric the combinations of light and shade termed watering, the pattern of which is previously decided instead of being due to chance only when produced after the weaving as usual.

The improvements consist in operating various degrees of tension at different points of the fabric to facilitate the production of the design, for which purpose the operator acts either on the warp or weft threads or on both simultaneously, varying the tension of the warps or beating the weft up with different forces. The variation in the tension is produced in the warp threads by classing them in groups, each group having separate bobbin beams or rollers, which warps are supplied at different degrees of tension during the weaving. The variable beating or tension is obtained by the aid of an additional reed, the teeth of which are fixed at one end, the other ends being free, but arranged in such manner as to be readily fixed when desired by the application of a part in the rear. All the teeth so fixed beat up the weft with a certain force, while the free ends of the teeth being deflected by the beating action will only slackly act on the weft, thus producing a variation in the beating. The beating may be constantly tight or slack for the same teeth of the reed, in which case the parts interposed are fixed or varied by series of teeth or separate teeth, the parts also moving in series or separately. The action of the parts is produced by the aid of a roller having variable rotary motion imparted to it according to the requirements of the fabric. This roller has relief surfaces on its periphery acting on the parts above mentioned, causing them to approach or recede from the free ends of the teeth of the reed. By varying the speed of the cylinder different effects may be obtained, or, if desired, the cylinder may act directly on the teeth.

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Fig. 1 of our engraving represents a front view of part of a batten provided with a roller, and also showing the mode of actuating the same; fig. 2 is a transverse section of same. A is a metal cylinder provided with relief surfaces acting on the oscillating levers B whereby to bear on or release the free end of each tooth of the reed, there being as many levers provided as there are teeth of the reed to be deflected. D is the mechanism for rotating the cylinder A at each throw of the weft; motion is imparted by the cord *d* acting on a ratchet d^1, and thence transmitted to the endless screw *a*.

DR. LIVINGSTONE.

THE following information, relating to the illustrious traveller, appears in the "Natal Mercury" of the 11th January, having been reproduced from the "Transvaal Argus," received in December:—Mr. Marthinus Swarts, the elephant hunter, who has just returned from one of his annual shooting excursions in the interior near the Zambesi, informs us that in June of last year he spoke to some natives who had accompanied the great traveller, whom they call "Minarie," signifying "Good," the name to which Doctor Livingstone is known to the natives. These men Mr. Swarts met three days' journey north of the Victoria Falls, who informed him that in the beginning of April last "Minarie" (the doctor), stated to them that he was now going away, and dismissed them, giving them various presents, and also sending presents by them to Retanga. This took place at a certain spot twenty days' journey on foot from where Mr. Swarts met them, and close to some very large river which runs in an easterly direction. Retanga is chief of the Barootsi, and Cepopo is his chief captain. This very large river has its sources at some distance from the Debebe, and is described by the natives as considerably larger than the Zambesi. Mr. Swarts further says that the coast cannot be very far distant, as the natives had sea shells in their possession, which they stated they had got from the big water, meaning the sea. Mr. Swarts also says it would be impossible for the Doctor to transmit any letters, as no native could be induced to carry them beyond his own tribe, for venturing beyond certain death to the messenger would be the consequence. So far as we know, this very large river is not laid down on any map, and, being hitherto unknown, it is very probable that the Doctor, after dismissing these native servants, had proceeded to explore it, intending to reach the coast at a point where this river discharges itself into the India nOcean.

FIRES AND FIRE ENGINES IN PARIS.

A STATISTICAL return has been made of the number and nature of fires which have occurred in Paris from 1840 to 1860 inclusive. During these twenty years there were 5,472 conflagrations, exclusive of 23,056 chimney flues catching fire. The total damage done amounted to 16,457,344f., being an average of 820,000f. per annum in round numbers. This sum, large as it is, cannot be compared to the losses experienced in former days, before the precautions against such disasters had reached the point of perfection at which they now are, and when scarcely any other remedy was attempted but that of pulling down the adjacent houses, and parading the Holy Sacrament in procession along the streets. From some further information on this subject given by "The Times," it appears that the first fire engines came into use in 1699, and a M. Dumourier-Duperrier was appointed director-general of these engines, the number of which was fixed at thirteen. In 1716, after a violent fire which broke out in a wax chandler's shop at the corner of the Rues St. Martin and Neuve St. Mery, and which threatened to destroy the whole quarter, the number of fire engines was increased to thirty, which were distributed among the different quarters of Paris. M. Dumourier, who, in virtue of his contract, had instructed thirty-two firemen in the management of the engines, was now obliged to raise the number of these *gardiens* and *sous-gardiens* to 120, and to provide them with uniforms. He received 40,000 livres for his first outlay, and 20,000f. per annum for the pay of his men, the keeping his engines in repair, &c. The city soon after organized a fire brigade of its own, under the direction of the Prevot des Marchands. Fire engines were known long before 1699, in other countries in Europe; it was the Dutch model which Dumourier introduced at Paris. The organization of fire brigades was frequently improved, and more particularly in 1811. In future, when the plan of the city for raising water to the tops of the houses shall have been carried out, fire engines will become almost useless. Every house will be provided with a main-pipe, to which a hose may be screwed at a minute's notice, and the firemen will merely have to turn a cock in order to get an indefinite supply of water, and direct it to the proper spot without pumping.

IMPROMPTU ON AN AMERICAN BLOWING ENGINE.

Whene'er 'tis wished to make a noise
One generally *brass* employs,
As in the present case; and here
I think it really doth appear
That *brass* is put in its right sphere,
For all good engine makers know
That steel on brass does sweetly go
At any speed, or any rate,
If them you well do lubricate,
And let them run, they'll go all right,
Provided they're not kept *too* tight—
But when, through want of care or thought,
Good "lubrication" is forgot,
Then "brass" and "steel" do not agree
(As in this case we yet may see);
And when it happens t'will be seen
The "Blowing Engine" stops—I ween.

* * *

Legal Intelligence.

ROLLS' COURT.

February 19.

(*Before the* MASTER OF THE ROLLS.)

THE ACCLIMATIZATION SOCIETY OF LONDON *v.* THE ROYAL ZOOLOGICAL SOCIETY.

THIS was a bill filed by the Acclimatization Society against the Zoological Society and Mr. Jeffries Stone, the amateur naturalist, of Ewell, Surrey, and Monmouthshire, to compel the delivery up of some valuable game birds, alleged to have been delivered by Stone to the Zoological Society, when in reality the birds belonged to the Acclimatization Company. Our readers are doubtless aware that the latter Society was formed in 1860 for the purpose of introducing, acclimatizing, and domesticating in this country foreign birds, fishes, insects, and vegetables, and of propagating the breed of them as much as possible. In 1865, Mr. Jeffries Stone, then a member of the Council of the Acclimatization Company, obtained a promise from Mr. Medhurst, our Consul at Hankow, in China, that he would send him over some rare pheasants (known as Reeve's pheasants, Lady Amherst breed, and Tragopans.) In 1866, the secretary of the Acclimatization Company wrote to Mr. Medhurst to remind him of his promise to Mr. Stone, whereupon Mr. Medhurst replied that, instead of forgetting his promise, he had taken a good deal of trouble to honour it, and had made two shipments of the promised birds to Mr Stone, and intended to send more as opportunity offered. It was then discovered that the birds sent by Mr. Medhurst had been intrusted by Mr. Stone to the Zoological Society, and hence this suit. The Zoological Society refused to give up the pheasants except to Mr. Stone, and this gentleman refused to part with his right of possession on the ground that Mr. Medhurst consigned the birds to him personally, quite independently of any consideration as to whether he belonged to one society or another. Mr. Stone's position was supported by an affidavit of Mr. Medhurst, who admitted that in whatever he did he meant to oblige Mr. Stone mainly, being satisfied that Mr. Stone would do the best he could for the public in attending to the breed of the birds, and sending them, as he thought fit, to proper depositaries.

The Court gave judgment on Friday last, holding that the Acclimatization Society had failed to make out the case alleged by their bill, which was, therefore, dismissed with costs.

Mr. Baggallay, Mr. Southgate, Mr. Cracknall, Mr. Downing Bruce, Mr. Kekewich, and Mr. Latham appeared in the case.

Correspondence.

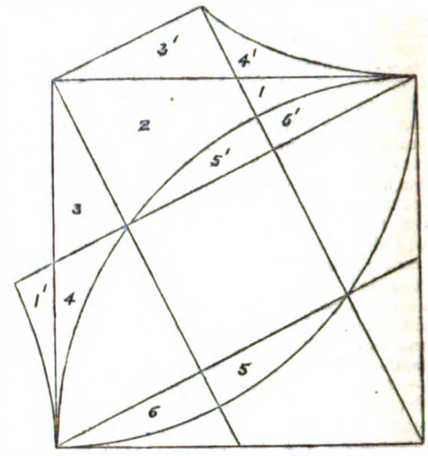
SQUARING THE CIRCLE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Your correspondent, Mr. Harvey, will find, in the preface to the "Nautical Almanack," the use of trigonometrical lines in determining the relative positions of the celestial bodies. The correctness of the values of trigonometrical lines, based upon the long accepted ratio of the circle to its diameter, is verified by the fact that the computed positions of the celestial bodies agree exactly with their observed positions.—I am, Sir, yours, &c.,

February 23. COMMANDER, R. N.

SIR,—I have carefully read that part of Mr. Harvey's last letter (No. 10), describing the diagram accompanying it, but I cannot see how the four spandrils are proved to be equal to one-fifth of the tangent square of the circle, and I herewith send a part of Mr. Harvey's diagram (No. 10), and will



thank him to prove that 1 and 4 are together equal to 5 and 6 separately, which correspond to 5' and 6'. If Mr. Harvey can do this, I will admit that the inscribed circle contains four-fifths of the tangent square; but it appears to me that Nos. 1 and 4 are together considerably in excess of 5 and 6, when taken separately, and this is more noticeable when they are jointed together, as in the diagram now sent. (See Nos. $1^1.4$, and 1.4^1. I am much obliged to "A. W." for his acknowledgment of the closeness of my approximation, which I think is rather nearer the truth than he states, as from some carefully executed drawings which I have just made, it appears nearer than what the tables of areas make it, that is, instead of being one-half per cent. too little, it does not look to be much more than a fourth. With reference to Mr. Nicholson's remark about the rule I have mentioned for finding the circumference, I beg to inform him that it gives a trifle more than three times the diameter and one-seventh, and that the depth of the segment of which the side of the inscribed square is the chord is more than twice the depth of the segment of which the radius is the chord, and not less, as he states in his letter.

My approximate solution of the problem, besides giving exact ratios to the inscribed and tangent squares, enables a circle to be drawn nearly equal to a given square, by simply taking two-fifths of the diagonal for a radius, the circle in this case being a very little larger than the given square.—I am, Sir, yours, &c., WM. HAYDEN.

Chichester, February 22.

SUGGESTIONS ON THE DEFENCE OF FORTRESSES.

No. V.

SIR,—The present letter on the above subject should be considered as explanatory of and supplementary to various suggestions made in former and to be made in future letters. In my last letter I suggested the employment of balloons for the purpose of dropping shells of a peculiar shape upon the enemy's ships; and it may with truth be said that the enemy may retaliate in the same fashion. Now, although it is to be hoped that at the time when aerial navigation will have reached such a degree of perfection that our aerial trains would run as regularly and brave wind and weather in the same way as our steamers do on the surface of the sea, common sense will have made proportionate progress in real civilization, so that then human courage, ingenuity, and talent would be chiefly occupied in warring with the elements,—still, that time, if ever it comes, is many generations yet ahead of us, and meanwhile we must take things as they are, including aerial navigation with all its imperfections. From some of the following remarks it will be seen that both in the employment of stationary (anchored) balloons for purposes of observation and reconnoitering, as well as the bomb balloons formerly alluded to, for the purpose of doing damage to the enemy, the defenders of a fortress or fortified harbour will, in many respects, enjoy particular advantages; in any case, they invariably will have plenty of time for making their arrangements and for carrying on their operations on a well-considered and maturely-planned system.

In my letter No. III., I alluded to a peculiar class of rifles of extraordinary large size, for the purpose of throwing projectiles to very great distances; such rifles, constructed on the very best system, would be mounted on the towers* and other elevated parts in our fortress in such a manner as that, when mounted, they would bear some resemblance to the telescope in theodolites and astronomical instruments—

* The construction and relative position of these towers will be described in a future letter.

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one or more telescopes being mounted in the same frame with the rifle, and the whole arrangements being so contrived that the rifle could be adjusted and fixed at any required angle with mathematical precision, and any given point within range be fired at with the certainty of being hit. I mentioned the employment of stationary telescopes in connection with these rifles, and I may here add that such telescopes may also be advantageously employed for general purposes of observations, independent of such rifles,—in which case such telescopes would likewise be mounted somewhat like the telescope is in a theodolite, with similar accessory parts for correctly determining horizontal and vertical angles; only in our telescopes, as well as the rifles before mentioned, the vertical arcs, horizontal limbs, and all other parts, ought to be of a much larger size, and more substantially made, so as not easily to get out of order even if handled by rough hands. It will be seen that, as throughout our works, and at distances from each other, we should have several such reconnoitering stations or terrestrial observatories, the distance between each two of which observatories forming a base-line of well-known length, the exact distance of any object seen from any two of such stations could easily be determined with mathematical precision, without delay, at the moment such object appears; and as all the stations are in electro-telegraphic communication, not only with each other, but also with all the other parts of the work, the exact distance of such an object from any given point could at the same moment be communicated to the batteries, which would thus be enabled, without trouble, to bring their guns to bear at the proper range, so that, in addition to the fire of our big rifles, the guns of our batteries would, in a measure, be guided, as it were, by our observatories. I leave your readers to judge how much more effectual the fire and how much more simplified the handling of our batteries would be rendered by such an arrangement; and it may easily be imagined how very annoying to the enemy would be our thus "surveying" (in the American sense of the word*) the surrounding land and sea surface by means of our long-range rifles.

The fixed aim lines, and the prepared tables of aim lines alluded to in my letter, No. IV., would be intimately connected with the above arrangements for determining angles and distances; and the turntables, gun-carriages, rails, turrets, and other similar parts of our works, should also be graduated and marked in such a manner that they could be used independently as very large scale horizontal limbs, and vertical arcs, &c. Now, even supposing that the enemy also should employ balloons, I venture to say, that, thanks to the above arrangements, the defenders would have greatly the advantage over him—for his balloons could be disabled by means of our monster rifles before they could do us any harm; while the unavoidable absence on his part of such carefully-planned arrangements for observation and precise fire, which we have had ample time to prepare, would obviously prevent him from returning the compliment as regards our balloons. I may add that additional advantages may be derived from the use of explosive bullets in our large rifles. In the campaign of 1866, in Germany, several Austrian ammunition waggons were blown up by Prussian explosive rifle-bullets. Owing to the necessity of having to receive a specially careful training, the men attending to the above observatories and guns would form a special branch of the service. In fact, on comparing the present state of the art of war with what it was only thirty or forty years ago, we find that, owing to the influence of art and science, a number of special services, never before dreamt of, have sprung into existence; take, for example, the department of field telegraphy in the Prussian army; by this department alone, and in a few weeks, about 6,000 miles of telegraph wire were laid down,—each component division of the northern army, and even smaller divisions on important service, spinning like spiders a telegraph thread in their rear wherever they marched to. Another special corps is the field railway corps, by the help of which corps the Prussians, on taking possession of a hostile railway, whence all the *personnel* had been withdrawn, were enabled to run trains in a quarter of an hour as regularly as if they had been doing nothing else for years.

Permit me to mention another instance illustrating the admirable organization of that "army of citizens," and the far-seeing sagacity of its leaders. Near Riesa, the river Elbe is traversed by a large railway bridge which had been destroyed by the Saxons; the Prussians then appeared, and in a very short time the glittering lines of the stern northern warriors were seen pouring across the river on a pontoon bridge. Of course, that was nothing very new to the numerous well-treated and unmolested spectators of the proceeding; but they were puzzled by seeing a lot of waggons laden with mysteriously-shaped and lettered and numbered pieces of timber, which kept at the same time coming up from the rear, and several of which also crossed the pontoon bridge; but very soon, to their utter amazement, their destroyed railway bridge seemed to grow again, as it were, by magic, growing from pier to pier by the well-regulated exertions of a beehive of sturdy Prussian carpenters and other artizans; and soon ponderous trains, laden with war material and troops, thundered over it. That bridge was rebuilt in almost as short a time as it took to destroy it, because the dimensions of all its parts were known to the Prussian reconnoitering engineers, and, anticipating its destruction, all the component parts of a new bridge had been carefully prepared several days before. That campaign proves that the greatest chances of success will ever be with that army in whose organization and handling the discoveries and teachings of modern science and art are most made use of in preparing for and carrying out all the various arrangements and plans; so, also, will the defence of a fortress be rendered the more efficient if all possible advantage is taken of all useful modern discoveries and the improved methods of their practical application, in the planning and construction of the works, in their armament, and the organization and handling of the defending forces. A certain definite amount of work may be performed either by a larger working force in a shorter space of time, or by a smaller force during a longer period; and as regards the construction of new fortifications, or the modification of existing works and their adaptation to modern requirements, I must deem the latter course to be the safest and most economical one, simply because in our age of rapid progress, by making any changes in our fortificatory works only slowly and by degrees, we should, paradoxical though it seem, be better enabled to keep pace with the improvements in the means and mode of attack, because then any changes that may, by such improvements, be rendered necessary in the mode of construction, could be effected with less trouble, less delay, and less expense. On the other hand, were there to be effected on a large scale sweeping, radical changes, with the exercise of great energy, and great sacrifices of money and labour, such energy, labour, and money might turn out to have been expended in vain, if by further improvements in the various apparatus for, and the mode of engineering employed in the attack, such works should turn out to be inadequate for the purpose for which they were destined; hence the government of this country is pursuing a wise course in making such changes in their fortifications and the construction of ships of war by transitions, as it were, from stage to stage, and with great caution and circumspection.—I am, Sir, yours, &c.,

February 25. G. J. GUNTHER.

* An officer of an United States' squadron was asked (while lying some years ago in a colonial harbour), "What are you going to Japan for?" "Merely for a survey—shall draw our lines with cannon balls!" he growled in reply.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

Mr. J. BIRD'S (Birkenhead) question is a purely legal one, and his right to recover for the drawings rests upon the terms of the agreement under which they were supplied. As Mr. Bird solicits our opinion, we may tell him that we think his case a very weak one. As he puts it to us it seems as though he had been endeavouring to persuade certain parties to adopt his patent, and had failed. But he should consult a solicitor, who will settle the question.

R. E. T. (Bolton). If you will send your name and address, we will reply to you by letter.

RECEIVED.—G. B.—T. C. S.—B. W.—H. S.—Messrs. C. M. and Co.—A. T.—R. E. J.—W. H.—J. A. C.—B. H.—G. R.—Messrs. K. and Co.—S. K. M.—R. N.—J. H.—W. R. N.—D. H.—R. I.—G. E. P.—S. E.—Messrs. S. Bros.—J. B.—G. A. R.—G. W. H.—Messrs. M. Bros.—P. G. D.—F. C. R.—R. F.—T. C. R.—G. J. G.—J. T. D.

Meetings for the Week.

MON.—Society of Engineers.—Discussion on the papers read on "The Surveys of Proposed Lines for a Ship Canal Between the Atlantic and Pacific," on "The Panama Railroad," and on "The Darien Ship Canal," at 8.30 p.m.
Royal United Service Institution.—Major W. H. Ross, R.A., on "Field Artillery on the Connected System," at 8.30 p.m.
Royal Institute of British Architects.—A Special General Meeting.
Royal Institution.—General Monthly Meeting, at 2 p.m.

TUES.—Royal Institution.—Mr. George Scharf on "Historical Portraiture," at 3 p.m.
The Institution of Civil Engineers.—Mr. Christer Peter Sandberg, A.I.C.E., on "The Manufacture and Wear of Rails," at 8 p.m.

WED.—Society of Arts.—Mr. John Randall, one of the Artizan-Reporters on the Paris Exhibition, on "A Workman's Views on Technical Education," at 8 p.m.

THURS.—Royal Institution.—Mr. George Scharf, on "Historical Portraiture," at 3 p.m.

FRI.—Royal Institution.—Mr. Kingdon Clifford, on "Some of the Conditions of Mental Development," at 8 p.m.

SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

Naval, Military, and Gunnery Items.

THE winter general meeting of the National Rifle Association will be held at Willis's rooms, at 2.30 p.m., on Wednesday, the 4th of March: Field-Marshal His Royal Highness the Duke of Cambridge, president, in the chair.

THE Prussian Government has ordered a 9-inch breech-loading gun from Sir W. Armstrong, the powers of which are to be tested side by side with Prussian cannon of the same calibre but different make.

THE whole of the boilers for the "Hercules" have been fitted, and on Saturday the three iron lower masts, the largest ever constructed for a vessel of war, were fitted by means of the floating shears in Chatham Harbour.

MARSHAL NIEL, the French Secretary of State for War, has devoted the spare room at the Invalides into a warehouse containing all the *impedimenta*—field ovens, camp kettles, tents, ambulances, &c.—required for an army of 200,000 men. Everything could be issued at a minute's notice.

THE French government have awarded to Captain George Swan, of the British ship "Phœbus," of Falmouth, a binocular glass, in recognition of his services in picking up at sea the crew of the French merchant vessel "Amiable Virginie." The Board of Trade will cause the reward to be presented in a befitting manner.

SQUADRONS of almost all the navies of the several nations have for some time past been cruising in the Mediterranean. After the American and the English, the Austrian squadron, from the Levant, has just left the Greek waters, and cast anchor in the Bay of Saint Andre, which forms the southern portion of the roadstead of Trieste.

THE monthly report of the Bureau Veritas of Paris shows that in January last 264 vessels were lost, of which 141 bore the English flag, while 35 were French, 24 American, 12 Prussian, 8 Dutch, 7 Norwegian, 5 Danish, and 32 of various other flags. The list of casualties compares favourably with preceding years, there having been 421 losses in January, 1867, and 411 in the corresponding month of 1866.

THE manufacture of war material is going on briskly in Turkey. Great activity has lately prevailed in the gun factory at Tophaneh, particularly in the making of gun carriages and ammunition waggons, in which a large number of workmen are employed. The models used were recently sent out from Woolwich Arsenal. The Muchir has also invited tenders from gunsmiths and engineers for the conversion of rifles into breech-loaders.

ADVICES from Constantinople, says the "Toulonnais," speak of some important measures in course of preparation with a view to arming on a large scale. It is even said that the Ottoman Government, at the same time that it is endeavouring to rekindle Mussulman fanaticism, meditates providing the whole population of that creed with improved arms, so as to create a landwehr like that which exists in other countries.

THE systems of signalling and telegraphing adopted by the American Government are now uniform in the army and navy. The cadets at West Point and the midshipmen at Annapolis receive the same instructions, so that when they become officers in any contingency of land or naval service, they will be enabled to open and maintain communication, by codes of signaling and electric telegraphy identical in their operation.

WE read that a new rifle, superior to any of those recently invented, was submitted to the Emperor Francis Joseph on his arrival at Pesth. The inventor is a Hungarian, M. Mersits de Roob. This weapon, a breech-loader, is said to be of very simple construction. It is charged by two motions, so that thirty shots can be fired in a minute. The envelope of the cartouche costs only 4c. instead of 8c., the price of those recently adopted for the Austrian army.

THE United States' Consul at Liverpool has been instructed by his Government to pay to John Williams, a pilot at Duffryn, and James M'Cartney, one of the crew of the Liverpool steam-tug "Reliance," the sum of 100 dollars each, as a reward for their noble conduct on the occasion of the wreck of the American ship "F. J. Southard," near Duffryn, on the 5th of December last, when at great peril to themselves

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they managed to get the end of a line ashore and establish communication with the vessel, and thus were mainly instrumental in saving the lives of the crew.

AN American paper states that a certain Walter Brown, of Portland, has a paper boat which is 31½ft. long, 12in. wide, and weighs but 22lb. The lightest wooden boat ever built of similiar dimensions weighed 41lb. The most singular part of the matter is that the boat is more than four times stronger than one of wood. All of it, save where the sculler sits, is gas tight, so that in the event of a race sufficient gas may be taken into it to reduce its weight to 8lb. The displacement of water by such a craft will be very much less than that of a wooden boat, and the same exertion will propel it proportionately faster.

Miscellanea.

IN making some excavations lately in a cellar of a house at Sarreburg, a great number of silver coins with the effigies of Louis XIV. and Charles V. have been found.

THE number of visitors at the Patent Office, South Kensington, for the week ending February 22, was 3,792; total number since the opening of the museum, free daily (May 12, 1858), 1,250,580.

LAST year 1,001,545 acres of land in Ireland were devoted to the growth of potatoes; in Great Britain, almost three times as large, and with more than four times the population, only 492,217 acres were thus used.

We are glad to hear that the Sheffield corporation have followed in the steps of the corporation of Liverpool, and have adopted the use of Aveling and Porter's 30-ton steam road rollers, for making the streets and roads of Sheffield.

WE learn that Vesuvius continues in about the same state as it has been for the last fortnight—one day the eruption appears on the decline, and the next the smoke and lava issue more abundantly than ever.

A LETTER from Alexandria, dated February 3, reports a disastrous fire three days before, which resulted in the total destruction of one of the largest cotton-pressing and storing establishments at Minet-el-Schiargua.

AN inland revenue return just issued shows that in the financial year 1866-67, no less than 136,978,045 penny stamps were supplied to the public for use on receipts, draughts, and other documents (other than letters) requiring a penny stamp.

THE belief expressed by some geologists that naphtha would be found in the Caucasus has been realized. A boring, 276ft. deep, near Kuaaco, has struck a source of this liquid, which yielded 1,500 barrels daily for one month.

THE Prince of Wales has subscribed £52 10s. to the fund which is being raised in Norwich in connection with the approaching meeting in that city of the British Association for the Advancement of Science. The meeting will commence August 19.

DURING a severe storm that prevailed in Newfoundland for three days lately, it is reported that thirty people have perished from the cold and in the snow. Mr. Mackay, the superintendent of the Newfoundland Telegraph line, nearly perished.

ONE day last week no fewer than 100 railway waggons left Anstruther and the adjoining stations laden with herrings chiefly for the London market. The total quantity was nearly 3,000 crans, making altogether about 3,000,000 herrings brought from the east coast of Scotland.

THE quantity of sugar used in breweries in England is reported to have increased from 9,983,340lb. in the year ending at Michaelmas, 1866, to no less than 39,317,264lb. in the year ending at Michaelmas, 1867. The increase in Scotland was from 209,113lb. in 1866 to 351,456lb. in 1867; and in Ireland from 148,434lb. to 1,465,296lb.

A PARLIAMENTARY paper just issued gives the text of a declaration signed by Sir Augustus Paget and Count Menabrea on behalf of their respective Governments, whereby it is agreed that Italian and English joint-stock companies may exercise all rights and enforce legal proceedings in either country. The declaration is to remain in force until revoked after a year's notice by either party.

THE number of visitors at the South Kensington Museum during the week ending February 22, were:—On Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 10,383; Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,457—total, 11,840. Average of corresponding week in former years, 10,884. Total from the opening of the museum, 7,209,589.

ACCORDING to the "South Australian Register," Mr. Underdown, of Adelaide, the exporter of Australian birds to Europe, has now in stock 35,000 pairs of shell parrots, 1,000 pairs of cockatoo parrots, 7,000 pairs of zebra finches, besides white cockatoos, magpies, and Port Lincoln parrots—altogether nearly 100,000 birds. 9,000 birds are marked as sold. The 70,000 shell parrots are this year's (1867) birds.

THE death has been announced of Mr. William Cory, well known as a coal and ship owner. It was mainly through his exertions, by the establishment of large floating derricks on the river, and the erection of extensive hydraulic machinery, at the Victoria Docks, for quick despatch in the delivery of coal at a low cost, that the trade in coal by sea has of late years been at all enabled to compete with that by railway.

THE effect of trade combinations in driving trade from old localities has of late been frequently alluded to. During the past week a cotton mill in Preston has received a large consignment of spinning machinery from Belgium, which, notwithstanding the cost of transit, has been supplied at 15 per cent. less than the English prices. Once Preston was a noted place for the manufacture of machinery, and it supplied a great part of Lancashire; now its machinery is being actually imported from the Continent.

A CONFERENCE of persons of every class interested in the provision of museums and libraries for the people, together with supporters of our leading social, educational, philanthropic, and religious organizations, will be held, under the auspices of the Public Museums and Free Libraries Association, on the 9th of March, at Sion College, the use of which has been kindly granted for the purpose. The president of the college, the Rev. William Rogers, M.A., canon of St. Paul's, will occupy the chair.

A SECOND collection of artizan's essays on the comparative merits of British and continental industry and manufactures is announced for publication. These essays, to which will be given the prizes offered in connection with the Paris Excursion Committee, will be of special interest as being the best contributions of men actually engaged in handicrafts to the literature of the porcelain and pottery, engineering, cabinet making, gold and silver smith's, tanning, and other trades.

THE golden rose sent this year by the Pope to the Queen of Spain is not, as might be supposed, an object of trifling value; on the contrary, it is a truly remarkable work of art, representing a branch of a rose-tree, with the thorns and buds in pure gold, and having at the extremity a flower of larger size. The bough rests on an elegant pedestal of silver gilt, which bears the Papal arms among its ornaments. The intrinsic value of the present, calculated by the weight of the gold only, is about £400.

THE funeral of the late Mr. William Herapath, F.C.S., took place on Friday last, at Bristol. His remains were interred at Arno's-vale Cemetery, and though the funeral was of a strictly private character, a large crowd of persons assembled around deceased residence, Manor-house, Old-park, to witness the departure of the funeral *cortege*. His name was associated with the analytical departments of chemistry which had most engaged the attention of scientific men during his lifetime, not only in England, but throughout Europe. He was well known, and greatly valued and honoured as one of the professors of chemistry and toxicology in the medical school of Bristol.

A BOSTON paper says that Mr. Charles Francis Adams, Minister to England, is possessor of the largest private library in Boston. It contains 18,000 volumes, and includes those that belonged to his father and grandfather. The late Theodore Parker's library, bequeathed to the Boston Public Library, contained 10,000 valuable, and some of them rare, books. The library of the late Abbott Lawrence (10,000 volumes), has been sold and scattered, as also has been that (7,000 volumes) of Rufus Choate. The libraries of Edward Everett and W. H. Prescott, each containing about 7,000 volumes, have been preserved by their families, as also has that of Daniel Webster, containing 5,000 volumes, chiefly on law. Mr. George Livermore, of Cambridge, is believed to have had the richest library in old Bibles and Biblical works in the world; at his death nearly all his books (4,000) were bequeathed to Harvard University.

THE quantity of unwrought steel exported from the United Kingdom was about maintained last year, the total to November 30 having been 30,517 tons, as compared with 31,529 tons to the corresponding date of 1866, and 20,868 tons to the corresponding date of 1865. The slight decline observable arose in the deliveries to the United States, which only amounted in the first 11 months of 1867 to 17,778 tons, against 18,799 tons in the corresponding period of 1866, and 9,418 tons in the corresponding period of 1865. The total value of the unwrought steel exported to November 30 last year, was £998,619, as compared with £1,029,907 in the corresponding period of 1866, and £686,110 in the corresponding period of 1865. The value of the unwrought steel exported in the whole of 1866 was £1,129,761; in the whole of 1865, £782,129; in the whole of 1864, £890,395; in 1863, £935,517; in 1862, £848,933; in 1861, £726,956; in 1860, £986,228; in 1859, £805,832; in 1858, £589,676; and in 1857, £748,579. The quantities of unwrought steel exported in each of the ten years were as follows:—1857, 22,374 tons; 1858, 16,378 tons; 1859, 24,744 tons; 1860, 32,173 tons; 1861, 21,810 tons; 1862, 25,779 tons; 1863, 28,687 tons; 1864, 26,834 tons; 1865, 23,877 tons; and 1866, 34,647 tons.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—2107, 2134, 2182
BUILDINGS AND BUILDING MATERIALS—2128, 2150, 2158
CHEMISTRY AND PHOTOGRAPHY—2121, 2170, 2175, 2198, 2200
CULTIVATION OF THE SOIL, including agricultural implements and machines—2160, 2162, 2176, 2181, 2191
ELECTRICAL APPARATUS—2147, 2192
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2111, 2112, 2117, 2136, 2138, 2140, 2163, 2174
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—2110, 2122, 2132, 2137
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—2145, 2171
GENERAL MACHINERY—2133, 2135, 2144, 2148, 2155, 2164 2177, 2193
LIGHTING, HEATING, AND VENTILATING—2125, 2126, 2130, 2152, 2154, 2157, 2173, 2179, 2180, 2186, 2188, 2194, 2196, 2199
METALS, including apparatus for their manufacture—2114, 2142, 2161, 2166, 2185, 2189
MISCELLANEOUS—2108, 2109, 2113, 2116, 2124, 2127, 2129, 2131, 2139, 2141, 2146, 2151, 2159, 2184, 2187, 2195, 2197
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2115, 2119, 2123, 2143, 2149, 2156
SHIPS AND BOATS, including their fittings—2118, 2165, 2178, 2183
STEAM ENGINES—2169
WARFARE—2120, 2153, 2167, 2168, 2172, 2190

2105 W. BARNINGHAM and J. THOMPSON. *Improvements in machinery for bending, straightening, and punching rods, bars, and other articles of metal.* Dated July 18, 1867.

This improved machinery consists of a strong cast-iron bed, supporting the adjustable die holder of the punch and the blocks of the bending and straightening apparatus. An adjustable roller is placed under the centre of the punch, and is so arranged that it can be raised or depressed; the frame for the carrying roller is made with a taper lower edge, which is acted upon by a wedge which is made to slide underneath by a screw furnished with a lock nut. The punch is made of a plain bar of steel fitting in the sliding ram, and it is provided with taper packing pieces to utilize the steel to the greatest possible extent; the sliding ram has a stop motion, so that the punch can be thrown out of action without stopping the machine. The bending or straightening ram is worked by a cylinder attached to the main casting, and a piston and rod to work an ordinary crank shaft, on which is a pinion driving a spur wheel for working an eccentric or crank, and the sliding ram is thus moved alternately backwards and forwards, the stroke or movement of which is adjustable by means of a screw with left hand threads; or the lengthening or shortening of the ram may be effected by water pressure, either by having a head of water at the command of the operator, or by injecting water into either side of the piston or ram; or the stroke may be varied by means of a taper block moved with a screw; or the stroke may be lengthened or shortened by means of an adjustable crank pin, &c. The bar or other article to be bent or straightened is pressed against loose blocks that may be taken out and replaced when worn, or thicker or thinner ones are required.—Patent completed.

2107 T. D. WALKER. *Improved means of heating the feed water supplied to steam boilers.* Dated July 18, 1867.

This invention consists in conducting or forcing the feed water into the boiler through pipes placed along the sides and back end of each furnace or firebox of a steam boiler or steam generator, by which the temperature of the said feed water may be raised to the same, or nearly the same, temperature as the water and steam in the boiler. The discharge end of the feed pipe is connected by a feed valve to the boiler, as usual, and a tap is employed for regulating the supply.—Patent completed.

2108 J., J., and T. PALMER. *Improvements in movable spanners or screw wrenches.* Dated July 18, 1867.

This invention consists in certain improvements in actuating and adjusting the movable jaws of movable spanners or screw wrenches of the kind called Clyburn's spanners or screw wrenches, that is, spanners or screw wrenches in which the movable jaw usually works across the body in a line at right angles, or nearly at right angles, to the handle of the spanner or screw wrench. In actuating the movable jaws of the said spanners or screw wrenches according to this invention the patentees construct and arrange the parts in the following manner:—The bar of the movable jaw works in a recess made across the body of the spanner in the usual way. In the end of the bar of the movable jaw they make a screw box, in which screw box one end of a screw works, the other end of the said screw turning in the body of the spanner immediately under the fixed jaw. A milled collar is fixed by a cross pin or otherwise to the screw. By means of this milled collar the screw may be rotated in one or other direction. A hole is made through the body of the spanner from side to side, in which hole the milled collar is placed and works, the said milled collar being flush, or nearly flush, with the faces of the said body. Instead of placing the milled collar for turning the screw in a hole or recess in the body, one end of the screw may project from the edge of the body, and have a milled head thereon for rotating the screw. By turning the milled collar or head in one or other direction, the screw box of the movable jaw is moved upon the screw in one or other

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direction, and the movable jaw advanced towards or withdrawn from the fixed jaw on the body of the spanner, and the distance between the two jars is thus adjusted.—Patent completed.

2109 W. WARDEN. *Improvements in securing the more effectual obliteration of postage and other stamps.* Dated July 18, 1867.

This invention consists in preparing the label with a chemical material in the substance of the label itself, and using another chemical material in a more or less colourless obliterating solution, the union of which chemicals will instantly produce a distinct colour, or have a blackening effect, and which effect would not be produced excepting by such union, and, consequently, not of an impervious material, be interposed between the two chemicals, which would be thereby detected.—Patent abandoned.

2110 G. T. BOUSFIELD. *Improvements in heating and cooling apparatus.* (A communication.) Dated July 18, 1867.

This invention is not described apart from the drawings. —Patent completed.

2111 J. J. and E. HARRISON. *Improvements in looms for weaving.* Dated July 18, 1867.

The patentees claim, first, the adaptation of an abutment for the weft fork in connection with the sweel, together with the construction and arrangement of the weft hammer, as described. Second, the construction, adaptation, employment, and use of springs in combination with levers, as described, or any modification thereof, whereby a perfect and even tension is obtained upon the warps. Third, the use of inclined surface discs employed in combination with other arrangements of mechanism for giving tension to the warp, the said inclined surface discs being employed for easing or reducing the tension at any time for purposes required when weaving, as described.—Patent completed.

2112 R. T. BRADBURY and T. BOTTOMLEY. *Improvements in carding engines.* Dated July 18, 1867.

This invention relates to those carding engines in which a "fancy" is employed, situate above the "doffer," and consists in an arrangement whereby the patentees are enabled to arrest small particles or flyings of material and cause them to be conveyed to the doffer. For this purpose they propose to employ two shipping rollers working with each other, the one being in contact with the fancy, and the other with the doffer. The invention is specially adapted to carding engines which are used for wool or other fine fibre in different colours or conditions, for, by its use, the flyings are prevented from being mixed.—Patent completed.

2113 A. PATON. *Improvements in letterpress and lithographic printing machinery.* Dated July 18, 1867.

The arrangement for driving the cylinder of the ordinary printing machine is defective in so far as respects obtaining a good register, since the cylinder will sometimes stop short of a complete rotation, and sometimes go beyond it, according to the speed with which it is driven, and either way a defective register in the printing occurs. To obviate this the patentee arrests, by the action of a brake, the motion of the cylinder (while it is driven by the ordinary gearing), before it has completed its full rotation, and forces it through the remaining part of the rotation by a lever or spring, or both, which will give it a regular and determinate amount of motion.—Patent completed.

2114 J. HARGREAVES. *Improvements in utilizing certain materials or products obtained during the manufacture of steel and iron.* Dated July 19, 1867.

The patentee claims, first, the use of steel slag and steel cinder for the manufacture of glass by means substantially as described. Second, the use of steel slag for the manufacture of carbonates and hydrates of soda or potassa, by means substantially as described.—Patent completed.

2115 J. W. BUTLER and E. EDWARDS. *Improvements in apparatus for floating in and travelling through the air.* Dated July 19, 1867.

This invention consists in making and combining together wings or planes of the kind and in the manner hereinafter described, to which the aeronaut and the propelling apparatus are attached. These wings or planes are made of frames as light and strong as possible, and covered with some strong and sufficiently light material, which, in some cases, the patentees prefer should be flexible, such as cloth, canvas, or varnished silk; and in other cases of thin wood varnished, or of thin metallic plate, either of a single thickness, or double, with a space between for the purpose hereinafter mentioned. It has been found by experiment that such planes, if kept perfectly horizontal and allowed to fall through still air, will do so very slowly, and that even if a certain weight be attached to them proportioned to the number of square feet in their horizontal surface, they will still only fall at a certain speed, which, however great the height of the fall, will not be exceeded. It has also been found that if such horizontal planes with such weights attached to them be made to pass nearly horizontally through the air, but with their front or advancing edges slightly elevated, and if the angle of elevation and speed of horizontal passage through the air be proportioned to the area of such planes, and the weights attached to them, the planes will continue to pass horizontally forward without falling, and that thus, if the propelling force be continued, they may be made to travel for any distance and in any direction.—Patent completed..

2116 J. ROGERS. *Improvements in fastenings.* Dated July 19, 1867.

Here a casing divided into two parts is employed; one part of the casing is fitted with a hook turning on a stud or axis, and furnished with a knob or handle, and the other part of the casing contains a stump, which the hook on the other part of the fastening can be made to embrace or to liberate by turning it on its stud or axis. The form of the casing is a short cylinder closed at the top, and with a flange on its lower edge; it is divided into two unequal parts in a plane parallel to the axis of the cylinder. —Patent abandoned.

2117 J. T. BOUSFIELD. *Improvements in self-lubricating bolsters for spinning machines.* (A communication.) Dated July 19, 1867.

This invention is not described apart from the drawings. —Patent completed.

2118 P. H. METHAM. *An improved rudder, especially adapted for barges.* Dated July 19, 1867.

The object of this improvement is to enable a rudder to occupy greater or less space at the stern, and also to enable it to present greater or less surface as required to the action of the water. For this purpose the inventor forms the rudder of a number of detachable or removable leaves or pieces of different lengths, that is to say, they gradually increase in length from the stern outward. The leaves can be drawn in or out fan-wise.—Patent abandoned.

2119 J. SAXBY. *Improvements in apparatus for locking and actuating the locking and interlocking gear for regulating or governing the action and movement of railway points and signals in relation to each other.* Dated July 20, 1867.

This invention consists in applying to the vertically sliding bolt or stop usually fitted at the front or back of the hand lever used for acting upon railway points, and the signal apparatus of railways, an addition whereby the point or signal lever is secured or held in any prearranged position, whilst certain portions of the locking or interlocking gear may, by the action of the operator's hand on the lever of the sliding bolt, be acted upon so as to lock and unlock such portions of the signal or point apparatus as should be locked or unlocked. We cannot here give space to the details of this invention.—Patent completed.

2120 K. H. CORNISH. *Improvements in entrenching tools, to be carried on the stocks of firearms.* Dated July 20, 1867.

Here the inventor constructs a hand trowel or shovel with a suitable folding or removable handle, the blade of which is so shaped as to be on the butt of the stock of the firearm on which it is intended to be carried, a suitable slot being cut in the wood for the reception of the handle when the entrenching tool is fixed to the stock. When a folding handle is used, it folds over to the upper surface of the blade of the tool which rests on the wood of the stock when the entrenching tool is fastened to the butt. The blade of the trowel is kept in place on the stock by fixed and movable buttons and studs, or in any other suitable manner, the chief desideratum being facility of rapid removal from the stock when required for use. He prefers to shape the point of the blade somewhat after the fashion of a bricklayer's trowel, in order that it may be used for digging, turf cutting, bricklaying, or plastering, as required.—Patent abandoned.

2121 J. HARGREAVES. *Improvements in the production of compounds of soda from chloride of sodium, and compounds of potassa from chloride of potassium, and in apparatus employed therein.* Dated July 20, 1867.

The object of this invention is to produce silicate and aluminate of soda, and silicate and aluminate of potassa. In carrying the invention into operation the inventor makes use of the combustion of hydrogen, or of any mixture of hydrogen with other gases, or any gaseous material containing or capable of evolving hydrogen, or the combustion of any fluid or solid material containing or capable of evolving hydrogen.—Patent abandoned.

2122 T. BROMWICH. *An improved means of allowing the escape of superfluous carbon from casks of newly-made wine, cider, perry, and other fermenting liquors.* Dated July 20, 1867.

The liquid is poured into the cask up to the purge hole, and in the course of two or three days afterwards all the openings in the cask are stopped and made air-tight, with the exception of a hole (about 3-8ths or ½-inch in diameter), which is cut in a convenient part of the barrel, usually at the top. This hole is closed by a boss or knob of leather, india-rubber, gutta-percha, flannel, &c. The boss or knob is caused to be pressed closely down upon the hole by a metallic spring or weight, so that the cask may be completely air-tight. Its effect will, therefore, be to effectually exclude the outer air, but when the liquor inside the cask has generated a certain amount of carbon, the internal force so generated will be sufficient to open the valve, and so allow the surplus carbon from time to time to escape until the liquor inside has ceased to ferment.—Patent abandoned.

2123 C. F. WHITWORTH. *Improvements in apparatus for preventing accidents at junctions, crossings, and sidings of railways.* Dated July 20, 1867.

The specification of this invention is too elaborate to be quoted here at sufficient length for an intelligible abstract.—Patent completed.

2124 A. BUDENBERG. *Improvements in joints of pipes or tubes.* (A communication.) Dated July 20, 1867.

The object here is to obtain a close joint to pipes or tubes capable of being set at various angles. The parts of the pipes or tubes at the junction are of a spherical form, one part of such sphere forming part of one pipe or tube, and the other part forming part of the other pipe or tube. The parts of these spheres where the junction takes place are inclined by preference to an angle of 45deg. with the axis of the parts of the pipe, and are fitted with leather or other packing. These parts are held together by a screw clip, or by other suitable means.—Patent completed.

2125 W. TAYLOR. *Pipes for ventilating, heating, and vaporizing hothouses, malthouses, and other buildings and residences.* Dated July 20, 1867.

The patentee claims, first, the application of chambers or passages to pipes for receiving hot water, &c., so that such chamber or passage may receive water or other liquid to be evaporated whilst they at the same time act as conduit for the passage of air for ventilation, and thereby moisten as well as heat the air so supplied for ventilation, whereby hothouses, malthouses, and other buildings or residences, may be ventilated, heated, and vaporized, as described. Second, the method of forming the joints of pipes used in heating hothouses, malthouses, and other buildings and residences, as described. —Patent completed.

2126 W. G. CREMER. *Improved automatic apparatus for the ventilation of railway carriages, omnibuses, and other vehicles, and the cabins of steamboats.* Dated July 20, 1867.

In performing this invention openings are made in the sides and near the ceiling or roof of the carriage, vehicle, or cabin to be ventilated, and in each of these openings is placed a vertical wicket, such wicket being supported on pivots, so that it can move both backwards and forwards. The outer end of the wicket projects a short distance from the outer side of the carriage, &c., and stands at an angle therewith of about 45deg. When the train, vehicle, or steamboat is in motion, the counter current of air at the sides thereof impinges against the wickets, thus causing a strong and constant exhausting current from the inside of the carriage, &c., vehicle, or cabin outwards. When the direction of transit of the train, boat, &c., is changed, the wickets shift by reason of the counter current of air which comes into operation, and are reversed in position, a similar process of ventilation being thus effected. A door is provided opposite to each of the apertures by which they can, when desired, be entirely closed.—Patent completed.

2127 A. SEZILLE. *An improved process of decorticating, crushing, and treating dry peas.* Dated July 20, 1867.

This invention consists in treating the peas by a moist instead of a dry process, whereby losses are obviated, and the apparatus is rendered inexpensive and easy to work. —Patent abandoned.

2128 R. SHAW and J. STIRK. *Improvements in brick-making machinery.* Dated July 20, 1867.

The object of this invention is to construct bricks by a simple and direct acting apparatus, thereby ensuring a durable machine, as well as one that may be worked economically. The inventors effect this by the use of an ordinary vertical pug mill (for disintegrating the lumps of clay), having at the bottom an aperture of about the size of an ordinary brick, and placed over a suitable rectangular table which sustains a shaft having a double ratchet wheel upon it, and driven by suitable gearing. Between the top of the table and the bottom of the pug mill, a space of the depth, say, of a brick, intervenes to permit the passage of a series of moulds placed across the table. The moulds, although close to each other, are in no way connected, but are successively traversed along the table by the action of the ratchet wheels upon projections on their extremities, and each in turn comes under the aperture in the bottom of the pug mill, receives a charge of clay, and is thrust forward by the one behind it, a drag roller rotating on the top of the moulds keeping each in its place. The brick may then be discharged from the mould by being thrust out through a perforated portion of the table upon an endless band below.—Patent abandoned.

2129 W. POTTS. *Improvements in apparatus for suspending pictures and other articles.* Dated July 20, 1867.

The patentee claims making this apparatus of a rail or foundation of iron, having a close fitting, or nearly close fitting, ornamental covering or casing of brass, or other metal or alloy, or of a non-metallic substance, substantially as described and illustrated, and attaching the said apparatus directly to the wall of the room by means of screws, or by making it engage with staples or screws fixed in the wall of the kind described.—Patent completed.

2130 J. HOOPER. *Improvements in ventilators.* Dated July 20, 1867.

The patentee claims constructing and arranging or combining the parts of a ventilator substantially as described and illustrated, whereby a series of flaps or doors covering a corresponding number of openings in the body of the ventilator may be simultaneously raised or simultaneously lowered, so as to open or close to the required degree the said openings in the ventilator.—Patent completed.

2131 B. P. FRANZONI. *A new or improved method of hardening plaster, plaster castings, and the like.* Dated July 22, 1867.

This invention consists in submitting plaster or materials, or articles made of plaster, such as plaster castings, for the purpose of hardening, and, consequently, of rendering the same more durable, to a bath or solution of glue.—Patent abandoned.

2132 T. A. BRIETHAUPT. *Certain processes of manufacturing extract and essence of hop, to be substituted for the plant itself in the making of beer.* Dated July 22, 1867.

Here the hop extract is a dark brownish product which may present itself under three forms—first, dry and pulverulent; second, soft and thick; third, liquid. It has a very bitter taste, is soluble partly in hot water and partly in alcohol, and serves to give bitterness to beers in their making. Several processes for carrying out the invention are described in the specification.—Patent completed.

2133 H. LEA. *Improvements in taps or valves.* Dated July 22, 1867.

This invention consists in arranging the parts of the tap or valve so that the liquid gas or vapour closes the tap or valve by its pressure on a large area, and opens the tap or valve by its pressure in an opposite direction on a small area when the pressure on the large area has been removed.—Patent completed.

2134 W. R. LAKE. *An improved apparatus for cleaning boiler and other tubes.* (A communication.) Dated July 22, 1867.

This invention consists in the combination of a series of spiral scrapers with movable and stationary heads arranged upon a guide and draught rod, in the combination of one or more elastic or flexible scrapers with the said rod, and in the combination of a coiled spring or equivalent and adjusting nut with the rod and movable head, the whole being constructed and arranged as described.—Patent completed.

2135 J. WALKER. *Improvements in machinery for washing bottles, casks, and other vessels.* Dated July 22, 1867.

We cannot here give space to the details of this invention.—Patent completed.

2136 H. VON S. SAKUNLUNSKI. *Improvements in transferring devices in lace and other fabrics and fac-similes of textures on to printing surfaces, and in the application of the devices and textures obtained from such surfaces.* Dated July 22, 1867.

The object of this invention is to produce, by the aid of the printing process, representations of reticulated ornamental fabrics, and fac similes of texture, for the purpose of ornamenting fabrics used for furniture or dresses, and for producing illustrations for pattern and other books.—Patent abandoned.

2137 W. E. NEWTON. *Improvements in brewing.* (A communication.) Dated July 22, 1867.

The object of this invention is to so treat the hops, and to so construct the vessel in which they are placed, that, when the beer is added to the hops, the whole aroma of the hops will be extracted by the beer and retained therein. —Patent completed.

2138 D. WELSH. *Improvements in looms for weaving.* Dated July 22, 1867.

We cannot here give space to the details of this invention.—Patent abandoned.

2139 E. TOMLINSON. *Improvements in ornamenting, printing, colouring, enamelling, staining, cutting, creasing, bending, and manufacturing articles from wood and other material.* Dated July 23, 1867.

This invention has for its object improvements in printing or placing designs or labels on wood, card, paper,

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metals, and particularly on wood and scale board, for match or other boxes, which are printed or stamped and cut through at one operation, and for boxes creased and bent, the whole being the result of the same combined action. This is accomplished by placing knives, cutters, or rules made of any suitable material in combination with the printing press, or any suitable machine (either cylindrical or flat pressure), that is, the knives or cutters are fixed in the required position in the forme, or that part that receives the pressure resulting from the action of printing, so that the wood, card, paper, or other material is first cut through and then stamped or printed, and with boxes creased or bent, the whole being the result of the same combined action; or in some cases to perform one or more of the said operations at one and the same time.—Patent abandoned.

2140 J. H. JOHNSON. *Improvements in the manufacture of nets and netting.* (A communication.) Dated July 23, 1867.

The essential feature of this invention consists in using one-half of the twines or cords or every alternate one of the full size that would be used if the netting were made in the usual way, whilst the other half of the rest of the twines consist of a single strand of the full sized twines when that twine has three strands, and two strands when the full sized twine has six strands, and so on, that proportion giving an equality in strength and proper appearance to the netting, but other proportions may be used.—Patent completed.

2141 W. DENNIS. *Improvements in letter boxes, letter pillars, and such like depositories.* Dated July 23, 1867.

This invention consists in constructing the box with or without a fan wheel at the aperture, and dividing the box at about the centre thereof with two pieces of metal of a triangular form, somewhat similar to the letter V, and either with or without a flap joint near the point thereof; the flap joint may be shut by a hinge and made to balance and close of itself after a letter in its descent has pushed it open and passed through into the bottom of the box.—Patent abandoned.

2142 H. A. DUFRENE. *Improvements in preserving iron from oxidation.* (A communication.) Dated July 23, 1867.

This invention consists in covering the surface of the iron to be protected from oxidation with a coat of brass—that is to say, with a coat of an alloy of copper and zinc.—Patent completed.

2143 W. EASTERBROOK. *Improvements in machinery or apparatus for actuating, setting in motion, locking, interlocking, and controlling railway points and signals.* Dated July 23, 1867.

This invention relates to a former patent, dated 29th March, 1867 (No. 927), and consists in the introduction and use of two rods, instead of one rod, parallel to and connected with the main lever, and worked by a spring handle, and both rods extended to a sufficient distance below the top plate, and then flattened or widened as required, and there such rods, instead of the main lever, are securely locked, so that by means of notched plates and stops on the main lever, when such rods shall have been lifted, certain bars are made to slide, and the conflicting rods are instantly and firmly locked down in their respective notches before the lever itself is moved or pulled over. The object of this system is the better securing of the opening and shutting of points and regulating signals.—Patent completed.

2144 J. MARLEY. *Improved apparatus for the prevention of overwinding and falling of the cages used in mine shafts, lifts, and hoists.* Dated July 23, 1867.

In order to prevent the overwinding of the cage, independently of the detaching hook when the cage bottom is drawn beyond the safe point of the "settle board," a catch is actuated by suitable mechanism, such as is well understood, shuts off the steam from the engine, and applies it to a powerful steam brake. In passing the before-mentioned safe point the cage enters "conductors" which are gradually contracted towards the top, so as to have the effect of stopping the cage. The conductors rest at their upper parts either against springs or weights, in such a way as to admit of their opening out to some extent, and thus effect the purpose of preventing the cage being stopped too suddenly. A safety chamber is provided, which consists of boxes either close or grated, when necessary, corresponding with the size of the cage which is drawn into the chamber. This arrangement prevents the men from either falling or leaping out of the chamber when the cage is drawn into the boxes, and which latter extend in height from the bottom of the before-mentioned conductors to their top at the safety buffers. In order to prevent the cage from falling out of this chamber through the breakage of the rope, even if a safety cage be used, a series of catches or "heps" is placed within the same. The safety table is placed immediately under the ordinary heps, and covers the whole of the working shaft by the closing of two tables or trucks over the same. When the cage reaches a catch placed near the top of the safety chamber, the mechanism is actuated, by which the safety tables or trucks are released and run down an incline so as to close over the shaft.—Patent abandoned.

2145 S. BONSALL. *Improvements in spring bed bottoms.* Dated July 23, 1867.

This invention cannot be fully described without reference to the drawings.—Patent completed.

2146 S. BONSALL. *Improvements in tanning, and in the machinery and apparatus to be employed therein.* Dated July 23, 1867.

The patentee claims, first, hanging the hides in a vat, and agitating the tanning liquid by means of a rotary dasher or agitator, substantially as described. Second, placing the dasher or agitator entirely in the inside of an ordinary pit or vat. Third, hanging the hides in a close water-tight vat, and agitating the tanning liquor by a rotary or otherwise moving dasher, while the liquor is under pressure within the closed vat, substantially as described. Fourth, the combination of the water-tight vat, the dasher, and a force pump, or other equivalent means of producing pressure within the vat, and the stop-cock arrangement for retaining the pressure, substantially as described. Fifth, the dasher described located in the lower portion of the vat in combination with the bars described, or other equivalent means of hanging, suspending, or supporting the hides in the vat either above or below the dasher, so that the tanning liquid when agitated by the dasher will freely permeate between the hides, substantially as specified.—Patent completed.

2147 SIR W. THOMSON. *Improvements in receiving or recording instruments for electric telegraphs.* Dated July 23, 1867.

This invention has more especially for its object to produce an instrument capable of recording by permanent marks such electric signals as have up to the present time been received by the mirror galvanometer, as described in the specification of a patent granted to the patentee February 20, 1858 (No. 329). The peculiar merit of that instrument is that it continuously indicates with approximate exactitude the variations of strength in the received current, the movement of the spot of light follows every variation in that current, and these varying strengths being followed by the eye can be interpreted under circumstances in which ordinary instruments indicating the mere presence or absence of a given strength of current would be useless. By these improvements the patentee is enabled to construct an instrument which draws or marks on a strip of paper a curved or broken line, giving a graphic representation of the varying strength of current, or, if required, of electric polarity, at the receiving end of the cable, and gives a permanent record of every feature of the effect due to the sender's action.—Patent completed.

2148 W. GEEVES. *Improvements in machinery for cutting tenons.* Dated July 23, 1867.

According to this invention the patentee arranges tenon cutting machinery to produce two tenons simultaneously one at each end of a bar or piece of wood at any required distance the one from the other, and so that, without any setting out of the work on the bars or pieces of wood, any number of them may be tenoned at each end to exactly the same length.—Patent completed.

2149 R. LAKIN. *Improvements in aerial locomotion.* Dated July 24, 1867.

The object here is to carry passengers or goods in suspended vehicles attached to wire or other ropes, supported upon strong elevated columns of masonry and ironwork combined. These columns must be sufficiently high to allow the vehicles to pass over the tops of houses or other buildings, instead of running on the ordinary roads or streets.—Patent abandoned.

2150 W. SIMPSON and W. HOWITT. *Improvements in the construction of the roofs of horticultural and other buildings and structures.* Dated July 24, 1867.

The patentees claim constructing the principles of the roofs of horticultural and other buildings and structures hollow instead of solid, and of tubes or pipes and sockets, either separately or in combination, with longitudinal pipes, rods, or bars, as described.—Patent completed.

2151 W. BETTS. *Improvements in the manufacture of capsules.* (A communication.) Dated July 24, 1867.

This invention relates to colouring metallic capsules for bottles, &c., whereby the coloured capsule has the appearance of being coated with sealing-wax, whilst at the same time such coating is capable of resisting the bending and friction necessary for the application of the capsule to a bottle. A white elastic varnish, known as "sochuée, is used.—Patent completed.

2152 H. AITKEN. *Improvements in the manufacture of coke.* Dated July 24, 1867.

Here retorts are used which are situated at an angle of 25deg. to the horizon, but which may be placed at any other angle from the horizontal to the perpendicular. The upper and lower ends of the retorts are wider and deeper at the bottom than the top, and taper gradually from the bottom to the top. The retorts are provided with lids or doors, the bottom lid or door being made the full size of the retort; the top lid or door may be made smaller than the retort, if desired. The retort is charged from the upper end with the coal or slack from which the coke is to be made, and suitable space left for expansion. Suitable pipes, condensers, and holders are employed for taking off and receiving the liquid and gaseous products of the distillation, and the inflammable part of the gas is conducted below the retort, and there used as the fuel by which the temperature for the distillation and conversion is effected, or chiefly effected.—Patent abandoned.

2153 R. B. RODEN. *Improvements in breech-loading fire-arms.* Dated July 24, 1867.

These improvements, whilst they are applicable to all systems having vertical faced breech-blocks, are more especially intended as further improvements upon the inventions for which letters patent were granted as follows:—No. 1828, year 1862, to F. E. Schneider and J. Snider, jun.; No. 2145, year 1864, to T. Wilson; No. 2741, year 1864, to J. Snider, jun.; No. 2912, year 1864, to J. Snider, jun.; No. 188, year 1865, to J. Snider, jun.; No. 2275, year 1865, to J. Snider, jun., and consists of the following arrangements:—Instead of placing the lock on the side of the stock, as now generally practised, it is inserted in the middle of the same, and directly over or in connection with the trigger guard, which may or may not be modified to suit the particular form or construction of lock. The lock may be of any suitable construction, and so arranged as to operate or function a striker or bolt, which can be used either for percussing the piston or striker which produces the ignition of the cartridge, or for holding the breech-block against accidental explosion, or both. Instead of the ordinary dog or hammer a lever thumb-piece is used by which the striking or locking bolt is retracted after the discharge of the arm. The breech tang and tail pin are also modified so as to clear the mechanism of the lock. These improvements further extend to a method of and in arrangements for extracting the expended cartridge case, whether such extractor be operated in connection with the breech-block or otherwise. This is effected by arranging the extractor and its bed so as to operate on the rim of the cartridge case at or a little below its diameter, the diameter corresponding with the horizontal axis of the barrel, and by forming or placing an inclined plane on the bed of the shoe, either elastic or otherwise, by which means the cartridge case may readily be ejected from the shoe. In the case of existing arms a stud or stop is placed in the shoe at any suitable point, and by drawing back the extractor sharply when the head or rim of the cartridge comes in contact with such stud or stop, it will cause the case to fly out in a similar manner. This stud or stop may be made rigid or elastic. The said invention further consists in constructing a ridge or flange on the underside of the breech-block, which ridge or flange fits into a corresponding groove in the bed of the shoe, its object being to retard any escape of gas backwards in case of the bursting of a cartridge on explosion, but this is only used in the absence of a locking bolt.—Patent completed.

2154 T. PRIDEAUX. *Improvements in open fireplaces and stove-grates, for the purpose of economizing fuel and securing a more perfect combustion.* Dated July 24, 1867.

Here the inventor constructs in the chimney of the fireplace, or other convenient place, a tube or flue open at end to the external atmosphere, or to the atmosphere of the room or building in which the fireplace is situated, and at the other end communicating with a chamber constructed at the back or sides, or back and sides of the fireplace, the chamber being provided with a grating or perforated plate at the part next the fire; air thus passes into the tube or flue at the open end, and thence into the chamber, being heated in such passage and issuing through the grating or perforations into the fireplace among and above the burning fuel, thereby effecting a material saving of fuel and a more perfect combustion.—Patent abandoned.

2155 A. M. CLARK. *An improved reciprocating motion.* (A communication.) Dated July 24, 1867.

This invention relates to a new and improved reciprocatng motion for engines and other purposes. Its object is to convert a reciprocating motion into a rotary, or a rotary into a reciprocating motion, without the use of the crank, thereby avoiding the two dead points at each revolution with less strain and wear of the parts. It consists in the employment of a pinion or toothed wheel, working in a double or top and bottom rack, and of an inner and outer cam to relieve the dead joints.—Patent completed.

2156 S. TURTON. *Improvements in apparatus for facilitating communications between passengers, guards, and drivers of railway trains.* Dated July 25, 1867.

In one or more compartments of every carriage composing the train is placed one or more handles, which are connected to, or form part of a drop rod which, when the handle is moved, acts on a catch, and liberates a weighted lever or arm which fits on a rod extending the whole length of the carriage. The extreme end or ends of the rod are taken into the guard's van, or to the engine, or to both, and connected to a bell, whistle, or other alarum As soon as one of the levers above referred to has liberated the catch, the weighted lever or arm in falling turns or partially turns a longitudinal rod extending from end to end of the carriage; the ends of these rods are connected by a self-acting universal coupling. The position of the weighted arm and handle will indicate the compartment and the carriage in which the signal has been given for calling the attention of the guard.—Patent completed.

2157 W. HOWES and W. BURLEY. *An apparatus for securing lamps for railway and other carriages.* Dated July 25, 1867.

This invention consists, first, in forming on the side of the lamp next to the carriage a tapered socket, open at the bottom and closed at the top, where a female thumb-screw is fitted; the screw is free to turn horizontally, but is screwed in position vertically by having a groove cut round the neck, into which groove the end of the pin, passing through the side of the collar at the top of the socket, enters. Second, in forming a lamp iron (fixed to the carriage) with a stem made to fit the socket above mentioned; at the top of which stem there is a small screw, the end of which, when the lamp is placed upon the iron, enters the female on the thumb-screw, upon turning which the lamp will be firmly secured. When removing the lamp, the thumb-screw and taper form of the socket facilitate the lifting of the lamp, and prevent it from getting fixed or jammed upon the stem.—Patent completed.

2158 C. H. MURRAY. *Improvements in machinery for moulding clay for making bricks, tiles, and other analogous articles from plastic substances.* Dated July 25 1867.

This invention consists in constructing the dies or apertures in brick-making machines through which the plastic material is delivered with movable hollow boxes or vessels provided with perforated sides, and supplied with any suitable lubricant, which, by exuding through the perforations in the boxes, will lubricate the desired parts.—Patent completed.

2159 C. T. MOULAN. *Improvements in the construction of movable joints for connecting metallic pipes and tubes.* Dated July 25, 1867.

The object here is to connect together iron tubes, such as are used for gas or water. To this end a small shoulder is cast on the outside, and near the end of each of the tubes a cast iron ring is then slipped on over the joint where the tubes are to be connected, and on either side of this ring are placed vulcanized india-rubber washers, which are firmly pressed against the ring by means of concave sockets provided with ears, whereby they are strongly bolted together by screw bolts, and by tightly screwing up these sockets leakage will be effectually prevented.—Patent abandoned.

2160 W. E. NEWTON. *Improvements in the construction of mould boards for ploughs.* (A communication.) Dated July 25, 1867.

This invention consists in making the mould boards of ploughs of such a shape that the grade of the board will be a true inclined plane from the point to the extreme end of the wing, where the greatest height of the plane terminates at a point from the ground equal to the width of this plough, which may be supposed to be one foot.—Patent completed.

2161 A. WILSON. *Improvements in the casting of ingots.* Dated July 25, 1867.

This invention consists in placing the ingot mould upon the table of a weighing machine supported by a steel yard or weighted levers, or suspended from a spring balance. The ingot mould and everything in connection with it is then weighted. By adding the weight of the ingot to be cast to the weight of the ingot mould and its accessories, the patentee is enabled to make the ingot of any given and desired weight.—Patent completed.

2162 J. BROWN and W. LILLIE. *Improvements in reaping and mowing machines.* Dated July 25, 1867.

This invention consists in employing two wheels, either bevel or spur wheels, of different diameters on the first driving shaft, which may be cast in one piece, or may be made separate; these wheels are fitted to slide endwise simultaneously upon the shaft on which they are carried; or they may be keyed fast on the shaft, the shaft being arranged to move endwise in its bearings to enable the wheel or wheels to gear into one of two pinions, which may either be cast in one piece, or separately, and are carried on the intermediate shaft.—Patent completed.

2163 W. WOOD. *Improvements in producing and treating fibres from rags, and in apparatus for the same.* Dated July 25, 1867.

An important feature in this invention consists in

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evenly distributing upon the rags an excess of the oil or lubricant ordinarily employed, instead of merely sprinkling it thereon, as usual.—Patent abandoned.

2164 A. MACKIE. *Certain improvements in the method of composing and distributing type, and in apparatus to be employed for such purposes.* Dated July 25, 1867.

This invention is designed for the purpose of setting or "composing" a duplicate or multiplied number of columns of type of the same matter simultaneously, which is useful for special purposes, and where a reproduction of the same information is required in type. The improved method of setting the type consists in placing the letters in transverse lines (each line being a row or series of same letter), and one line above another in layers, so that when all the type is "set," if the block of type so formed be "sliced" at right angles to the layers, the line of type removed by each "slicing" forms a perfect column of legible matter.—Patent completed.

2165 T. M. ALMOND. *Improvements in signalling at sea, and in apparatus to be employed for such purpose.* Dated July 25, 1867.

Here the inventor furnishes each vessel with two signal lanterns placed in a vertical line, one about three feet (more or less) above the other on a small spar supported in a socket or bracket at any convenient place in a conspicuous part of the vessel. These lanterns have shutters, and red and green glasses, and are kept darkened by means of the shutters when not required for signalling. As soon as a vessel is sighted, the signalman uncovers the lanterns and shows two white lights (one above the other) to signal to the vessel that she has been seen, turning the spar slightly in the socket (if necessary) so as to direct the light towards the ship. So long as the vessel holds on her original course the white lights are shown, but the instant that the person in charge gives the word "port" or "starboard" to the helmsman, the signalman shows two red or two green lights to indicate to the other vessel the change of course adopted.—Patent abandoned.

2166 C. E. BROOMAN. *Improvements in the manufacture of cast steel and its derivatives.* (A communication.) Dated July 25, 1867.

The patentee claims the manufacture at one continuous operation on the sole of a reverberatory furnace heated by gas of four kinds of cast metal, viz., hard steel, soft steel, cast iron (fer fondre), and mixed metal, by the simple variation of the doses, this continuous process comprising three features—first, the original bath of casting; second, the refining in excess by the addition of iron or ore; and, third, the return of the bath to the desired point by adding a fresh quantity of casting, and the process being based on the high temperature of the metallic bath, and on the carburation and decarburation of the metallic bath, all as described. Second, the refining of the casting directly by the chemical action of oxide of iron, as described, without any injection of air or steam. Third, the fusion of a casting in a liquid bath, the surface of which is preserved from oxidation by a gaseous layer always reductive, as described. Fourth, the manufacture of cast steel and its derivatives on the sole of a furnace, below which is an empty space for cooling it, as described. Fifth, the decarburation of the casting in presence of solid matters which will absorb the carbon, such as ores and metals of iron and steel under the simple action of a very high heat (2900 to 3650deg. Fah.), as described. Sixth, regulating the decarburation and the recarburation of the bath by varying the work of the furnace, and the dosing of the materials, according to the quality of steel or metal to be produced, as described.—Patent completed.

2167 C. E. BROOMAN. *Improvements in the manufacture of cartridge cases.* (A communication.) Dated July 25, 1867.

Here the inventor makes the interior of the case of paper, pasteboard, cloth, or other suitable material, and the exterior of brass, iron, steel, zinc, or other metal or alloy; as the inner tube has a certain rigidity, the outer metallic tube may thus be made very thin.—Patent completed.

2168 G. L. BARENS and J. F. LADOUGNE. *Improvements in breech-loading firearms and in cartridges.* Dated July 25, 1867.

This invention consists, first, in a breech-piece having the cap and the other for the cartridge; this breech-piece also acts as a cartridge extractor, and permits of regulating the carrying power of the gun; at the same time, it prevents all escape of gas, and gives more security for the fire. The invention also consists in a new action to tilt and secure the barrels or barrel.—Patent completed.

2169 J. EDGE. *Improvements in steam engines.* Dated July 26, 1867.

This invention relates to the "slide valves" used to regulate the admission and discharge of the steam to and from the cylinders of steam engines, and to the "governors" employed to control the speed of the engines, and consists, in so far as relates to the "slide valves," of a novel method of actuating the said valves, applicable, principally, to engines working expansively. In carrying the invention into effect the patentee employs two separate valves for the admission of the steam to the cylinder, and two for the discharge thereof, or for opening a communication between the cylinder and the condenser. These aforesaid valves are preferably of the description known as "gridiron" valves, or of a form similar thereto, the valve boxes being situated as near the ends of the cylinder as is convenient for the purpose of obtaining short passages between the valves and the interior of the cylinder, but they may be otherwise situated. The valves are actuated by "cams" or "tappets" fitted on a "shaft," or on "shafts" to which a rotary motion is imparted by the engine, the said shaft or shafts revolving at one-half the speed of the "crank shaft" of the engine. The valve spindles are preferably furnished each with two "bowls" for the cam to act upon, and with a suitable frame to carry the same, each cam being so formed as to give two movements to the valve which it actuates during one revolution of the cam, the movements being similar to each other, but in opposite directions, so that, taking for example the inlet valve admitting steam for the forward stroke of the "piston," the said valve is moved by its cam in one direction to admit the steam to the cylinder for a forward stroke, and back again to its former position to admit steam for the next succeeding forward stroke, each movement admitting the steam for a suitable portion of the stroke, and "cutting off" the said admission at, or nearly at, any desired portion of the stroke. The "cams" actuating the "inlet valves" may be stepped or otherwise formed or arranged for altering the "cut off." The valves may be actuated by separate shafts, or one shaft may actuate two or more valves. The improvements in the "governors" of steam engines are as follows:—On a shaft or stud a ratchet wheel is mounted, having one half, or other suitable proportion, of its teeth pointing in a contrary direction to the remaining portion; or two separate wheels or segments, with the teeth of each one reversed as compared with the other, may be employed. An arm or lever carrying two pawls, and having a reciprocating motion derived from the engine, is mounted on the same centre of motion as the above described "ratchet wheel," the aforesaid "pawls" acting in opposite directions on the teeth of the "ratchet wheel," and being kept out of action when the engine is running at its proper speed by a curved guard which is interposed between the pawls and the "ratchet teeth," the guard being moved around the ratchet wheel by a rod or other connection which is actuated by the sliding "sleeve" of the governor, so that as the sleeve rises or falls with the varying speed of the governor, one or other of the "pawls" is allowed to act upon the ratchet teeth, and the ratchet wheel is rotated, the movement of the ratchet wheel being employed to move the inlet cams, as before described, for altering the "cut off." There are other features which we cannot produce here.—Patent completed.

2170 C. SILVY. *Improvements in photographic apparatus (photographic cartridge.)* Dated July 26, 1867.

This invention relates to apparatus which, on being combined with the camera obscura now used in photographic apparatus, allows, by suppressing the ordinary frames and dispensing with dark tents, of taking panoramic views on all points of the horizon.—Patent completed.

2171 R. REID and E. H. CRAIGIE. *An improved reclining chair.* Dated July 26, 1867.

This invention is not described apart from the drawings.—Patent completed.

2172 G. B. NORTHCOTE. *Improvements in apparatus for charging and turning cartridges for breech-loading firearms.* Dated July 26, 1867.

This apparatus consists of four bags or holders containing respectively the powder for the charges, the shot, the wads to be placed in the cartridge cases between the powder and the shot, and the wads to be placed in the cartridge cases over the shot. Beneath these bags or holders there is a slide acting to measure the powder and the shot, and to cause the escape of the wads one at a time from the wad bags or holders. Underneath this slide is a bed plate forming part of the frame of the apparatus, and in this plate there are two, or it may be three, passages, one passing vertically or direct through it, and having the cartridge case to be charged immediately beneath, the other or others passing in an oblique direction, so as also to lead into the cartridge case. Over the first hole a rammer is mounted; it can be depressed by the hand of the operator to force down the wads into the cartridge cases, and it is brought up again by a spring. The stem of the rammer may pass through a frame which is able to move it for a part of its stroke; this frame carries spring blades which enter the cartridge case, and open it out should it require it to ensure the wads entering truly. The cartridge case may be held in a tube which is mounted on axes, so that after receiving its charge, it can be turned partly round, so as to bring the mouth of the cartridge case opposite a closing or turning apparatus. The operation of the apparatus will be obvious to those familiar with the subjects.—Patent completed.

2173 E. SMITH. *Improvements in gas regulators.* Dated July 26, 1867.

The object here is to regulate the supply of gas as it issues from the main to the burner, in order to prevent variation in the size of the flame, notwithstanding any difference that may occur in the pressure of the gas in the main. An additional illuminating power is also given to the light by means of a reflector, all as described. The invention primarily consists in placing the passage for the gas inside the regulator; a valve is placed in the base of the regulator, the upper end of which is weighted according to the quantity of gas to be consumed per hour, and connected to a diaphragm, formed by preference of leather made from goat's skin; the space between the diaphragm and the base of the regulator forms a chamber for the reception of gas from the supply pipe which it enters by the valve; the pipe for conveying the gas from this chamber to the burner leading into the same, a reflector of silvered glass is placed round the tube leading to the burner; it is screwed or fixed at top to a metal cap holding the burner, which latter the inventor makes, by preference, of lava or steatite, and at bottom it fits into the chamber containing the diaphragm, which latter chamber is made of "Britannia" metal.—Patent completed.

2174 J. SMITH and W. SCHOFIELD. *Improvements in the construction of elastic rollers for squeezing yarns and fabrics, and for other purposes.* Dated July 27, 1867.

This invention consists in making rollers with an elastic surface composed of rings, washers, or spiral bands of india-rubber, or any suitable compound of india-rubber.—Patent completed.

2175 E. A. RIPPINGILLE. *Improvements in the mode of distilling or separating the more volatile portions of petroleum and other mineral oils, and in means or apparatus for ascertaining the igniting and explosive point of such oils.* Dated July 27, 1867.

This invention consists, chiefly, in the employment of a jet or jets of steam to draw or force in a current or currents of air through the petroleum or other mineral oil from which it is desired to separate the more volatile portions, such jets acting in a somewhat similar manner to the blast of a locomotive engine.—Patent completed.

2176 T. REID. *Improvements in agricultural implements for digging potatoes, for grubbing, for forming drills, and for similar uses.* Dated July 27, 1867.

This invention consists in adapting or adding to a frame like that of a double-moulded plough, firstly, a small single share in front running on the surface, and serving to turn over to one side the "shaws" or above-ground part of the potato plant; and, secondly, a coulter to divide the earth placed a little behind the surface share, and having a mould board fixed to it to continue the turning over action on the shaws; and, thirdly, two or three pairs of knives fixed to the sole of the plough-frame to detach and throw out the potatoes, the front pair of such knives being in about the position of the ordinary share, and united in front, but diverging behind, outwards, and slightly upwards, whilst the other pair or pairs of knives is or are similarly placed further back, and are longer, the hindmost being the longest.—Patent abandoned.

2177 W. E. GEDGE. *An improved machine for cutting slate in quarries previous to laying them open, and for cutting in coal-pits, mines, and stone quarries.* (A communicaton.) Dated July 27, 1867.

This invention is not described apart from the drawings.—Patent completed.

2178 E. T. HUGHES. *Improvements in the mode of constructing and propelling steam vessels.* (A communication.) Dated July 27, 1867.

The object here is to decrease the weight and draught of water of steam vessels, and, consequently, the resistance to their rapid motion; and also to increase and make more available the effective power by which they are driven, while at the same time the patentee makes them stronger and less liable to sink or become disabled. The invention consists, first, in applying the power to drive the paddle-wheels of a side-wheel steamer to the paddle-wheels at or near the peripheries by gearing teeth or cogs on or near their peripheries, into which the teeth of a driving wheel (which is itself driven by a suitable engine) engage. Second, in constructing the driving wheel in two parts, viz., a rim on which the teeth are formed, and a central body or driving portion, and inserting between the body and rim india-rubber, or some other elastic non-resonant body. Third, in applying heat to the gearing on the peripheries of the paddle-wheels (when it is necessary to do so to melt ice which may accumulate thereon) by steam introduced into pipes set into or upon the wheels for that purpose. Fourth, in combination with the application of the power for driving the vessel as above stated, constructing and supporting the hull of the vessel with transverse walls at frequent intervals (the walls being securely fastened to the sides and bottom of the vessel, and connected together by means of a web at or near their tips), and without ribs, thereby gaining great strength with comparatively small weight of materials.—Patent completed.

2179 W. E. NEWTON. *An improved water and gas meter.* (A communication.) Dated July 27, 1867.

This invention is not described apart from the drawings.—Patent completed.

2180 P. A. ROHART. *Improvements in the manufacture of gases for the production of light, heat, and motive power, and in apparatus for that purpose.* Dated July 27, 1867.

This invention is not described apart from the drawings.—Patent completed.

2181 A. JACK. *Improvements in machinery or apparatus for digging potatoes, turnips, and other roots.* Dated July 27, 1867.

Here a framework of iron is employed, which is supported on wheels, so that it may be dragged over the surface of the field out of which the roots have to be dug. The attendant follows behind the digging apparatus, and at the place where he is situated the handle of a lever is placed. The lever is jointed to the main framing, and its opposite end is attached to a frame placed below it. The frame carries the digging or root-raising apparatus, which consists of a grated or gridiron plate; this is situated at an angle with the plane of the field from which the roots are to be raised, so that as it is drawn over the ground the root-raising plate may enter the surface of the ground in such manner that its lower edge descends below the level of the underside of the roots which are to be raised. The use of the lever before referred to is to adjust the elevation or depression of the root-raising plate below the surface of the ground. One of the large wheels which carry the apparatus has a circular toothed ring fixed on to it, the teeth of which gear into, and, when the apparatus is in motion, actuate a pinion on a cross shaft, to which a series of arms is fixed; these arms revolve in proximity to the root-raising plate, and as they revolve their effect is to separate and throw back on the surface of the dug ground the roots that have been raised on to the plate. This last operation cleanses and separates the roots from the earth or soil in which they have been embedded, and the cleaning action may be further improved by attaching chain harrows to the back of the apparatus, which, in passing over the roots, rub them still cleaner.—Patent abandoned.

2182 H. CHAMBERLAIN. *Improvements in hot blast stoves.* Dated July 27, 1867.

This invention has reference, partly to ordinary hot blast stoves, and partly to a novel construction and arrangement of hot blast stove. One of the essential features of the invention consists in packing the flues or spaces between and amongst the blast pipes or passages of ordinary hot blast stoves, or of hot blast stoves of this improved construction, with open brickwork, so disposed as not materially to interfere with the draught, whilst they act as magazines or storers of heat by becoming highly heated throughout the entire length or area of the heating chamber or space, and when so heated will radiate a uniform or nearly uniform degree of heat.—Patent completed.

2183 G. FRANKLIN. *Improvements applicable to ships' compasses.* Dated July 27, 1867.

In constructing steering compasses the inventor employs an inverted card, that is to say, a compass card with the points marked upon it on the under side. Below the card, and in front of it, he mounts an inclined mirror, so as to reflect the light from the card to the eye of the steersman, who, looking in the direction of the mirror, sees an image of the card in a vertical or nearly vertical position, with the point which marks the direction of the ship's head uppermost. The card is lighted by means of side glasses which at night have lamps set in front of them. The inclination of the mirror is made adjustable, so that the instrument may be set to suit any distance from the wheel at which it may be placed.—Patent abandoned.

2184 T. JONES. *Improvements in locks and latches.* Dated July 27, 1867.

This invention consists of the addition of the mechanism hereinafter explained to locks and latches having spring bolts with bevelled ends, which mechanism has for its object to prevent the bolt of the lock or latch being forced back by pressure applied to its end. The invention, as applied to a spring latch having a barrel lock, is as follows:—Immediately over the bolt is a lever turning upon a pin in the latch case. This lever is pressed upon by a spring, that end of the spring which presses on the lever being of a V or convex shape, and bearing upon a projection on the lever immediately over the pin on which it turns. The projection is also of a V or convex shape. On the barrel of the lock is a projecting piece which, on turning the barrel, comes against a projection on the

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under side of the lever, and raises the long arm of the lever, or that end of the lever turned towards the bevelled end of the bolt. The lever remains in the raised position during the further motion of the barrel and the withdrawal of the bolt. After the opening of the door and the withdrawal of the key the lever retains its raised position until the closing of the door, when the forcing back of the bolt causes a shoulder on its inner end to strike against the tail of the lever, and depress the long arm of the lever, causing it to engage at the back of the head of the bolt, and to prevent the motion of the bolt inwards. The bolt cannot now be forced back by the insertion of a tool or instrument between the door and door frame. The introduction and turning of the key effects the raising of the lever and the liberation of the bolt in the manner before described. The lever is retained in one or other of the positions described by the V-shaped end of the spring pressing upon one or other side of the centre of the V-shaped projection over the axis of the lever. In order to enable a person inside the room to liberate the latch bolt without the use of the key, a small knob outside the latch case may be connected through a slot in the latch case with the lever. By means of this knob the lever may be raised and the bolt liberated.—Patent completed.

2185 J. WOOD. *Improvements in the manufacture and treatment of certain kinds of iron.* Dated July 27, 1867.

In making cast iron capable of being annealed, according to this invention the inventor takes hematite pig iron, and to one part by weight thereof he adds from one-third of a part to one part by weight of scrap steel, or wrought iron, and he melts the mixture together in a crucible or cupola. The larger the proportion of steel or wrought iron the stronger and the tougher will the resulting cast iron be. The cast iron made in the manner described is cast in the usual way. In annealing cast iron made in the manner described he uses powdered charcoal, and he effects the annealing in the usual way, excepting that he heats the cast articles in the powdered charcoal, or subjects them to the annealing process during a much shorter time than when the annealing is effected by the use of hematite or Cumberland ore, as is usual.—Patent abandoned.

2187 A. MACFIE. *Improvements in apparatus for supporting lines for drying clothes, and for other like purposes.* Dated July 27, 1867.

This invention consists of apparatus for supporting lines for drying clothes, &c., whereby the line can be easily lowered, and easily brought again into and fixed in its raised position. The details of the invention are too voluminous for insertion here.—Patent abandoned.

PROVISIONAL PROTECTIONS.

Dated October 10, 1867.

2846 C. Avery, Little Cross-street, Islington. Improvements in breech-loading firearms.

Dated October 12, 1867.

2877 J. H. Johnson, Lincoln's Inn-fields. Improvements in knitting machines. (A communication.)

Dated January 18, 1868.

177 J. Whiteley, Huddersfield. Improvements in twining jennies, or apparatus for twining or doubling cotton, silk, worsted, and other fibrous substances.

Dated January 22, 1868.

222 J. Dixon, Aberburch-yard, City, contractor. Improvements in the construction of floating saloon baths.

Dated January 28, 1868.

293 T. Hydes, ironmonger, and J. Bennett, engineer, Sheffield. Improved means or appliances for facilitating the transit and application of caloric, also for mixing caloric with air, water, and other fluids and gases, also for economizing the consumption of fuel, consuming smoke, generating steam, and increasing and distributing heat, and for refrigerating purposes.

Dated January 29, 1868.

312 G. Thornton, farmer, Chesterfield. Improvements in straw elevators to take straw from thrashing machines.

Dated January 30, 1868.

331 C. H. Roeckner, Whitchurch, Hants. Improvements in machinery for the manufacture of paper.

Dated February 4, 1868.

379 T. Scott, Fushie Bridge, Mid Lothian. Improvements in kilns or apparatus for drying grain, or other granular matters.

381 A. C. Sterry, Woodgate Cottage, Ewell, Surrey. Improvements in, and applicable to, locomotive engines and carriages on railways.

383 P. Graham, Oxford-street. Improvements in corks or stoppers for closing bottles and jars.

385 W. E. Newton, Chancery-lane. Improvements applicable to steam boilers for automatically sounding an alarm at the extremes of high and low water, also for automatically sounding an alarm when the steam in the boilers exceeds a given pressure. (A communication.)

Dated February 5, 1868.

387 T. W. Walker, Poole, Dorsetshire. Improvements in the manufacture of bricks, tiles, slabs, and other like articles, and in the materials and machinery or apparatus employed therein.

389 S. G. Taylor, Tyldesley, Lancashire, spinner and doubler. An improved mode of lubricating the spindles of machines for spinning and doubling.

391 F. Ardache, St. Vaast, Hainaut, Belgium, printer. Improvements in apparatus for winding flat cords, ropes, and bands.

393 H. Bunning, jun., Field House, New Cross. Improvements in apparatus for burning combustible liquids in furnaces.

395 W. E. Newton, Chancery-lane. Improvements in buttons, and in the means of securing them to garments or other articles of wear or use. (A communication.)

397 J. A. Jones, Middlesborough, engineer. Improvements in the production of iron and steel.

Dated February 6, 1868.

399 C. W. Guttridge, Landport, Hampshire, grocer. An improved apparatus for cutting soap.

401 A. E. Borgen, Corn Exchange Chambers, Seething-lane, City, merchant. The preparation of phosphor free matches, made either with or without paraffin, stearine, or wax, without the use of phosphor, and without requiring any prepared surface in order to obtain an instant light. (A communication.)

402 W. J. M. Rankine, of the University of Glasgow, Professor of Civil Engineering and Mechanics, and J. M. Gale, Glasgow, civil engineer. Improvements in condensing steam, and in apparatus therefor.

403 H. Brindle, Leyland, Lancashire. Certain improvements in shuttles to be employed in looms for weaving.

404 J. Honeyman, jun., Glasgow, architect. Improvements in arrangements and apparatus for trapping and ventilating in connection with drain or other pipes.

405 W. E. Newton, Chancery-lane. Improvements in steam gauges. (A communication.)

406 J. C. Cole, Smethwick, Staffordshire, engineer. Improvements in drill braces, applicable also to spanners and other like implements.

407 J. T. White, King Edward-street, City. Improvements in fire-lighters.

408 G. F. Bradbury and T. Chadwick, Oldham, sewing machine manufacturers. Improvements in, or applicable to, certain sewing machines. (A communication.)

409 B. M. Oakeshott, Sloane-square, Chelsea. An improved hot air simple or medicated vapour bath.

411 W. Tongue, Kennington, engineer. Improvements in machinery for straightening and preparing fibrous materials for combing or spinning.

412 P. E. Masey, Regent's Park. Improvements in machinery or apparatus for obtaining aerial locomotion, part of such improvements being applicable to rotary steam engines and boilers for other purposes.

413 H. W. Hart, Norfolk-terrace, Bayswater, engineer. Improvements in the manufacture of safety envelopes.

Dated February 7, 1868.

414 C. and C. H. Longbottom, Bradford, agents. Certain improvements in, or applicable to, machinery for spinning, twisting, and winding fibrous substances, and to looms for weaving.

415 J. O'Donnell, Woburn-mews West, and T. Arkill, River-street, King's Cross. Improvements in apparatus for raising and lowering venetian and other blinds.

416 S. Read, Edinburgh. Improvements in finishing paper and textile fabrics, and in the machinery or apparatus connected therewith.

417 J. and J. Cash, Coventry. Improved machinery for the manufacture of looped and textile fabrics, and in the fabrics produced thereon.

420 G. Tucker, Canonbury-road, St. Mary, Islington. Improvements in the manufacture of rain water pipes and certain other articles in cast iron.

421 W. Drake, Park Wharf, Nottingham, timber merchant. Improvements in machinery or apparatus employed in the cutting of wood, laths, and for other similar purposes.

422 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in locks. (A communication.)

Dated February 8, 1868.

423 J. B. Wilson, Haydock, Lancashire. Improvements in compressing, forging, and rolling steel and other metals, and in machinery for such purposes.

424 G. Harford, Newcastle-upon-Tyne, sail cloth manufacturer. Improvements in scaffolding and apparatus to be used for building and other similar purposes.

425 A. M'Knight, Birmingham, manufacturer. A new or improved powder or composition for cleaning and polishing articles made of steel, iron, copper, brass, or other metals.

426 T. Walker, Birmingham, engineer. Improvements in the construction of sewers and drain pipes or tubes.

427 P. Rothwell, Hampstead-road, gas engineer. An improved regulating valve for the delivery of specific quantities of gas, water, or other fluids.

429 J. Dixon, Nuneaton, Warwickshire. Improvements in the manufacture of braces.

433 J. Key and E. Hoskins, Birmingham, metallic bedstead manufacturers. Certain improvements in metallic bedsteads.

435 W. Brooke, Manchester, merchant, and R. Edmondson, Bank Top Mill, Blackburn, manufacturer. Improvements in heads for weaving.

437 J. E. Billups, Cardiff, contractor. Improvements in separating powders of sulphate of barytes of various degrees of fineness, thus obtaining an exceedingly fine powder, and in the separating apparatus adopted for the same.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," February 25, 1868.

2846 C. Avery. Breech-loading fire-arms.

2868 J. Buckingham and J. S. Block cy. Regulating the feed of steam boilers.

2873 R. Canham and J. Thomson. Stoves.

2877 J. H. Johnson. Knitting machines. (A communication.)

2882 E. Ward. Hats.

2884 M. Fitzpatrick. Railway trains.

2892 M. Vogl and H. Van Dyk. Muffs.

2900 A. and A. C. M. Prince. Telegraphic communication.

2905 D. Pidgeon and W. Manwaring. Reaping machines.

2908 M. Wilkin and J. Clark. Signaling upon railways.

2912 J. Rives. Casting metals.

2918 J. Bannehr. Supplying deodorizing matter to earth closets.

2920 W. Tredgold and J. M'Neil. Steam boilers.

2923 H. W. Garrett and G. Holcroft. Firearms.

2925 E. Casper. Preventing the bursting of the tubes in steam and water pressure gauges. (A communication.)

2926 J. Hill and S. Shelley. Looms.

2929 J. Seward and H. Smith. Steam boilers.

2930 T. Kitchen. Grinding wheat.

2931 H. J. Bale. Cooking by means of gas.

2939 M. J. Matthews. Pianofortes.

2941 W. R. Lake. Breech-loading fire-arms. (A communication.)

2943 L. Newton and J. Swailes. Stoppers for bottles.

2944 J. Schwartz. Cooling water.

2947 E. Butterworth. Spinning cotton.

2948 M. W. Shove. Letter boxes.

2952 W. Crossley and T. C. Hutchinson. Manufacture of alumina.

2956 J. Clapier. Manufacture of pillows.

2960 W. R. Lake. Electric telegraph apparatus. (A communication.)

2961 J. Adams. Breech-loading revolver fire-arms.

2969 W. Beale. Telescopic apparatus.

2994 S. Stackard. Bottling apparatus.

2998 R. Weare. Treating urine and fæcal matter.

3006 W. R. Lake. Curing meat. (A communication.)

3019 F. M. Smith. Armour plates.

3025 A. M. Clark. Steam generators. (A communication.)

3033 C. E. Brooman. Manufacture of lace. (A communication.)

3038 W. Potts. Making moulds for metallic screws.

3050 L. Perkins. Actuating the valves of water meters.

3071 J. Watkins. Axles for carriages.

3079 J. Gilmour. Pianofortes.

3085 A. G. Avenell. Frame for packing bottles in cases.

3107 W. E. Newton. Covering steel or iron plates with copper. (A communication.)

3135 J. Botterill. Dyeing textile fabrics.

3172 T. W. Ingram and E. C. Kemp. Gas lamps.

3212 A. M. Clark. Tubular boilers. (A communication.)

3246 R. Heathfield. Machinery for the manufacture of cut nails. (A communication.)

3271 K. J. Winslow. Conveying rotatory motion to axles.

3285 T. H. Tilley. Couplings for boring tools.

3352 E. H. Bentall. Conversion of iron into blooms.

3621 H. A. Bonneville. Machinery for carding wool. (A communication.)

3659 G. Layton. Manufacture of soap.

139 J. Head. Furnaces for puddling.

150 W. Betts. Manufacturing materials for capsules.

261 C. W. Dixon. Rotating slide valves.

275 A. H. Thurgar. Securing the corks of bottles.

313 W. Guise. Scouring needles.

332 J. Thompson. Feeding bottles for invalids.

376 J. Dewar. Preserving animal substances.

393 H. Bunning. Apparatus for burning combustible liquids in furnaces.

397 J. A. Jones. Producing iron and steel.

403 H. Brindle. Shuttles.

405 W. E. Newton. Steam gauges. (A communication.)

407 J. T. White. Fire-lighters.

416 S. Read. Finishing paper.

429 J. Nixon. Braces.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed February 21, 1868.

2413 J. M'Intyre
2414 J. L. Norton and G. Hawksley
2421 E. A. Dana
2422 J. Varley
2425 A. and E. Wigzell
2431 W. R. Lake
2432 P. Kniaghininsky, P. Galahoff, and N. Ossipoff
2434 W. Berry
2436 E. Sonstadt
2440 J. W. Webb
2454 W. T. Watts and D. J. Fleetwood
2476 J. A. Brown
2468 A. M'N. and M. A Wier
2477 W. J. Matthews
2488 W. R. Pape
2504 J. K. Smythies
2553 J. Eichhorn
2628 H. M. Mellor
2685 A. Ziegele
2686 H. Forbes
2691 P. H. Colomb and F J. Bolton
2734 F. Meyer and W Wainwright
3106 A. V. Newton
3688 A. V. Newton

Sealed February 25, 1868.

2435 W. C. Thurgar
2450 W. Pedder
2464 J. and R. D. Paulin
2465 W. Muir
2484 C. Gelstharp
2486 H. Vallance
2487 C. Tessier
2494 E. Y. Robbins
2496 E. T. Archer
2522 F. Versmann
2528 A. M. Clark
2529 J. G. Tongue
2547 W. R. Lake
2548 C. E. Brooman
2590 P. R. Couchoud
2683 A. M. Clark
2710 A. Taylor
2739 J. H. Johnson
2799 J. H. Johnson
2973 W. Brookes
3358 A. V. Newton
3633 J. Davidson
3662 W. E. Newton
31 W. E. Newton

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

466 T. Ogden
481 R. Willison
488 C. V. and A. O. Walker
504 G. Sinclair
522 J. Howard
548 M. B. Nairn
559 J. M. Hart
581 J. Park

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

484 J. Howard and E. T. Boustield
486 J. Young
500 W. Whalley
453 A. Barclay
516 J. Wilson
518 C. Beslay

LIST OF SPECIFICATIONS PUBLISHED

For the week ending February 15, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, MARCH 6, 1868.

COMPARATIVE MERITS OF ZINC AND COPPER AS COATINGS FOR THE PROTECTION OF SHIPS' BOTTOMS.

A SHORT time ago we noticed that the iron plates which were coated with zinc on Mr. Daft's plan had been taken out of the water alongside Portsmouth dockyard, after an immersion of nearly three years, and that they were found to be in a satisfactory condition to those concerned, being covered with a thin deposit of mud only. That iron plates protected by a coating of zinc received no damage from the chemical action of sea water was proved some years ago by the experiments instituted by Dr. Calvert and Mr. Johnson, of the firm of Richard Johnson and Nephew, galvanizers, of Manchester, which experiments and their results were published in a small pamphlet at the time, and noticed by us in this Magazine. It was then shown that, practically, sea water had no chemical action on galvanized iron, and it was thence concluded that galvanized iron was the proper material of which ships should be built, at least to above the water line. No doubt, it was hoped by the experimenters that those who use iron ships would see their own advantage in the use of galvanized iron, and thus contribute to the advantage of the galvanizers. But they have not seen it yet: they are an obtuse set, these shipowners; still we think there is something to be said for them even, although Mr. Daft has again proved the same fact to them. The fact is that shipbuilders are bewildered with an embarrassment of expedients for the protection of ships' bottoms from fouling and corrosion. Copper, zinc, paints, cements, glass, soaps, and even kitchen stuff (!) have each in turn been recommended, and even patented, as the one thing needful to prevent the evils of fouling and corrosion.

Amongst all these expedients there is no question that copper or zinc are the most likely to succeed: yet which will—who shall say? Copper and zinc have each their advantages and their disadvantages, and, moreover, each possess advantages that the other does not, even supposing them to be successfully applied. There is more difficulty in the application than has yet been noticed by anyone. The advantages claimed for zinc are these,—that it is not attacked by sea water, that it is electro-positive to iron, that it is easily applied to the iron, and that it is inexpensive. The advantages claimed for copper are these,—that it is but slightly acted on by sea water, that it *is* slightly acted on by sea, thence producing a poison which destroys shellfish and sea weed. Copper being much less acted upon by sea water than iron is, it acts as a protector to the iron from corrosion; still, being slightly acted upon, thence producing a poison, it protects the ship from fouling. Zinc, not being acted upon by sea water, effectually protects the ship from corrosion, but then, from this very inaction, it must fail to protect the ship from fouling. An advantage is claimed for zinc over copper in that it is electro-positive to iron, while copper is electro-negative; consequently, it is said that if by any means the zinc were abraded no evil would happen to the iron: the zinc, being positive, would alone suffer and the iron be protected; whereas, if the copper were abraded, the iron only would suffer, the copper being negative to it. It is unquestionable that in case the copper were abraded the rapid destruction of the iron would result' but with regard to the alleged properties of zinc in sea water the results of abrasion are not quite so clear.

It is alleged that zinc is inactive in sea water, but that iron is active; which, then, is positive? We should say the iron, and we think all electro-metallurgists would say the same. How, then, would zinc protect iron in such a case? The iron must be destroyed and the zinc protected by the iron, which is a result not to be wished for, neither devoutly nor otherwise. If this be so, then zinc is open to the same objection as copper, in this, that in case of abrasion it will be the means of the rapid destruction of that which it was meant to protect. However, we must confess that we doubt the statement that zinc is less acted upon in sea water than copper is, and we will give one reason at least which we think is conclusive. A good many years ago the copper sheathing of wooden vessels did not last so long as the owners of the vessels desired (which is not surprising at any time); consequently, a remedy was asked for. Sir Humphrey Davey said to these shipowners, "I will tell you what to do; nail pieces of zinc on to your copper sheathing, and the copper will be protected, and the zinc only will be wasted away." Of course, it was immediately done, and the result was as the great chemist had said it would be; but there was another result along with it which was neither expected nor desired, namely, this, that though the copper was preserved it would not protect the ship from fouling; therefore the zinc was discontinued. There are two advantages which zinc has over copper, and these are, that it is more easily applied than copper, and is much cheaper; but then copper prevents fouling and zinc does not, though it will prevent corrosion.

On consideration, we think that the prevention of fouling is of at least as great importance as the prevention of corrosion. All we have said on this matter is on the supposition that the coatings are successfully applied. Taking the last two methods of applying the two metals to the iron, namely, Barnabe's for copper and Daft's for zinc, we see many difficulties to be overcome. The separate plates being coated—and what sane person would attempt to coat a whole vessel at once—these single plates must be riveted together. If the coating be copper it will hardly stand hammering down at the joints; besides, how are the rivet heads to be protected; in fact, whether the coating be copper or zinc the same difficulty will be found in building the plates into the bottoms of ships. We do not see any chance of successfully applying either copper or zinc directly to ships' plates. With respect to armour plates the case is different, for these are attached to the vessel with screw bolts, the heads, or the whole of which, can be covered with the coating metal. For armour plates we think copper has the advantage, as it prevents not only corrosion but fouling. To apply a protecting coating to the bottoms of ships successfully, we think it is clear that it must be as a sheathing, and between the sheathing and the iron there must be some insulating substance to offer some protection in case of abrasion. This being done effectively, as we think it can be, then we would say copper is the best material.

PRESSURE OF GAS IN CITIES AND TOWNS.

IN spite of all attempts to supersede its office and usurp its functions, coal gas has continued to maintain its supremacy, ever since the introduction of that useful and brilliant method of artificial illumination. From the time when the allied sovereigns paid a visit to London in 1814, and an ornamental structure in St. James's Park was lit up by 12,000 gas-lights in honour of the occasion, until now, all endeavours to substitute a material other than coal for the same purpose, have proved completely abortive. Strenuous efforts were made both by private individuals and incorporated companies in favour of oils, resins, fats, and numerous bituminous substances, all of which turned out utter failures when subjected to the trying ordeal of purchased shares and negative dividends. A few of the provincial towns, among which may be included Liverpool, encouraged the erection of works and premises for the manufacture of oil gas, but, unfortunately, the speculation turned out so gross a miscalculation, that apparatus for making gas from coal, was ultimately established upon the very site selected for its anticipated rival and supplantor. Theoretically, the superiority of oil gas is well known. It is free from most of the impurities common to coal gas, and has a far greater illuminating power. The facts of its ill success as a counter scheme to its rival is worth noting, as a proof that however accurate theory may be, it is worth little or nothing if it cannot combine with or adapt itself to the requirements of practice.

The question of the regulation of the pressure of gas has always been one of considerable importance in its distribution and consumption. It is not merely a matter of uniform and constant flow from the gas works, as might be at first imagined; the problem to be solved is much more difficult and complicated. What is required is that the flow should take place under conditions, which would allow the consumer to receive it under a constant pressure—a pressure which should be regulated in a manner, so as to be perfectly independent of the variations taking place in the gasholders, and totally uninfluenced by the different obstacles and impediments inevitably contingent upon an extended course of service pipes, and the disadvantages of lighting a large district. Manifestly, if we suppose the gas to have quitted the gasholder, and entered the principal main pipe with a constant pressure, any want of uniformity subsequently apparent in its flow, must be due to the medium through which it passes, and by which it is conducted to the burners. A uniformity of pressure into the chief main from the holder can always be insured by means of a "governor," which regulates the escape of gas into the pipe, quite independently of any inequality of action in the gasholder, or any other cause which might be at work to retard or accelerate its flow. Through a pipe of a certain size a certain quantity of gas can always be passed, but, according to the ratio existing between the volume of gas passing through in a unit of time, and the sectional area of the pipe, so will the flow at the end of the pipe take place with or without a loss of the pressure it possessed on entering it; in other words, there will be a difference between the final and the initial pressure. There is, in fact, a limit to the velocity, which determines whether the pipe should be regarded as a reservoir, or as a channel of efflux. From experiments recently made in Paris, it appears that when the velocity of the gas exceeds 8½ft. per second, the pipe becomes a channel, and no longer acts as a sort of reservoir. It is a very simple matter for anyone to convince himself of the variation in pressure that occurs with respect to the supply of gas in London. All that he has to do is to regulate the cock, so that the stream shall be steady, and then observe it for five or six hours, or longer, and it will be found that at times during the night the flame will increase so much as to actually sing, and at others it will sink so low as scarcely to afford half the quantity of light it would at another time. This arises, unquestionably, from the variation in the actual number of lights burning at the same period—that is, the pressure depends upon the number of burners in connection with the whole system. By this it is not intended to convey the meaning that

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the initial pressure is understood, but simply that the pressure or its equivalent, the velocity, with which the gas reaches the consumer is materially influenced by the number of outlets in the vicinity. There is clearly a proper velocity, or, to speak more correctly, a minimum, adapted for burning the gas. If the velocity of flow be greater than the rate of combustion, there is a loss at once accruing to the public.

AMERICAN SMALL ARMS.

THE position of the heavy ordnance question in America, as revealed by the report of the Chief of Ordnance, General Dyer, recently occupied our attention. We now turn to the same source for information relative to small arms and ammunition. The chief features of the past year in this respect appear to have been the conversion of a number of Springfield rifled muskets into breech-loaders, and the introduction of central-fire cartridges into the service. Over 23,000 rifles had been converted up to the date of the report—October 19, 1867—but since then a great many more have been turned out of hand, so that at the present time the converted arms number about 50,000. These have been issued to the troops as fast as completed, and now nearly all the infantry serving in the departments of the Missouri and the Platte are armed with them. Monthly reports have been received by the War Department from the commanders of companies armed with this weapon, and which have been highly satisfactory and favourable to the arm, and furnish abundant evidence of its excellence and fitness for the military service. The almost unanimous opinion expressed by the officers is that the musket is simple, strong, not liable to get out of order, and extremely accurate in firing. Some officers have suggested slight modifications for the improvement of the arm, but the defects mentioned by them are said to exist in the unconverted arm, and to be in no way connected with the peculiar method of conversion. A few officers have recommended a further reduction of the calibre, while not one has expressed the opinion that it is too small. In a campaign against the Indians during last summer these arms are said to have done excellent service, very few having been rendered unserviceable. More have been reported as rendered unserviceable through carelessness than from all other causes. The report does not give any idea of the principle upon which the rifles are converted, which, to our mind, is a pity, as we should like to know which of the many American notions has been adopted. From the introduction of central-fire cartridges we of course infer the general principle of the new weapon, but we should like to have had a few details. Whatever the principle may be, we think it must be very far from perfect if it allows carelessness to render it unserviceable. This, too, indicates a defect in the military system which permits of such carelessness. The General, however, is very confident of this arm, firmly believing that no musket has been converted into a breech-loader in his country, nor in Europe, which is superior for military purposes to that which has been produced at Springfield Armoury, and that none equal to it in serviceable qualities can be produced at less cost. He, however, intimates that the arm is susceptible of some slight improvements, which, in fact, are to be introduced into future weapons. This is significant: trifles are sometimes of the first importance.

It is amusing—and might be instructive, if we had not had lessons enough here—to note the difficulties which the War Department has had to contend against in producing a good breech-loading musket. They arose from the impossibility of making any improvement which was not immediately claimed under some one of the many patents which have been granted for improvements in fire-arms, and from the extreme eagerness and strong efforts of some inventors and other parties interested in patents to have their improvements used by the Government. Many persons claimed to hold patents for improvements which were used in the conversion of the Springfield muskets; in some instances, several parties claimed to hold patents for the same thing, and it is believed that every improvement was claimed by more than one inventor. Rather warm work this for the department; so the officials declined to acknowledge the validity of any patents for improvements used in the conversion of the musket, knowing that it was not competent for them to decide the question, and believing that the proper course for patentees to take was to establish satisfactorily the validity of their claims, and then apply to Congress for compensation for the use of the patents. Congress will have enough to do if these inventors are only half as clamorous and persistent as some we have had to deal with in England. It does not speak well either for the Patent Office that a number of patents have been granted for the same thing. But these gentlemen will have to prove their claims before Congress will settle their little accounts, and this preliminary process will doubtless greatly thin their ranks.

We have already stated that the central-fire cartridge has been adopted, and the report states that they are "the first of the kind that have been introduced into the military service of any country, or manufactured anywhere in considerable quantities." Now, in this we differ from the gallant General, inasmuch as in our own country the central-fire cartridge was introduced into the service a year and a-half ago at least, and more than "considerable quantities" of them have been turned out, and a pretty noise they have made one way and the other. Going into figures, the General reports that about fifty thousand *can be* produced daily at Frankfort Arsenal, although he does not say how many *are*. The number, however, must be considerable, as upwards of seven millions have been manufactured, and 367,943 have been fired by troops, and in proving muskets and ammunition, only 1,317 of which have failed to explode—about one-third of one per cent. It is believed that no other cartridges have ever given such good results. Upon the whole, the total grand result of the report must strike every one as highly satisfactory—the best ordnance, the best small arms, and the best cartridges. The judgment of the reporter is, of course, based upon protracted trials, but with regard to the small arm we should like to have had some particulars of the trials. We are not indisposed to take for granted the statements of an official report, but as, in the case of the heavy guns, General Dyer entered somewhat into detail, we are a little disappointed that he did not do so with respect to the small arms. It would have enabled others to judge for themselves as to the high order of efficiency of the weapon had its principles of construction and the details of the experiments been vouchsafed.

THE EXPERIMENTAL FORTIFICATIONS AT SHOEBURYNESS.

THE question of our national defences has, like most questions, two sides. On the one hand, it is contended that forts should be so constructed as to be perfectly impenetrable to shot, even at the closest ranges. On the other, it is urged—chiefly by military men—that only such power of resistance is required as will meet the probable hazards of war. The one party would have our soldiers stowed carefully away behind an impregnable shelter, constructed at immense cost, their pluck and prowess being to a certain extent ignored, whilst the other gives the soldier credit for the possession of those qualities to which, in the main, victory in battle is due, and would see them properly sheltered within less expensive structures. We are not now going to discuss this question, but will merely observe in passing that considering what we are doing afloat, the second proposition appears by far the more reasonable for application ashore. The question of the best method of carrying out the principle of coast defences will, however, shortly be put to a practical test at Shoeburyness, where some experimental structures have been erected. It is our present purpose, then, to give our readers some particulars of these representative forts; when the experiments have been carried out we shall report the results.

The first point to which we would invite attention has a direct bearing upon the question we have already referred to, inasmuch as it involves the testing of various methods of protecting guns and men. With this view, a casemate has been erected which is covered with several kinds of armour and backing. The piers which carry that part of the arch immediately over the gun are 12ft. wide and 8ft. deep, and are covered with ¾-inch iron plates connected by angle irons with the protecting plates. The armour consists, in the first place, of a course of 2-inch plates which are laid over the entire face of the casemate, except, of course, the port. Where this plating is unsupported by the piers—as, for instance, in the space under the arch, which is allowed for traversing the gun—it is backed by a row of vertical caissons. These caissons are simply 15-inch cylinders, made of ¾-inch iron, and filled in with concrete; they are riveted to angle irons and cross bars of ¾-inch iron. The port is 3ft. wide and 3ft. 6in. high, outer dimensions, and it allows the gun a lateral range of 70deg. On each side of the port, and immediately in the rear of the armour-plate, is a solid forging of iron 9ft. long, 9in. wide, and 13in. deep, placed vertically, and which thus strengthens this, the weak point of the structure. These forgings are strengthened by horizontal distance pieces of iron 6in. wide and 7in. deep halved into them at the levels of the port sills. The tops of the forgings are bolted to a horizontal iron bar, having a sectional area of over 6in., and being bedded in the concrete backing, whilst at the bottom they are secured to a horizontal plate of 3-inch iron. To guard the gunners within from accident from splinters, the arches are lined with ¾-inch iron plates, and iron screens of the same thickness are placed inside. The piers and arch are built of concrete and brick in cement, the other parts of the casemate being of brick in cement. The brickwork of the arch is 18in. thick, and that portion of it which covers the space between the caissons and the piers is carried by wrought-iron girders. Above the brickwork is a course of concrete, which is 15in. deep at the crown of the arch. Bolt tubes are built into the masonry, and pass through the backing, so that the armour-plate bolts can be taken out, and the plates removed without disturbing the rest of the structure. This method of building in the tubes affords great facilities in constructing the works and plating them at the finish.

We now come to the armour-plating, of which there are in the present instance no less than six varieties, four of which contain a quantity of iron equal in each case to an 8-inch plate. The fifth has an amount equal to 8½in., but the sixth only equals 4½in., the space between it and the 2-inch plate being filled in with concrete. The first target of the six, counting from the left hand of the beholder, is a vertical strip of plating 4ft. 3in. wide and 8in. thick. The second is a strip of armour of the same width, but only 4½in. thick, connected with the 2-inch backing by hollow iron stringers placed vertically. These stringers are 7in. deep, and of a section giving an area equal to a 3½-inch plate. At this point in the casement is the port, and

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here is a course of 6-inch plating which extends across, above, and below the port, as far as its right edge. This plating is also carried on vertical stringers, but of a different pattern from the last, being Mr. Hughes' patent, with the shape of which our readers are doubtless familiar. The sectional form is somewhat that of the Great Western, or bridge rail, the area being in the present case about equal to a thickness of 8in. of iron. This armour is supported partly by the left pier and partly by the cylindrical caissons. On the right of the port is laid 4-inch armour-plating for a width of 3ft. 4in., carried on vertical stringers, similar to those used in No. 2 target, but somewhat heavier, to compensate for the loss of half an inch in the diminished thickness of the front plate. From the edge of this plate to the end of the casemate a 4½-inch plate is laid, partly on stringers, similar to the last, and partly on concrete, forming thus the fifth and sixth targets. The frontage presented to the firing gives a total area of about 360 square feet, the length being 30ft., and the height 12ft. We should add that this casemate is purely experimental, and does not represent anything previously constructed.

Turning to the representative structures, we first notice the Plymouth Breakwater Fort, which is in course of construction, the ironwork having been contracted for. As a simple shield is clearly an incorrect representation of a complete fort, some additions have been made in this target in order to render it similar, as regards strength, to the fort it purports to represent. Externally the front is an iron-plated target, 21ft. 9in. long, and about 13ft. 6in. high. The face slopes inwards 1ft. in the first 11ft. of its height, and above that it assumes a retiring angle of 45deg., the iron plating being reduced to a thickness of 3in. The outer armour consists of three 5in. plates running horizontally, out of the lower two of which the port, 2½ft. wide and 3ft. high, is cut. In rear of this armour is a layer of iron planks about 16in. wide, and 5in. thick, placed vertically. Behind these is a layer of similar planks above, and plates below, placed horizontally, and so as to break joint with the other planks and armour-plates. The total thickness of iron is, therefore 15in. The armour is supported by five iron girders, which are run up the back of the iron planks and armour to which they are bolted by through bolts. Each girder consists of two iron planks 1ft. wide and 5in. thick, placed 6in. apart, and connected at the top and bottom by cross bolts, while the bolts which pass through the armour and between the girder planks are secured by nuts to cross pieces of iron 1½in. thick, which connect the girder planks, and bind the whole ironwork firmly together. As, however, the fort is built of iron on a granite foundation, it is necessary that the tough plates be securely imbedded in the solid stone. To this end an iron plate, 2ft. 7in. wide, and 2½in. thick, is laid in a recess cut in the granite floor, and extends along the whole front. It abuts against the inside of the lowest armour-plate, and carries the planks and back lower plates, their edges being laid upon it. Holes cut through it, and about 6in. deep into the granite, receive the feet of the girders, which are thus rooted in the solid foundation, and serve to hold firm the foot of the armour. The plating and its vertical girders abut at the top against an iron plate connecting the ends of longitudinal girders, which support the arches of the casemate roof, and are in their turn held up by a box girder, supported at its extremities upon piers of brick in cement 4ft. thick, cased with ¾-inch iron plates. Between these piers and the rear of the armour-plate girders, a clear space is left in order to prevent any damage the front may receive from affecting the stability of the piers and roof, and also that the bolts passing through the armour-plating and girders may be reached for removal.

The essential points in which this experimental front differs from the fort itself may now be referred to. In the first place, in order to compensate for the want of continuity of thrust obtained in the fort, tie-rods are built into the arches of the experimental front. In the true fort the front is oval, whilst in the experimental one the face has been made flat, in order to save expense. This, again, gives a weak point, to meet which the shape of the pier has been slightly altered. An old piece of masonry having been utilized, there is not room for an entire pier; its dimensions, therefore, have been reduced. Again, the spacing of the roof girders is not quite the same, because the target, representing only a part of the real fort, could not have its girders projecting in the air. The ends of the plates lack the continuity of support obtained in the fort. This is to some extent met by increasing the size of the end bolts, but in any case the ends must be weaker than the same points in the fort. One or two alterations have been made in the target, which, however, are to be introduced in the fort itself. For instance, muzzle-pivoting carriages are to be used in future, so that the size of the fort is greatly reduced. The substitution of an iron plate in the third thickness instead of iron planks is also new, but is likewise ordered for the fort. Spare test-plates will supply the iron wanted for the purpose. The experimental work has, however, one advantage in this respect, that the hind plate will be about 21ft. 9in., while in the real fort the length is about 14ft. Other forms of armour-plating might be substituted for the one at present proposed, without altering the piers or the iron roof supports, but the War Office estimates show that this would involve an extra expense. The ironwork for the experimental front costs about £2,500 per gun, whilst the plates and compound backing for the armoured casements cost about £2,800 per gun. John Brown and Co. propose solid plates 14in. or 15in. thick, held between vertical iron beams grooved to receive the edges of the plates. This system, according to the War Office estimate, is calculated to involve an outlay of about £3,500 per gun for ironwork alone. This is, of course, a very large advance on the other systems, although the advantage gained in having a solid plate would be very great. But we are inclined to think the estimate is based on the production of only a few of these large plates, inasmuch as we have been informed by the above-named eminent firm that when these extra thick plates are required in anything like quantity, the cost will be but little higher than that of the ordinary plates. A system of 18-inch cast-iron backing and an 8-inch plate with an inner skin of 1-inch iron could be produced for about £2,000 per gun.

The last structure we have to notice is the Millwall shield, which was originally made by the Millwall Company, for a trial of Mr. Hughes' stringers by the War Office. This shield has a front of 12ft. by 8ft., and is composed of armour-plates 6in. thick on the upper half, and 9in. thick on the lower half. The backing consists of Mr. Hughes' wrought-iron stringers placed horizontally, their sectional area being about equal to a 2-inch plate. Behind the stringers, and riveted to their bases, are two thicknesses of ¾-inch plates, which rest against another series of stringers placed vertically, and having a depth of about 7in. We understand the cost of this shield to be £1,200, or £200 more than that of the Gibraltar shield. The hollow tubes for the bolts are introduced in the Millwall shield. To test the increased resistance to be obtained by adding plating to the outside of existing structures, three 1-inch plates have been bolted to the outside of half that portion of the shield protected by the 6-inch plate. The whole shield is further strengthened and supported by iron struts at either end. Besides the foregoing, there will be trials of some of Sir John Brown's 15-inch and other heavy armour plates, the results of which will add materially to the value of the experiments. According to the present arrangement, which, however, may be altered before the experiments are commenced, these structures are to be tested by firing from heavy guns. The 12-ton, the 18-ton, and possibly the 23-ton rifled guns, and the 19½-ton American 15-inch smooth-bore gun, are to be brought to bear on them. We shall look forward with interest to these trials, as their results cannot fail to prove highly instructive. We are also hoping for particulars of the gunnery experiments at Fortress Monroe, in America, which were talked about some time since, and which would be highly useful for comparison with our own results.

NOTICES OF BOOKS.

NO public questions, affecting vitally the material condition and comfort of the people, and the welfare of the community, are of greater importance, or better entitled to attention, than the questions of water supply for our cities and towns; and, again, the kindred subjects of the most effective mode of removing, and the most profitable way of disposing of the waste matter in sewage which proceeds from our clustered population. These important subjects are ably dealt with in the volume before us.* Mr. Haskoll dashes into his great subject of water supply rather abruptly, and in such style as to convey the impression, which his text serves to confirm, that he is perfectly familiar with his subject. In the first chapter, an immense amount of interesting information *apropos* of catchment basins is given relative to the upper basins of the Severn; to the rainfall on the gathering grounds of the Manchester Waterworks in Longendale Valley; to the fall in the Cumberland and Westmorland lake districts; and in the gathering grounds of Loch Katrine, and the district from which the city of Glasgow is supplied with water. The subject of rainfall is exhaustively discussed by the author, who has been at great pains to collect a large mass of valuable information from almost all parts of the country. The geology of the subject in relation to water supply from under ground is also fully treated; and, in connection with this branch of the subject, all is said that needs to be advanced in relation to well-boring. Many very curious facts are given by the author relative to the bodies and supplies of fresh water which are to be met with in various situations, and subject to various influences and circumstances, in different parts of the country. The distinctive chemical qualities and ingredients of such water supplies is also fully narrated, and the mass of facts and observations brought together upon the subject, as a whole, is so complete as to entitle Mr. Haskoll's book to rank as an indisputable authority upon many points of this important subject, and to be accepted as a trustworthy guide by all who are concerned in this branch of engineering practice.

The author discusses with equal thoroughness the cognate subjects of sewage and sewage utilization; and, as in the case of water supply, he gives full particulars concerning actual systems, as well as theories, and discusses the most important achievements and projects for dealing with the valuable products known as sewage, which have been hitherto almost entirely wasted. The undeniable merits of Mr. Haskoll's work are its comprehensiveness and lucidity, the large mass and masterly arrangement of the information it contains, and, not least, the author's thorough independence in his treatment of the vexed questions with which he has undertaken to deal.

It is at all times delicate, and it is often

* "The Practice of Engineering Fieldwork, Waterworks, Sewers, Sewage, and Irrigation." By W. DAVIS HASKOLL, C.E. London: Atchley and Company.

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difficult, to judge correctly of motives, but it may not be doubted, as to the production of many books, that, like Peter Pindar's razors, they are "made to sell." Some authors reel off their text as the conjuror draws ribbon from his mouth, and others make books by the help mainly of scissors and paste. One class of author is content if his book sells, and is perfectly indifferent as to whether anyone is the wiser or the better for its publication; and bookmakers of another class are pleased enough if they see their name in print, for "a book's a book although there's nothing in't." But there is another and a higher class of writers, with whom profit, or the exhibition of their names upon title pages, are very subordinate considerations, who collect and elaborate with great labour and toil a large amount of valuable information, which they digest and reproduce with a view to far higher practical purposes than their now fame or aggrandisement. Of this class of work is the book before us.* The subject undertaken by the gallant and accomplished author is intrinsically dry and difficult of treatment, but, as regards the one quality, he contrives to invest the subject with much information that is fitted to interest any reader of ordinary intelligence, and, as regards the difficulty of the subject, he lays down his premises firmly and clearly, and draws from them conclusions that only a sophist will attempt to controvert. Colonel Smith was formerly Master of the Calcutta Mint, and in that capacity acquired such an amount of knowledge on this intricate subject as has given him a complete mastery over it. He accepts the conclusion of the Indian Government Commissioners on Currency that the demand for a gold currency is almost unanimous throughout India, but he dissents from their recommendation to introduce a ten-rupee gold coin as a legal tender, and recommends instead the introduction of the sovereign as the basis of the Indian currency. As touching the desirability of the introduction of gold into India, he adverts to the absurdity of ships traversing half the globe freighted with gold in one direction, and with silver in another, for the adjustment of balances of trade capable of settlement without either voyage, and with a saving of expense of a quarter of a million sterling annually. The writer gives incidentally a great amount of valuable and interesting information touching seignorage, the value, and fluctuations in value, of the precious metals, and upon other subjects. He shows conclusively that his recommendation might be adopted satisfactorily by an easy adaptation to it of the rules and practices of the Mints, and urges that the adoption of the recommendation of the Commissioners, as regards their proposed mode of conversion, would inevitably be attended with disastrous consequences. It is to be hoped that Colonel Smith's able statement may secure, as it well deserves, the attentive consideration of those whom it may concern, and primarily of the Secretary of State for India.

Much matter crops up from day to day to remind and impress us that the railway interest is of vast magnitude and importance. The annual returns by the Board of Trade concerning railways, to which we recently adverted, communicate a great mass of interesting particulars touching the number of miles open, capital, passengers, live stock, goods and minerals carried, traffic receipts, rolling stock, &c.; but this compendium is altogether barren in one important particular —the number and classification of the employés who conduct, or are concerned in the conducting of this enormous traffic. This information is supplied in an admirable little work,† by Mr. W. F. Mills, of the Railway Clearing House, the indefatigable secretary of the Railway Servants' Provident Society. The special design of Mr. Mills' work is to investigate and record the numbers, classification, wages, and special hazards of railway employés, and to give an account of the various provident societies connected with the service. In 1860, a Parliamentary paper was published, giving the numbers of the respective classes of railway officers and servants then employed in the United Kingdom, but no similar return has been published since that date. Taking that return as his datum, and including the 4,000 miles opened since then, Mr. Mills arrives at the conclusion that there are now employed in connection with the railways of the United Kingdom 19,962 officers and 200,008 servants, or a grand total of 219,970. Of the first class there are 438 secretaries and managers, 3,933 station masters, and 13,297 clerks. In the second class are 5,171 engine drivers, and rather larger numbers of firemen and guards respectively, with 40,167 artificers, 25,381 porters, 12,901 platelayers, and 81,284 labourers. Mr. Mills's principal object in the interesting work he has produced appears to be to promote the interests of the provident societies connected with railways, of which he gives a full account. His labour in his book appears to have been undertaken and gone through *con amore*, and will, we hope, serve well the purpose for which it was intended. It is well worthy of the attention of the general reader, and certainly demands the attention of all who are personally connected with "the railway service."

One of the first attempts to produce a succinct or condensed account of the "Exposition Universelle" has been forwarded to us from Paris,* in a *brochure* of some 220 pages. It does not pretend to be a record of everything that might be of interest to the scientific and professional man, but merely treats of the more important and salient features in connection therewith. We are somewhat at a loss to conjecture why so large a space should have been devoted to "Céramique-Glaces-Verrerie," and so comparatively small a number of pages allotted to a subject so important as that of "Matérial des Chemins de Fer." A chapter is given to the well-known establishment of "Creusot," a full description of which appeared in last year's volume of our contemporary "The Engineer;" and special notice is made of "The Dockyards of the Mediterranean." A history of these establishments will be found in our present columns, including an account of some of the most remarkable productions of their workshops. The subject of artillery is briefly treated of in a dozen pages, and the author considers the display of English ordnance to be particularly interesting, although Blakeley and some other manufacturers were not represented.

The latter half of the volume is composed of gratuitous information furnished by engineers, manufacturing firms, and others specially concerned in the various arts of construction and branches of industrial enterprise. One would suppose, at first sight, that but very little difficulty would be experienced in enlarging a volume to almost any extent by these means. The reverse the author states to have been the fact. So far back as 1865 the publishers intimated to all intending exhibitors that they would be glad to insert gratuitously any information, descriptions, and cuts, that would be useful and acceptable to the public, and anticipated a correspondingly liberal return for their offer. They confess to be very much disappointed, much of the information forwarded being of a character so limited that it was little better than useless for publication; and in many instances cuts and diagrams were sent without any accompanying description, and consequently had to be totally rejected. Such of the communications as could be rendered presentable have been collected, and constitute the "Documents Communiques" in the "Etudes." We think a considerable improvement would have resulted by arranging these short articles, notices, and paragraphs in alphabetical order, a plan that would greatly facilitate reference, and enable one to see at a glance whether any particular article was described in the volume.

* "A Gold Currency for India and the Introduction of the British Sovereign." By Colonel J. T. SMITH, F.R.S., &c London: C. and E. Layton, Fleet-street.

† "The Railway Service: its Exigencies, Provisions, and equirements." By W. F. MILLS. London: W. J. Adams, leet-street.

* "Etudes sur L'Exposition Universelle, 1867," Par Turgan. Paris: Michael Levy Frères, Libraires-Editeurs, Rue Vivienne, 2, Bis, et Boulevard des Italiens; 15, A la Librâire Nouvelle.

ELECTRICITY AND TELEGRAPHY.

THE submarine cable from Dunwich to Zandvoort, on the coast of Holland, which we announced some time ago as broken, has lately been repaired. The time occupied in the necessary operations has been longer than usual, on account of the bad state of the weather, the unusual quantity of high winds compelling the repairing ship to remain in harbour.

We believe a Telegraphic Convention will be held this year at Vienna, to revise the last International Convention at Paris. We trust our Government will send over a representative on this occasion, and subscribe like the other European Governments have done to the Convention; from correspondence which has lately taken place we have every reason to hope they will do so. The position our Government stands in as owners of the Persian Gulf and Indian lines, and in view of the probable transfer of the English systems, renders it incumbent upon them to take part in the conference.

The submarine cable which connected the south of Sicily with the African coast has been for some time interrupted. The breakage is supposed to be about half way in deep water, at a distance of about forty-five miles from Marsala. The French steamer, "Dix Decembre," has been obliged to put back to Toulon, without—although many attempts have been made—being successful in repairing the cable; the two ends being broken in very deep water render grappling difficult. This vessel was fitted up by Mr. Siemens for repairing operations with the necessary machinery, but so arranged that the operations were carried out at the stem of the vessel instead of at the bows. Although this plan may be useful for suddenly reversing in paying-out operations, when a fault has occurred, and it is necessary to recover some of the cable, yet when the work required to be done is purely grappling and repairing, we certainly have the notion of an "old sailor that the bows of a ship are the proper place" for such operations. The "Dix Decembre" will take in more cable, in order to complete the repairs at an early date.

We anticipate shortly an announcement that the rates for messages in Italy will be greatly reduced.

Portugal is following in the steps of France with regard to her recent innovation for telegrams to be forwarded to vessels at sea. We learn, by a Royal decree, that a system of semaphores is to be established on the Portuguese coasts in connection with the land telegraph, so that on payment of certain rates, messages can, as in France, be sent to vessels of all nations.

We have at various times noticed electric thermometers, but lately a thermometer has come under our observation that we are not aware of having appeared in our columns: the invention is for making electricity, in connection with a thermometer, regulate the temperature of a room. The apparatus consists of an ordinary mercurial thermometer, at the bottom of which, in connection with the mercury, is inserted a platinum wire. Another wire, capable of being elevated or depressed, is placed at the other end of the thermometer. These two wires are in connection with the two poles of a battery, and forming part of the circuit is an electro-magnet, whose armature controls the opening or closing of a valve for the admission of hot air.

When it is required to preserve a room at a fixed temperature of, say, 60deg., the point of the upper platinum wire is brought to the required number on the thermometer; the circuit being incomplete, the valve is open, hot air is admitted until the

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mercury registers 60deg. When the circuit becomes closed the electro-magnet at once comes into action, and the valve is shut, cutting off the supply of hot air. When the temperature becomes reduced the valve is again opened; so, it will be seen, that a nearly even temperature can be maintained. This apparatus has already been introduced into practice, and so arranged in hothouses that the temperature has scarcely varied a degree.

Some experiments by Messrs. Janin and Roger on the light obtained from a magneto-electric machine confirm what has been already remarked, that the light from these machines is more applicable to lighthouse purposes than that obtained from a battery, on account of the light from the incandescent carbons being less blue and less rich with chemical rays. The object of these experiments was to observe the effect upon the carbons of the alternate direction of the induced currents of a magneto-machine. Throughout the experiments the light from the lamp with carbon points was continuous, but with the series of currents in the one direction the light had an increased brilliancy as well as the arc, whilst with the currents in the opposite direction, the arc was invisible and the carbons less brillant.

PHOTOGRAPHY.

PHOTOGRAPHIC GLASS—CHANGES IN GLASS—IRON IN GLASS—MANGANESE IN GLASS—GLASS FOR TRANSPARENCIES AND LUNAR PHOTOGRAPHS—CEMENTING GLASSES.

ALTHOUGH glass is popularly supposed to be one of the most unchangeable substances that man can make, the changes that take place in it very shortly after manufacture are of the greatest annoyance to photographers. The rays of the sun which act upon photographic films are, some of them, invisible to the eye, because they belong to the extra-violet part of the spectrum, and to most of these rays all kinds of glass are opaque. Hence a longer exposure of the plate in the camera is always necessary when a picture is taken in a glass house than when it is taken in the open air, because the period of vibration of the molecules of glass is such that some of the extra violet rays of the spectrum are absorbed and completely cut off from the sitter. Yet the photographer cannot day by day take all his pictures in the open air because of the changes of weather or temperature, the disturbance of dresses and drapery caused by wind, and because of other palpable impediments. So, at the outset, he is obliged to work beneath a medium which cuts off part of the photographic rays.

Glass not only cuts off most of the short invisible rays, but some of the visible part of the spectrum also, as may be seen by the greenish or yellow tinge of nearly all descriptions of glass. For this reason there has been a demand on the part of a few intelligent photographers for a very white and transparent glass for their operating rooms, that known in the market as "crystal sheet" being the description thus selected. Sad experience has, however, proved that the advantage gained at first by the use of white glass is lost in the long run, for, after exposure to daylight and sunlight for a very few weeks, this glass changes colour, most frequently acquiring a yellow tint, thereby becoming the very worst glass for photographic purposes. A glass of greenish tint, like those commonly on sale, is very objectionable in photography. A few of the white glasses acquire a slightly purple instead of a yellow tint by exposure to light, and if these samples could be known beforehand, they would be the best for photography, but nothing but experiment can test the fact. In the midst of all these difficulties the conclusion seems to be general that under present circumstances common crown is about the best glass for photographic houses, and that the sample chosen should be thin, have a blue rather than a green tint, but be as white as possible. A decidedly green glass should be rejected.

Mr. Gaffield, an American, has tried experiments with all kinds of common glass, his results showing that if a piece of glass be cut in two, and one-half be exposed for a few weeks to the sun, while the other half is kept in darkness, the former in the majority of cases will be found to have changed colour. His experiments were considered at the last meeting of the Photographic Society of London, and no better suggestion could be made than that common crown must be employed for the present. Mr. J. A. Forrest, a glass manufacturer of Liverpool, says that the clearness and transparency of glass depends much upon the kind of stove used in the melting, but the principal cause of deleterious change of colour of glass in daylight is the presence of an oxide of iron. This oxide of iron finds its way into the crucible, as a constituent of the sand employed in glass-making, and sand free from iron cannot be found either in this country or on the Continent. Some districts yield sand more free from iron than others, and as far as Mr. Forrest knows, the sand from Leighton Buzzard is the best to be had in Europe, next that of Fontainebleau, but the best of all is from the Cape of Good Hope. Iron causes the glass to have a greenish tint at first, changing to yellow by exposure to light. Therefore, the real question at issue is, whether it will pay glass manufacturers to get rid of this iron in the sand by chemical means, and to produce a better glass by lengthening the time of melting. If photographers were known to be willing to pay a higher price and to take large quantities of such a glass, the supply would soon meet the demand. It would be necessary that the photographic world should have convincing evidence from the manufacturer that his glass is durable and unchangeable, and not ordinary glass, sold as a superior article.

The presence of manganese in some samples of common glass causes rapid tinting of the glass on exposure to daylight, but as the colour thus produced is usually purple it is not so very objectionable.

Optical glass is often anything but durable. Some samples of it are troubled with a disease known to opticians by the expressive but not very nice name of "sweating." Others sometimes become covered with a white crust after long exposure to air, because of the large quantity of lead entering into their composition.

Of all photographic silver prints those taken on collodion, and afterwards cemented with Canadian balsam between two pieces of glass, are believed, for reasons recently set forth in this Magazine, to be the most imperishable. The amber tree of prehistoric times once dropped its liquid gum along the shores of the Baltic, and often did it fall "pat" upon an unlucky insect, preserving it to our day in its crystal case. Amber is a turpentine resin, so also is Canada balsam, and if the latter will only preserve the collodion picture as long as the former has preserved earwigs and blue-bottle flies, photographic transparencies are very imperishable. It has been said that a film of Canada balsam between two plates of glass rapidly becomes very brittle, also that arborescent cracks sometimes creep into the film of balsam which cements telescopic object glasses. Very little, however, is known as to the durability of films of Canada balsam between plates of glass, and information on the point is not easy to obtain. Nevertheless, most cemented lenses appear to be permanent enough, and to show no symptoms of coming apart after the lapse of years. Marine glue of pure quality has been suggested as a suitable cement for transparencies.

Supposing Canada balsam so placed to be, as a rule, practically imperishable, the question arises what is the durability of the glass enclosing the picture. Most kinds of glass, when finely powdered, are largely soluble in water, though not so when unbroken; hence it is supposed, with reason, that the inside of a sheet of glass is more pasty and soluble than the external surfaces. In the early days of photography it was found that "patent plate," a glass which has its natural surface ground and polished away, yielded more readily than common glasses to the action of hydrofluoric acid. Mr. Warren De La Rue once used what is called in the market "extra-white patent plate," in taking his photographic negatives of the moon; but after lengthened experience he rejected it because he found that the glass was so hygroscopic that it destroyed his negatives if they were left lying about in the observatory a considerable time before cementation to a second piece of glass. He now uses "polished flatted crown," selecting the pieces with great care. For all these reasons it seems that polished flatted crown is as durable a glass as can be used for cemented transparencies, and that crown glass is durable is proved by the fact that beads of it, several thousands of years old, have been found in Upper Egypt, in some of the tombs of the Kings. M. Stas, the celebrated chemist, is now giving attention to the questions affecting the durability of glass, and some of his experiments were recently recorded in the "Chemical News." Perhaps, after a time, now that so much attention has been drawn to the subject, a permanent, and in every respect satisfactory, photographic glass will find its way into the market. For all purposes, whether for glazing, for negatives, or for transparencies, it is desirable that a thin rather than a thick glass should be introduced.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

NEW ALLOYS OF TIN AND LEAD—PROCESS FOR STAINING WOOD—PRESERVATION OF BUILDING MATERIALS—A MODIFICATION OF SORET'S CEMENT—MALLETT'S PROCESS FOR OBTAINING OXYGEN AND CHLORINE.

TWO new alloys of tin and lead are described by M. Plho. While containing less tin than is used in common pewter, they are said to possess most of the advantages of that useful alloy. They are not acted upon by vinegar, sour wine, or salt water. The first is made by melting 1 part of tin with 2·4 parts of lead. The lead is first melted and skimmed, then the tin is added, and the mixture is stirred continually with a wooden stick until it begins to cool, to prevent the lead from settling to the bottom. This mixture has the density of 9·64, and its melting point is 320deg. Fahr. It may be rolled cold, and the plates do not crackle when bent. It takes a very good polish, and tarnishes but little on exposure. It will mark paper like lead, and is so soft that it may be scratched with the nail, but it will not foul a saw or file.

The second alloy is made by melting together in the same way 1 part of tin with 1·25 parts of lead. This alloy is less elastic and harder than the foregoing. It is rather brittle, less malleable than the former, and fills up a file. Neither of these alloys was acted on by boiling with acetic acid for half an hour, and standing in the acid for twenty-four hours longer, nor had salt water any action upon them; hence, they may be useful for some kinds of utensils.

Dr. Stolzel adds another to the many receipts already given for staining wood of a brown colour. He first of all paints over the wood with a solution made by boiling one part of catechu (cutch or gambir) with thirty parts of water and a little soda. This is allowed to dry in the air, and then the wood is painted over with another solution made of one part of bichromate of potash and thirty parts of water. By little differences in the mode of treatment, and by varying the strength of the solutions, various shades of colour may be given with these materials, which will be permanent, and tend to preserve the wood.

We have recently seen notices of the extended use of alkaline silicates in Germany for the preservation of building materials, both stone and wood. The latter application may be noticed here with the remark that such a fire as that which recently occurred at Charing-cross Station could not have happened if the woodwork had been protected by the means noticed. The cost is but small, and the immunity it gives from fire is complete. According to the expired, and almost forgotten, patent of De Wylde, the woodwork is first saturated with a very dilute solution of silicate of potash, as nearly neutral as possible, and when this has dried, one or two coats of a stronger solution are given. When lives are lost by fire almost daily, it seems strange that such means of protecting wooden staircases and flooring should be neglected.

We have before mentioned Soret's cement, which is formed by making oxide of zinc into a paste with a solution of chloride of zinc. This paste quickly sets into a hard mass, which may be applied for stopping teeth and a variety of useful purposes. Dr. Tollens gives a cheaper form of the same cement, which may be used for stopping cracks in metallic apparatus, and cementing glass, crockery-ware, and other materials. He mixes equal weights of commercial zinc white and very fine sand, and makes the mixture into a paste with a solution of chloride of zinc having the density 1·26. The mixture sets rapidly, but allows plenty of time for its application. As it resists the action of most agents, it will be very useful in the chemist's laboratory.

A report, by M. Dumas, on Mallett's process for obtaining oxygen and chlorine on the large scale, which we described at page 128, vol. 86, deserves

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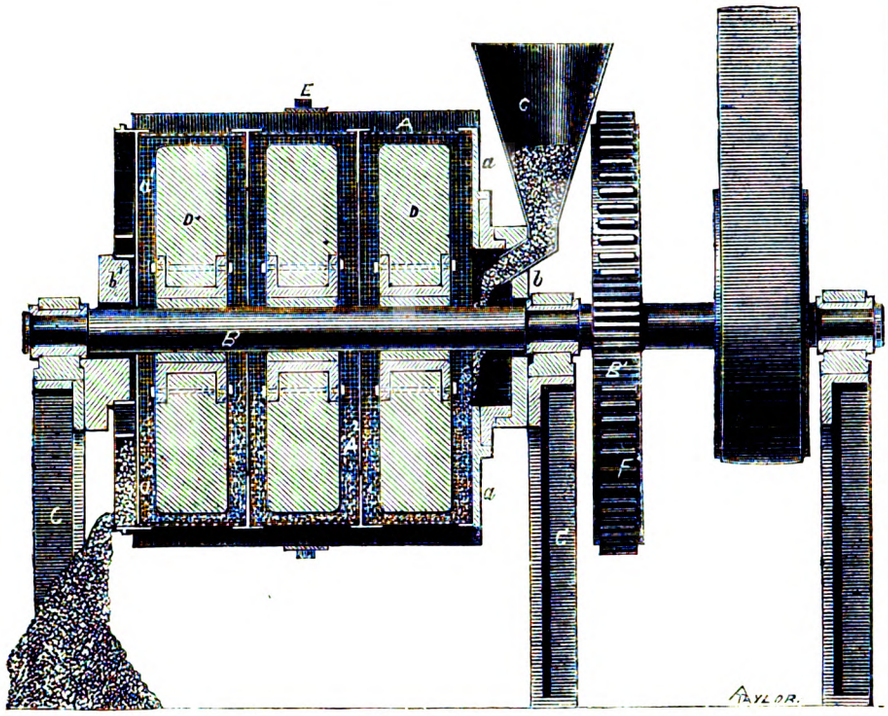
MACHINE FOR CLEANING GRAIN.

BY MR. A. MATHER.



notice, since it completely confirms the statements of the inventor. We refer our readers to the place mentioned for a description of the process, and need only say here that, according to M. Dumas, 100 kilogrammes of protochloride of copper can be made to yield daily from 15 to 18 cubic metres of pure oxygen, at a cost of from 50 or 60 centimes. Quite as successful results were obtained in the separation of chlorine from hydrochloric acid. The same amount of protochloride furnished chlorine for the daily production of 300 kilogrammes of chloride of lime. We hope the process will be adopted for utilizing the vast quantity of hydrochloric acid evolved from our soda works, and now, for the most part, wasted.

MACHINE FOR CLEANING GRAIN.

MR. ALEXANDER MATHER, of Edinburgh, has recently patented a novel arrangement of machinery which with slight modification is applicable as a wheat cleaner or as a barley mill. The accompanying engraving shows a longitudinal vertical section taken through the centre of the machine. A is a wire cylinder closed by end plates a a' of cast iron, and mounted concentrically with and turning on a horizontal shaft B. This shaft turns in bearings carried by the cast-iron standards C. Within the cylinder, and concentric therewith, are mounted three Newcastle millstones D D D; the number may vary according to requirements. These stones are made fast by cross bolts to metal centres which are keyed to the horizontal shaft. The cylindrical casing is strengthened externally by transverse bars A', and the space between the stones is divided for a certain depth by flanged rings A^2 which also serve to strengthen the cylinder, and form, as it were, bridges for the grain under operation as it accumulates in the cylinder to ride over in its progress to the discharging end of the cylinder. At its centre the cylinder is girt with a ring of spur teeth E, through which it receives a slow rotary motion. This ring of teeth gears into a pinion keyed to a second horizontal shaft mounted in bearings on the standards C and parallel to the shaft B. A rapid rotary motion is transmitted to the stones through a band pulley keyed on one end of the shaft B, and a spur pinion B' on this shaft gives motion through a large spur wheel to a spur pinion which drives the wire cylinder.

The end plates a a' of the cylinder are fitted to bearings b b^1, made fast to the standards C C. The end plate a is cast with a large central circular opening, and this opening is covered by a fixed bearing b, which has a central hole to allow of the free passage through it of the shaft B. Another opening is made in this fixed bearing to receive the spout of a hopper c. Grain is supplied by a constant feed to the cylinder from this hopper, the grain entering through the plate a and falling to the bottom of the cylinder. Here it is subjected to great friction between the periphery of the first stone and the cylinder, and as the grain accumulates it will rise above the edge of the first ring A^2 and riding over it will come under the action of the second stone, from which it will pass in like manner to the third stone, till it meets one of a set of discharge openings in the end plate a' of the cylinder. During this progress of the grain the dust or earthy matters are first removed and discharged through the meshes of the cylinder. A portion of the husks is then in like manner discharged and in a marketable condition, and the grain passes out at the discharging end of the cylinder in a clean state.

The end plate a' is fitted with adjustable shutters which slide in grooves provided to receive them, and are held in position by means of adjusting screws. These shutters serve to contract the discharge openings to any required extent, and thereby to regulate the discharge of the cleaned grain from the rotating cylinder. The time which the grain will take to pass through the machine will depend upon the speed of discharge permitted, and this being determined by the size of the discharge openings the amount of friction to which the grain is subjected may be regulated with nicety and with the greatest facility. For operating upon barley, which is a harder grain than wheat, a more extended rubbing surface will in general be required. This may be obtained by lengthening the cylinder and adding one or more millstones to those used for cleaning wheat; or by contracting the delivery openings, and thus keeping the grain longer under the action of the stones, the required effect will be produced.

One of these machines has been at work for several months past, giving excellent results. It is in use for cleaning wheat at the steam mills, Musselburgh, near Edinburgh. The proprietor of these mills states that it cleans the wheat very effectually, breaking the sand balls, which we believe is not easily accomplished by other machines. Several more of these machines are about to be set to work, and its efficiency will doubtless lead to its wide adoption.

ON THE DRYING OF STEAM BY WIRE-DRAWING, AND ON ITS LIQUEFACTION BY EXPANSIVE WORKING.*

BY W. J. MACQUORN RANKINE, C.E., LL.D., F.R.SS.L. and E.

THE following is a summary of Dr. Rankine's mathematical theory of this subject, and which forms an appendix to the paper we published last week:—

1. The "Thermodynamic Function" for a given substance in a given condition is a quantity which has the following properties—when the substance undergoes any change of dimension and temperature without communication of heat from or to other bodies the thermodynamic function is constant; and when such communication of heat takes place the change in the value of the thermodynamic function is equal to the dynamic equivalent of the heat received or given out, divided by the absolute temperature at which the change takes place, and is positive when heat is received and negative when heat is given out.

In symbols, let ϕ denote the thermodynamic function, $d\phi$ the change of its value, t the absolute temperature, and dQ the dynamic equivalent of the quantity of heat received by the substance; then

$$dQ = t\,d\phi; \quad . \quad . \quad . \quad . \quad . \quad (1)$$

and this is the general equation of thermodynamics. When there is no communication of heat ϕ = constant, and $d\phi = 0$.

2. For a substance which consists of unity of mass of a given fluid, partly in the state of liquid and partly in the state of vapour, the value of the thermodynamic function is as follows:—

$$\phi = \int \frac{K\,dt}{t} + (1-m)(v-v^1)\frac{dp}{dt}; \quad . \quad . \quad (2)$$

in which K is the dynamical value of the specific heat of the substance in the liquid state, m the fraction of the whole mass which is liquid, $1-m$ the fraction which is in the state of vapour, v the volume which the whole mass would occupy if it were wholly in the state of vapour, v^1 the volume which it would occupy if it were wholly in the liquid state, and $\frac{dp}{dt}$ the rate at which the pressure varies with the boiling point.

3. Let the suffixes 1 and 2 denote the values of the various quantities in the formula (2) at the beginning and at the end of the expansive working of the mass of fluid in question in a non-conducting cylinder. Then we have

$$\phi_1 - \phi_2 = 0;$$

and consequently,

$$\int_{t_2}^{t_1} \frac{K\,dt}{t} + (1-m_1)(v_1 - v_1^1)\frac{dp_1}{dt_1} - (1-m_2)(v_2 - v_2^1)\frac{dp_2}{dt_2} = 0; \quad . \quad . \quad (3)$$

an equation which gives the means of determining m_2 when the other quantities are given, and thus of ascertaining whether, and to what extent, the fraction of fluid in the liquid state will be increased at the end of the expansion.

4. By the following modifications the equation (3) is brought into a simpler form, which is approximately applicable in most cases that occur in practice. If the specific heat of the liquid can be treated as approximately constant the first term of equation (3) becomes approximately

$$K \text{ hyp. log. } \frac{t_1}{t_2}.$$

The factor $(v - v_1)\frac{dp}{dt}$ represents, according to the principles of thermodynamics, the quotient of the latent heat of evaporation (in units of work) divided by the absolute temperature. For many fluids the latent heat of evaporation can be expressed approximately by

$$a - b\,t,$$

a and b being two constants; and thus equation (3) becomes approximately

$$K \text{ hyp. log. } \frac{t_1}{t_2} + (1-m_1)\left(\frac{a}{t_1} - b\right) - (1-m_2)\left(\frac{a}{t_2} - b\right) = 0; \quad . \quad . \quad . \quad (4)$$

whence we obtain the following formula for the fraction of the mass of fluid which is in the liquid state at the end of the expansion—

$$m_2 = 1 - \frac{K \text{ hyp. log. } \frac{t_1}{t_2} + (1-m_1)\left(\frac{a}{t_1} - b\right)}{\frac{a}{t_2} - b}. \quad (5)$$

If the vapour at the beginning of the expansion, though saturated, is dry, m_1 is to be made = 0.

5. The values of the constants for water and steam are as follows:—

K = 772ft. per deg. of Fah., or 424 metres per deg. Cent.

a = 1,110,000ft., or 338,000 metres.

b = 540ft. per deg. of Fah., or 294 metres per deg. Cent.

The absolute temperature is found by adding 461 to the temperature on Fahrenheit's scale, or 274 to the temperature on the Centigrade scale.

6. When the expansive working corresponds to an indefinitely small fall of temperature $-dt$, equation (3) leads to the following differential equation:—

* From "The Engineer."

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$$\frac{K}{t}+(1-m)\frac{d}{dt}\left\{(v-v')\frac{dp}{dt}\right\}$$
$$-\frac{dm}{dt}(v-v')\frac{dp}{dt}=0; \quad . \quad . \quad . \quad . \quad (6)$$

which, by making the substitutions mentioned in Article 4, takes the following approximate form:—

$$\frac{K}{t}-(1-m)\frac{a}{t^2}-\frac{dm}{dt}\left(\frac{a}{t}-b\right)=0; \quad . \quad (7)$$

consequently,

$$\frac{dm}{dt}=\frac{Kt-(1-m)a}{at-bt^2}, \quad . \quad . \quad . \quad . \quad (8)$$

and according as this expression is negative or positive an indefinitely small extent of expansive working is accompanied by liquefaction or by drying.

7. The approximate rules for steam in the body of this communication were deduced from the results obtained by calculating a number of examples by means of the formulæ explained in this appendix. W. J. M. R.

Glasgow University, February 17.

MANUFACTURE OF BEET-ROOT SUGAR IN THE UNITED STATES.

By Mr. John Bimbeck.

THE manufacture of beet-root sugar has lately undergone considerable discussion in the daily papers. The following article upon the subject, from the "Journal of the Franklin Institute," may, therefore, prove interesting, as throwing a light upon the position of the question in America:—

Feeling a deep interest in all that relates to the successful progress of American industry, the writer was induced, during a late trip to the West, to make a visit to the beet-root plantation and sugar manufactory established at Chatsworth, Illinois. Chatsworth is a village of some 800 inhabitants, located in Livingstone County, on the line of the Toledo, Peoria and Warsaw Railway. The direction of this railway is east and west, connecting at Gilman, fifteen miles east of Chatsworth, with the Chicago branch of the Illinois Central Railway, at Chenoa, twenty-two miles west, with the Chicago, St. Louis and Alton Railway, and at El Passo, thirty-seven miles west, with the main line of the Illinois Central Railway. This location is on the prairie land; the marked feature of the country being its level surface, unbroken by either hills or trees of any size. The greater part of the land is uncultivated, and is covered with prairie grass.

The plantation and works of the Germania Sugar Company are located at the south-east corner of the village. They have 2,500 acres of land, 550 of which have been planted this year with the sugar-beet, and the balance with corn, oats, and hay. The refinery is located near the railway track, and consists of main buildings of wood, which contain the machinery proper, and several other frame buildings, used as storehouses and stables. The enterprise was started some four years since by the brothers Gennert, of New York, but has since been made a stock company, the members of which are all residents of the West. The planting is done in April, and the beets harvested in October, at which time the manufacturing commences and continues until March. On harvesting, the beets are piled in trenches in the fields for protection from the frosts, enough being taken each day to supply the working capacity of the refinery. The machinery was transported from Germany, and has a capacity for working sixty tons of beets in twenty-four hours.

The first process is the washing of the beets, and for that purpose is used a cylindrical vessel four feet diameter by ten feet long, its circumference or shell made of wooden slats placed longitudinally, with alternate openings between them. This drum is placed at an angle of 10deg., both ends are opened, the beets thrown into the higher end, and the drum slowly revolved by appropriate gearing in a water-tank of sufficient depth to bring the water-line midway between the axis and lower edge of drum. The interior of the drum is provided with a spiral screw and angle pieces, which give the beets a continual movement through the water towards the lower end, the earthy matter being washed off and passing through the openings between the slats into the tank below. The beets are discharged from the lower end on a revolving table some 12ft. in diameter, around which are placed women and boys, who remove all the diseased and defective ones, and prune off all the useless parts. The perfect beets are thrown into the buckets of an elevator near at hand, and discharged into a hopper on the floor above, which delivers them to two rasping or pulping machines. These machines are simple, and consist of revolving drums about 2ft. diameter by 2ft. long, the circumference being provided with projecting saw-blades set at a slight angle with their axis, the blades being parallel with each other, and about 2in. apart. The drums are revolved with great rapidity inside of close cases, and water to the amount of ten per cent. of the weight of the beets is introduced continuously during the operation. The discharge is a fine pulp, delivered into a traveling bucket, in front of ten centrifugal draining machines, which are placed on an intermediate floor midway between the first and second floors.

The charge for each centrifugal is 200lb. of pulp, in which 20lb. of water has been added during the rasping process, making 220lb. in all. The centrifugal drum is then revolved some 1,500 revolutions per minute, thirty-five per cent. additional water being introduced during the process. The juice evolved in the operation is conducted from the centrifugals by canals to a line of six defacators, each of 300 gallons capacity, while the dry pulp is removed from the interior of the drum for the use of the cattle as fodder. The defacating process is the same as pursued with sugar cane juice, excepting that an excessive quantity of lime is used for neutralizing the acids. Below each defacator is an upright cylindrical vessel made of wrought-iron plate, of about 600 gallons capacity. These vessels are provided with heating worms at their bottoms, and covers with hinges on top. The clear juice of each defacator is discharged into the corresponding vessel below it. The scum arising from the defacation is subjected to the action of scum presses, by which the syrup remaining is made available.

The lime employed in the defacation is removed by the action of carbonic acid gas, which is forced into the liquor while in the vessels below the defacators, by means of a steam pump. The gas is manufactured in a lime kiln, on the premises. On admitting the gas into the juice, the latter froths very much, which accounts for the necessity of having the receiving vessels of double the capacity of the defacators. On the decomposition of the lime, the supply of gas is stopped; the liquor is then heated to the boiling point, and by means of a monte-jus elevated to a tank above the filters. The deposit in the vessels, after the drawing of the liquor, is also subject to the action of the scum presses.

The filters are six in number, and of the bone-black variety, about 30in. in diameter by 30ft. high. Three of them are used for the first filtration. After leaving these filters, the liquor is carried to a series of three evaporators. They are plate-iron vessels about 8ft. diameter, by 4ft. deep, provided with a copper coil or worm at their bottoms. Steam is admitted into the coils and the liquor concentrated to about 26deg. B.; the scum arising during the boiling is also subjected to the action of the presses. From the evaporators, the juice is elevated by a second monte-jus to a tank above the second set of filters, and after this second filtration, passes to a vacuum pan, and is boiled down to the crystallizing point. Five centrifugal machines are employed for the purging operation. The sugar discharged from the vacuum pan is carried to a mixer, located on the floor above the five centrifugals; the mixer discharges into a travelling bucket arranged for supplying all the centrifugals.

The first product of this operation is a beautiful white sugar of heavy grain, ready for the drying tables and the market. The syrup evolved during this operation is re-boiled in the vacuum pan, and re-worked in the centrifugals, making a fair brown sugar. The refinery is supplied with the ordinary washers and ovens for re-washing and revivifying the bone-black. Steam is supplied by four 40in. by 30ft. double flue boilers, and two 60in. by 30ft. boilers, the two latter each containing five flues. The fuel used is coal; it is not of very good quality, but is to be had in abundance, one shaft being worked in the village. The price is about ten cents per bushel.

This, like most new enterprises, has met with its discouragements. The first attempt at sugar making on a large scale, was made during the autumn of 1866, and winter of 1867. Some of the machinery proved defective, and it was found impossible to obtain the requisite steam on account of deficiency of boiler power, and the want of a proper smoke-stack. The beet crop was an abundant one, averaging some fifteen tons per acre, and would have required four and a-half months working of the refinery to manufacture into sugar, at an average of sixty tons per day; owing to the defects mentioned, not near this quantity was reached, and, as a consequence, tons of beets had to be carted and thrown away to make room for the spring planting. Although the enterprise proved a failure in a pecuniary point of view, yet the cause was plainly seen to have been a remediable mechanical one. The product per acre proved the land to be well adapted to the culture of the beet, while the operation of the refinery, giving eight per cent. of sugar, compares favourably with the best results in Europe.

During the past summer, additional boiler power was placed, and other defects remedied, and those interested had every reason to hope that this present season would give a rich reward for all the energy, perseverance, and patience they had displayed. Unfortunately, this will not be the case, as this last has been the dryest season experienced in the West for a period of thirty years. No rain of any consequence has fallen since June, and the beet crop has proved a failure. It has been gathered, and gives an average of only three tons per acre, instead of fifteen, as on the previous year. The season has been an exceptional one in Illinois, and the effects o the drought has been very serious. Most of the wells have failed, cattle have been, and are dying from thirst, and the Illinois Central Railroad is carrying water from Chicago down their road for the use of their locomotives. Such a season may not again be experienced for many years. Notwithstanding these discouragements, there can be no doubt of the final success of the enterprise. Persons who have lived in the State some twenty years, and are familiar with its characteristics, assert that good crops of beets can be had at least nine years out of ten. The Messrs. Gennert have proved the feasibility of extracting the sugar in such quantities that there will be left a good margin of profit. They are the pioneers in this country of an enterprise which will eventually prove one of the most important elements of public prosperity. The enterprise can be carried on profitably in nearly all of our Northern States,—those which can offer the advantages of cheap land, cheap labour, coal, lime, water, and a ready market are, of course, to be preferred. As there can be no doubt in regard to our possession of the above facilites, then the only question to ask is, have we the engineering and mechanical skill to design and construct the proper machinery for the manipulation of beet-root into sugar, and the enterprise to engage in and carry forward the project to a successful result? In regard to the machinery, the question can be satisfactorily answered. Nearly all the parts required are precisely similar to those manufactured in this city during the past twenty-four years for Louisiana, Cuba, and South America, for making sugar from cane juice, the only difference being in the pieces used for extracting the cane juice and beet juice, respectively. At Chatsworth, the evaporating is done in open kettles, which is an expensive mode, so far as fuel is concerned, and is also destructive to the colour of the liquor. In Germany, in the best refineries, vacuum pans of treble effect are used for evaporating, three being generally employed. They are placed near each other on one common platform, the first being worked by the exhaust steam of the different steam engines in the refinery, the second by the vapours of the boiling liquor of the first, and the third, or strike pan, by the vapours of the second. The economy of this plan is self-evident, while the low temperatures required for boiling, as well as the absence of exposure of the liquor to the atmosphere, prevents the deleterious effects noticed by the use of open kettles. This system had its origin in this country, and has been most successfully practised for many years in Louisiana, Cuba, and South America, in the evaporation of cane juice.

The enterprising spirit required surely cannot be wanting. There has never been a lack of it in this country, and I feel sanguine that many years will not elapse before all the sugar consumed in the country will be of domestic growth and manufacture. The importance of getting all the saccharine matter from the raw beet has resulted in many devices for its extraction. In Europe are employed for that purpose hydraulic presses, centrifugals, cold maceration, and what is called the "Diffusion Process." The centrifugal process has been considered as best adapted for the purpose in this country, requiring but little labour in working, while the per centage of juice has been good, as compared with the other modes.

A beet-root plantation and refinery is about being started at Aurora, near Chicago, Illinois, and is to be worked on the diffusion principle. Those interested claim a gain of 1¼ to 1½ per cent. of sugar over every other mode, with less labour, and that the refuse or pulp is better as food for cattle. European capital will be employed in this enterprise, and as Congress has exempted from duty all machinery needed in the manufacture of beet sugar, the major portion will be imported, while our own steam engine and machine establishments, capable of doing the whole work, are suffering for want of orders.

NEW USES OF PAPER.

ONE of the latest uses of paper is its application in the manufacture of pails, wash-basins, pans, spittoons, &c., and, observes an American paper, strange as it may seem, it is nevertheless true that the above articles, as made by the Papier-mache Manufacturing Company, of Greenport, L. I., from a chemically prepared paper, are superior in many respects to any others ever before made. The paper from which these articles are manufactured is rendered impervious to the action of water or acids; the utensils can be placed in an oven until the water will boil in them; placed in the sun at the hottest season, or exposed to the severest cold, without the slightest effect on them; where wood would rot and iron would rust, these articles are unaffected, and, with proper usage, would be as good as new. In pails there is an advantage that water will not taste of the material, and will never soak and will never fall to pieces; they are lighter than the wooden pail, and being a non-conductor of heat, will keep water cool. The articles are coated with a vegetable composition, which, even if it does wear off, does not affect their durability, and does not injure them, except in appearance.

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COMBINED PORTABLE PUMPING ENGINE AND BOILER.

BY MESSRS. BROWN AND WILSON.

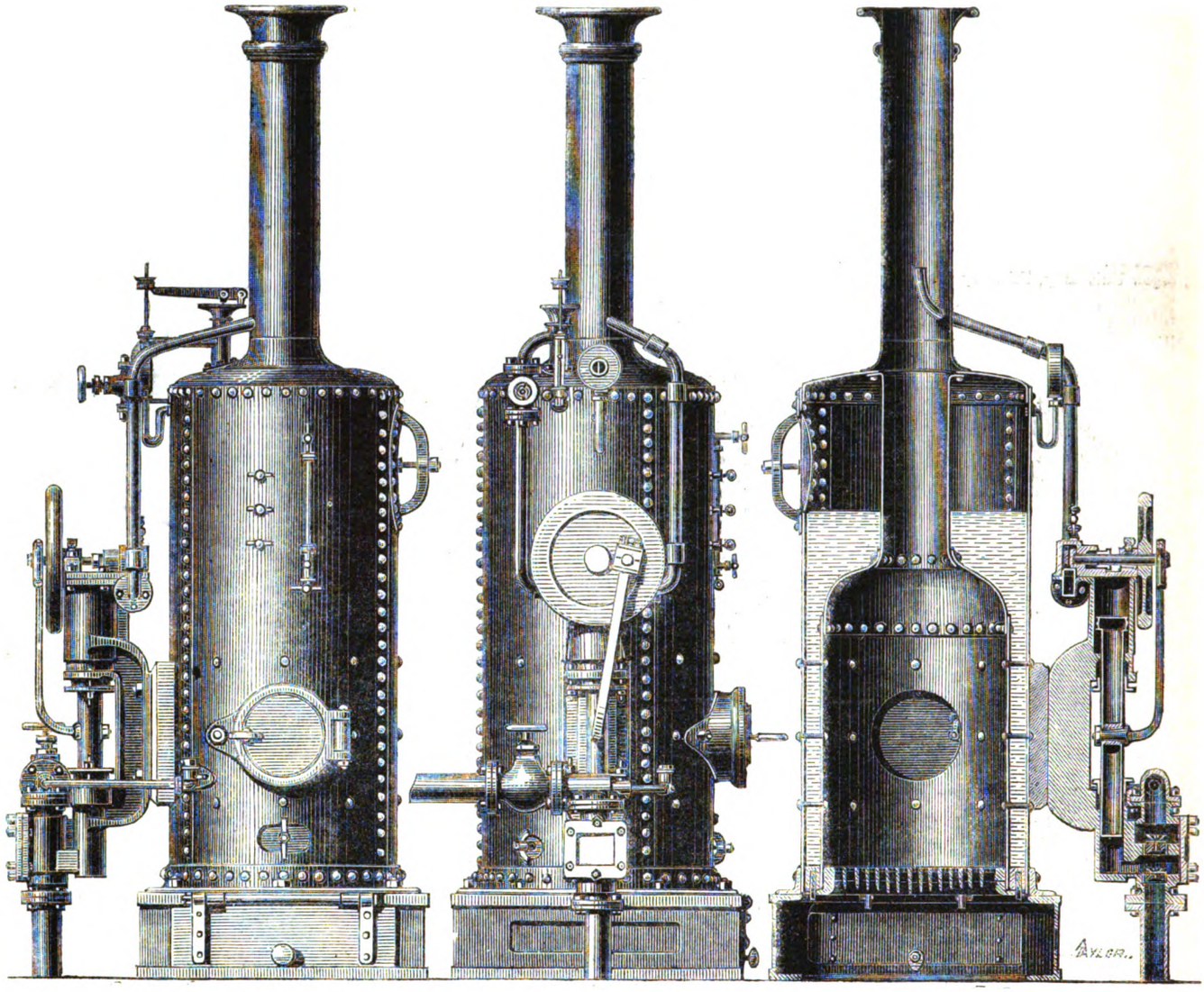

FIG. 1. FIG. 2. FIG. 3.

COMBINED PUMPING ENGINE AND BOILER.

THE engine represented in the accompanying engraving is attached to the boiler by its back; both are shown in side elevation in fig. 1, front elevation fig. 2, and in vertical section (on centre line of fig. 2) at fig. 3. The engine and pump are cast together, and are bored out together at the same operation, and with one bar. The pump, ram, piston, and rod, as will be seen, are in one piece, having at the centre of the ram a conical bearing, and at the small end a steel plate is dovetailed in, upon which the steel nut of the connecting rod works. The glands are also of gun metal, and the valves are of india-rubber working upon brass gratings for pressures up to 40lb., but above that pressure they are of the three-feathered description of clacks. Access is had to both suction and delivery valves by the door, as shown in fig. 2, and that without disturbing any pipes. The fly-wheel, shaft, and gear, for working the slide valve, are all carried upon the cylinder cover, so that the cylinder valve, face, and crank, for working the valve, can be at once inspected by removing the cover, and without disturbing any pipes or joints. The slide-valve is constructed with horns upon its back, which permit, by a sliding steel block, the vertical motion of a small crank, while the lateral motion is transmitted to the slide-valve. This crank is screwed and pinned on to the steel crank shaft, which passes through a stuffing box in front of the valve casing, and thence through the front journal, terminating in the wheel. In the face of the latter the crank pin is fixed, and the connecting rod having one end working in the centre of the ram, with the conical adjustment for wear, is bent out of the line of the engine some few inches, and lays hold of the crank pin in the face of the wheel. Exception might be taken to this rod on account of its curved form, but the fact is, assuming that the bend is rigid (and it is so, because there is so much metal put in it whilst the work done is so exceedingly small), there being an unyielding cantilever, and working in the centre of the ram, it is practically equivalent to working directly from that centre upon the crank pin. When we say practically so, we wish it to be understood that the work performed by the steam is not in causing a wheel to revolve, but a piston to reciprocate; consequently, the strain exists entirely between the cylinder and pump, and is resisted by the piston, rod, and ram.

The boiler, as will be apparent to most engineers, is one of the simplest construction, and only requires to have a few of its leading qualities pointed out. The firebox is a plain cylinder, with dome top stayed all round; this, with many, may appear superfluous, but when the box wears thin and oval the stays are a great security to the boiler; in fact, a firebox $\frac{1}{8}$in. thick will work, if properly stayed, and if it does fail it will be at one of the stays, and so it will drown out the fire and save a more serious accident. The top of the boiler is flat. Some vertical boilers are made with a dome top, but they never last long, this being on account of the greater heat of the firebox than the outer shell; consequently, a greater elongation from expansion of the box and flue than the outer shell, which eventually breaks the flue away at the neck next the box, unless the top is flat, or nearly so, and thus acts as an expansion joint. The fittings upon the boiler are those usually specified in good boilers, and the feed water is supplied from a small branch from the pump. We are informed by Messrs. Brown, Wilson, and Co., of the Vauxhall Ironworks, London, who have furnished us with the drawings from which our engraving is prepared, that 350 of these engines were sent out by them during the last year.

THE SOCIETY OF ENGINEERS.

AT the meeting of the Society of Engineers, held on Monday the 2nd inst., Mr. Baldwin Latham, President, in the chair, a discussion took place on Dr. Cullen's three papers. On the proposed lines for a Ship Canal "between the Atlantic and Pacific Oceans," "on the Panama Railroad," and "on the Darien Ship Canal." The following candidates were balloted for, and duly elected, viz.:—As member, Mr. Arthur Rigg, jun., of Chester. As associates, Mr. Francis Michael Cotton, Foules-terrace, Mr. Edwin Latimer Rumble, Maismore-square, Mr. Stephen Wurr, Victoria-road, Stoke Newington, and Mr. William Hart Cullen, New Malden, Surrey.

A NEW spring of naphtha has just been discovered at Koudako in the valley of the Kouban, in Caucasus. The jet rises from a depth of 274ft. below the surface of the ground, is 4in. in diameter, and ascends to a height of 40ft. The yield is said to be 6,000 pailfuls per day.

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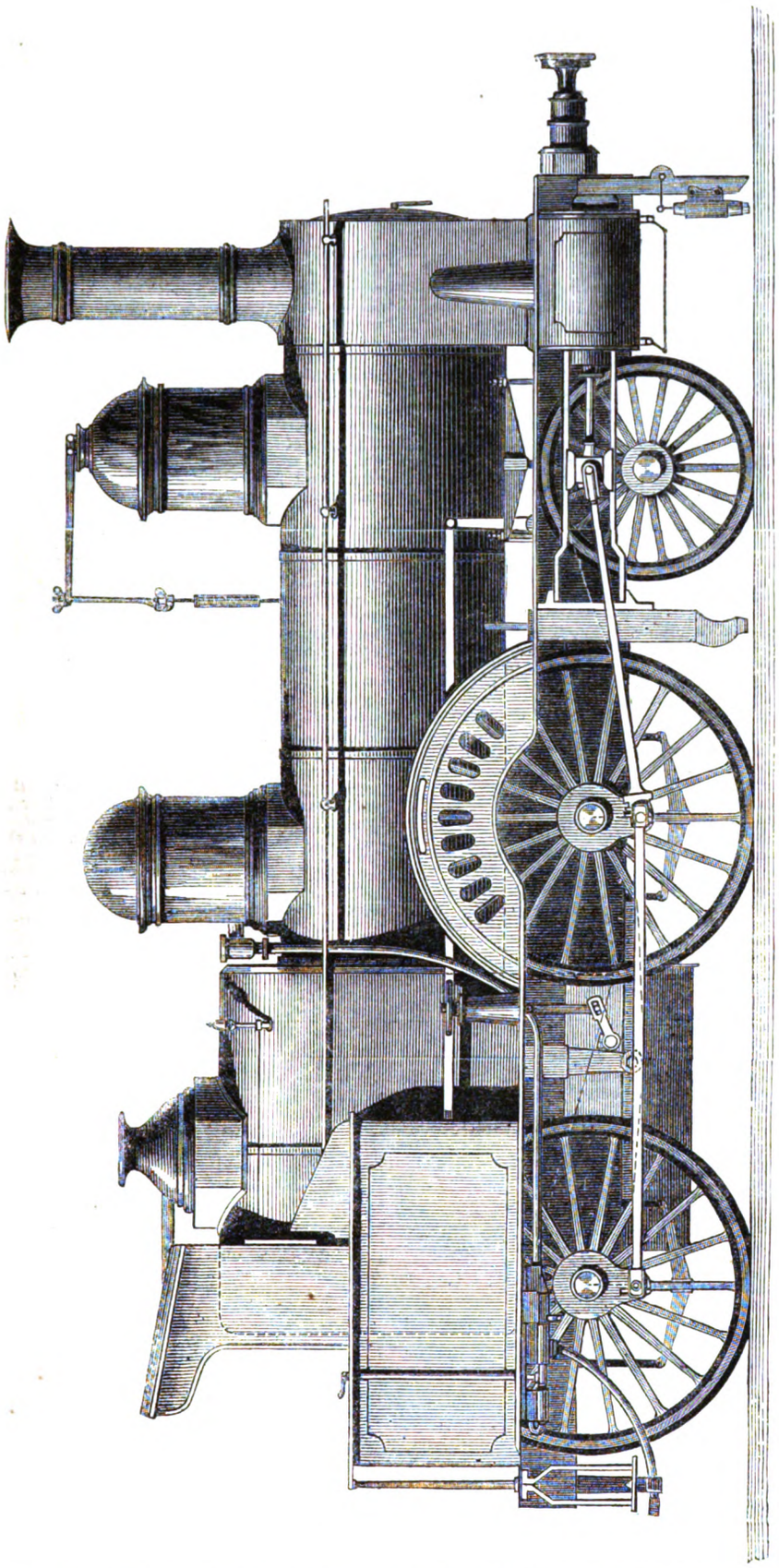
FAST PASSENGER ENGINE—BERGISCH MARKISCHE RAILWAY, PRUSSIA.

BY M. BORSIG.



FAST PASSENGER ENGINES—BERGISCH-MARKISCHE RAILWAY, PRUSSIA.

THE engine illustrated in the annexed engraving is one of several built by Borsig, and working the fast passenger traffic on the line from Dusseldorf to Dortmund, passing through Elberfield and Witten. The gradients on this railway are not very favourable—inclines of 1 in 100 being frequently encountered, while grades of 1 in 140 are very numerous. Between Erkrath and Hochdale, about seven miles from Dusseldorf, there is an incline of about 1 in 40, a mile and a-half long, up which the trains are assisted by a six-coupled, banking tank engine, weighing forty tons, and built by Borsig. The mode in which this engine is used is very remarkable. The incline was formerly worked by a stationary engine, which has long since been discarded. The rope, however, is retained, and the banking engine works on the descending line, hauling the ascending train, with the assistance of its own locomotive, to the top by means of the rope running over a suitable wheel at the head of the incline. By this means the gravity of the banking engine is utilized, representing a gain of one ton of tractive effort instead of a ton of resistance, or virtually a clear gain—minus the friction of the rope—of two tons of tractive effort. What proportion of this is realized after the friction of the rope is deducted we are unable to say—unless the gain be considerable it is unlikely that the rope would be retained.

The fast passenger engine we illustrate—the 1,781st built by Borsig—presents many points of difference from English practice, as will be perceived not only from a glance at the engraving, but from the following description:—Beginning with the principal dimensions, we find that the engine has 16in. cylinders, 22in. stroke, and four coupled driving wheels, 6ft. in diameter. The barrel of the boiler is about 3ft. 10in. in diameter inside, and nearly 14ft. long. The tubes are of iron, 180 in number and about 2⅜in. diameter outside. The inclined grate is 6ft. 2in. long, and about 3ft. wide, presenting about 18½ square feet of area. The heating surface of the firebox is about 80ft., and of the tubes about 1,020ft., or, in all, 1,100ft. The safety valves are loaded to 112lb. per inch. The weight is distributed as follows :—Leading axle, eleven tons; driving wheels, eleven tons; trailing wheels, eleven tons; total, thirty-three tons. It will thus be seen that the engine is heavy for the dimensions of the cylinders—a fact mainly due to the great size of the boiler rendered necessary in some degree by the use of slack coal. The upper part of the firebox shell rises to a great height above the barrel in order to provide steam space and room for the immense bridge stays supporting the firebox crown, which are 6ft. 2in. long and 10in. deep at the middle. We may add that the firebox is put in from the top before the outer shell is riveted up. The bridge stays are each connected to the crown by four sling stays, and the firebox shell is further strengthened by horizontal stays running right across.

Although two domes are seen, but one, that next the smokebox, is used as a steam chamber. It is placed in communication with the space above the firebox by a pipe, and contains the regulator valve. The other dome contains Wagner's apparatus for purifying the feed water sent to the top of the dome by the injectors. This apparatus has been used in the Bergische-Märkische line since 1863, with good results. In the annexed engraving we give a section of one form of the apparatus to illustrate the principle on which it acts. The water is fed in at the top, and, falling on a series of trays or partitions *m*, passes downward depositing sediment which would otherwise find its way to the boiler. The water, being highly heated by the steam within the dome, can no longer retain the sulphate of lime and magnesia in solution, and they are therefore thrown down. The trays are removed from time to time as they become foul and cleaned. The injector is of rather peculiar construction, the steam cone valve is suppressed altogether, and the water cone is moved by a cam worked by a handle from the foot plate. The injectors are disposed horizontally in a position found to be very convenient. They are made wholly of cast iron.

The springs of the coupled wheels are placed below the axles, their ends being connected by compensating levers. The springs of the leading wheels are coupled by a transverse compensating beam, so that the engine virtually rests on three points of support. The coupling and connecting rods are of Borsig's cast steel, rivalling that of Krupp in excellence; they are exceedingly light. The dimensions, measured on the engine, are as nearly as possible as follows:—Connecting rod, small end, depth, 2in.; thickness, 1 2-5in.; large end, depth, 3in.; thickness, 1 2-5in. The coupling rods, 8ft. 5in. long centre to centre, are but 2in. deep by 1 2-5in. thick at the smallest place, and 3 1-5in. by 1¼in. at the centre. The crank pins in the driving wheels are 3½in. in diameter, and in the trailing wheels 2½in. These are all extraordinarily light dimensions for an engine with 16in. cylinders, yet we believe that the line is nearly exempt from accidents due to the breaking of coupling rods.

As already stated, the fuel used is slack, which is of good quality, coming from the Ruhr district. The distance between the grate bars is not less than ½in. to ¾in. At first sight it would seem that on such a grate it would be impossible to burn slack without great waste. The system of working

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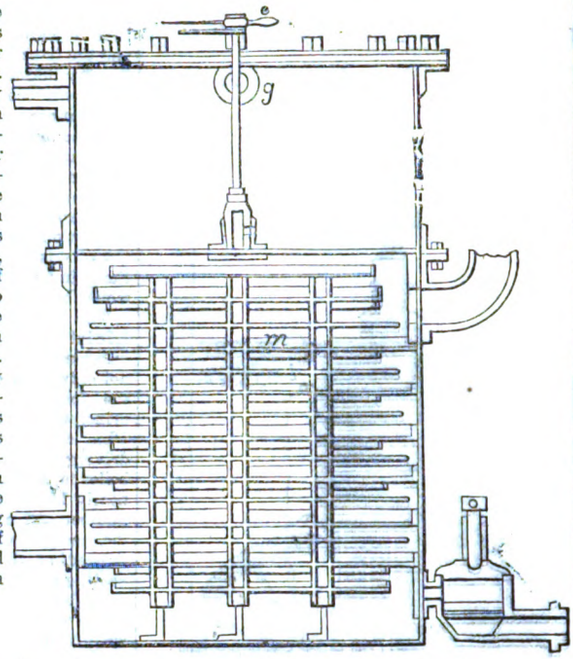
disposes of this objection. The fire is lit with large coal, and slack is subsequently fed on mixed with water to the consistence of thick mortar. The fuel quickly cakes, and may then be broken up, burning with little waste. Many sparks are produced, however, and to prevent their escape up the chimney, a very singular expedient is employed: a fine jet of spray from the boiler is thrown into the smokebox. The plan is generally used, with good results, on the German lines. A number of fast passenger engines very similar to that described were put on the line in 1863, but the intervals between the axles being respectively 6ft. 8in. and 7ft. 9in., the load was unequally distributed, the leading wheels carrying twelve tons, the driving wheels eleven tons, and the trailing wheels ten tons. This defect has been removed in the present series put on the line in 1865, by bringing the driving wheels nearer to the leading wheels. Mr. Stampte is the chief engineer of the line, the general management of which reflects much credit on him.



TECHNICAL INSTRUCTION.

THE Lords of the Committee of Council on Education have approved of the publication of the following Explanatory Memorandum to accompany their Minute of 21st December, 1867. This Memorandum shows fully the aid which the State affords in promotion of Technical Instruction at the present time.

1. It will be seen that this Minute creates three descriptions of scholarships or exhibitions for the encouragement of Science Instruction and for the support of students of the industrial classes while continuing their education. These are intended to supplement and enlarge existing action on the part of the Science and Art Department, and to promote secondary instruction in elementary schools, thus forming a connecting link between them and the Science and Art schools and classes.

2. The existing action through the Science and Art Department is to aid instruction in Science in the following subjects:—1, practical plane and solid geometry; 2, machine construction and drawing; 3, building construction or naval architecture and drawing; 4, elementary mathematics; 5, higher mathematics; 6, theoretical mechanics; 7, applied mechanics; 8, acoustics, light, and heat; 9, magnetism and electricity; 10, inorganic chemistry; 11, organic chemistry; 12, geology; 13, mineralogy; 14, animal physiology; 15, zoology; 16, vegetable physiology and economic botany; 17, systematic botany; 18, mining; 19, metallurgy; 20, navigation; 21, nautical astronomy; 22, steam; 23, physical geography. And in Art in Elementary Drawing as an education of the power of observation and in drawing, painting, modelling, and designing for manufacture and decoration.

3. In order to place a school or class in connexion with the Science and Art Department, it is necessary that a committee, consisting of at least five persons, should be formed, who will undertake certain duties of superintendence in connexion with it.

4. As respects Science, the aid consists of—(1) payments to the teachers on the results of instruction as tested by examination, (2) medals and prizes to the successful students, (3) grants to the school in aid of the purchase of apparatus to the extent of 50 per cent. of the cost, and (4) Royal Exhibitions and free admissions to the Royal School of Mines in London and the Royal College of Science in Dublin.

5. The payments to the teachers vary from £1 to £5 according to the class in which the student is placed. There are five classes, the fifth being the lowest. The payments are only made for the instruction of students of the artizan or weekly wages class, and those whose incomes are less than £100 per annum. The teacher to be qualified to earn payments on results must have taken a 1st or 2nd class, unless he has obtained some University degree.

6. The examinations are held in May. The examination in each subject is held over the whole kingdom on the same night. It is not necessary to enable a class to be examined and obtain prizes, &c., that the teacher should be certificated. If a satisfactory committee be formed, any class or single student can be examined, however taught.

7. Prizes, which, with some few restrictions, are open to all students, are given to those who obtain a 1st, 2nd, or 3rd class. To the best in each subject are given a gold, a silver, and two bronze medals.

8. Six Royal Exhibitions of the value of £50 per annum, tenable for three years, are given in competition at the May examinations. Three of these are to the Royal School of Mines in London, and three to the Royal College of Science in Dublin. Free admissions are given to the courses at these institutions to all who take gold medals.

9. The detailed rules will be found in the Science Directory, published by the Department, price sixpence, which will be furnished on application to the Secretary, Science and Art Department.

10. As respects Art.—Firstly.—Towards the teaching of elementary drawing in schools for the poor.—This aid consists of payments to the managers of 1s., 2s., or 3s. on account of children satisfactorily taught drawing, and who pass a very elementary examination of the first grade; and of payments of 5s. or 10s. on children or pupil-teachers who pass the more advanced or second grade examination, and of prizes to successful children and pupil-teachers. The first grade consists of drawing in outline from flat examples, drawing from regular solids or objects of simple form, and of easy problems in practical geometry. The second grade is an examination of a higher standard than that of the first grade, but in the same subjects, with the addition of perspective and mechanical drawing. Examinations are held in May in any elementary school taught by a master holding a certificate for drawing, or who has passed a second grade examination in any of the above three subjects of drawing taught in elementary schools.

11. Secondly.—Towards art instruction in night classes for artizans held in elementary schools, in literary, mechanics', or similar institutions.—This aid consists of payments of 10s. or 15s. on account of artizans or their children above 12 years of age satisfactorily taught drawing of the second or third grades; of prizes to successful students; and of payments towards the local expenses of examination. The third grade is represented by works embracing the whole course of instruction in night classes or schools of art, such as drawing from examples, from casts or models, from nature, the antique, or the life; painting, flowers, landscape, or from life; designing or drawing for decorative purposes.

12. Thirdly.—To schools of art held in rooms entirely devoted to art instruction.—This aid consists of similar payments to those awarded to night classes, and of the following additional payments:—20s. on account of every artizan satisfactorily instructed in art, £15 or £30 on account of art pupil-teachers, £5 or £10 on account or students trained for art teachers or national scholars. £3 on account of free studentships to artizans submitting advanced works. £10 on account of expenses of annual report and examination.

13. Prizes are given to successful students, and the advanced studies of the schools of Art are brought together in a national competition, when gold, silver, and bronze medals, and other prizes, are awarded. All payments are contingent on the employment of certificated teachers.

14. Elementary schools, night classes, and schools of art are aided to the extent of 75 per cent. in the purchase of examples.

15. Fourthly.—By the maintenance of the National Art Training School at South Kensington, in which highly qualified students from local schools of art are admitted and trained as masters for schools of art or as designers, or art-workmen. Such students receive allowances for their support of from 15s. to 40s. weekly.

16. Fifthly.—Through the National Museum of Decorative Art and the National Art Library, which are made as far as possible circulating collections for the benefit of local schools of art.

17. The detailed regulations for the administration of Art Instruction are given in the Art Directory.

18. As respects Elementary Schools.—By the Minute of the 20th February, 1867, additional grants are made by the Education Establishment at Whitehall to elementary schools under inspection for instruction in subjects of secular instruction beyond reading, writing, and arithmetic. The regulations under which such grants are made are issued by the Education Establishment, Whitehall.

19. The managers of an elementary school under inspection can permit their premises to be used for science teaching provided that there be no interference with the primary purpose of the elementary school or its three attendances. A science class may thus be formed in connexion with and receiving payments from the Science and Art Department. But no payments are made to teachers on account of Science teaching in respect of any instruction in Science that may be given during the three attendances of an elementary school receiving aid from the Education Establishment, Whitehall.

20. In an elementary school not under the inspection of the Education Establishment, and, therefore, not receiving State aid to elementary instruction, science classes may be formed in connexion with the Science and Art Department without any restriction as to the time or manner in which the instruction in science may be given.

21. From this brief explanation it will be understood how the Minute of the 21st December will affect existing institutions. This Minute provides for two forms of scholarship in connexion with elementary schools whether receiving State aid as such or not. The first of these is the elementary school scholarship. £5 are granted to the managers of any elementary school for the support of a deserving pupil if they undertake to support him for a year and subscribe £5 for that purpose. One such scholarship is allowed per 100 students in the school. The selection of the student for the scholarship is to be by competition; the details of this, however, the managers of the school may arrange as they please, subject to the approval of the Science and Art Department. The payment of £5 by the Science and Art Department is made conditional on the student passing in a branch of science at the May examination.

22. The second, a more advanced scholarship, is "the Science and Art Scholarship," of which, again, there may be one per 100 students. This is granted without any corresponding contribution on the part of the locality. The Science and Art Department makes a grant of £10 towards the maintenance, for one year, of the most deserving student or students in an elementary school who have taken a first grade in Elementary Geometry and Freehold or Model Drawing,* and passed in some branch of science, on condition that, at the end of the year, the student obtains at least a third class in the subject of science in which he originally passed or passes in some other subject. In both these cases the student must be from 12 to 16 years of age.

23. Lastly, for advanced scientific instruction, the Minute offers local exhibitions to enable students to complete their education at some college or school where scientific instruction of an advanced character may be obtained. The Science and Art Department will make a grant of £25 per annum, for one, two, or three years for this purpose when the locality raises a like sum by voluntary subscriptions. And if the student attend a State school, such as the Royal School of Mines in London, the Royal College of Chemistry in London, or Royal College of Science in Ireland, the fees are remitted. It is a condition that the exhibition is awarded in competition, the branch or branches of science for which may be fixed by the locality, and that the student pursues his studies satisfactorily.

ECONOMY IN PUDDLING.

AT the present time, perhaps more than ever before in the history of ironmaking, is it necessary that economy should be studied in every branch of iron manufacture, and it would appear that in no way can a greater saving be effected in puddling than by the use of Cambridge's patent fire-bars. These possess many advantages, not the least of which are that they are lighter and cheaper than those now in use, possess greater durability, more economical by the prevention of clinkers, and produce a higher ratio of steam. We are informed that a testimonial, fully bearing out these great qualifications, has been received by the manufacturer, Mr. Alfred Ryland, Birmingham, from Mr. John Evans (Cymro Du), for many years a practical puddler, and over twenty years Puddlers' and Mills manager at Abernant, afterwards at Dowlais, and now at Waterloo Iron Works, West Bromwich. In this he says that these bars "get the heat up better and work more regularly, and will burn cheaper or smaller coal than the old flat bars." And he adds, "I have used these bars with what is called here 'rough slack,' and the iron has come round as soon as in the other furnaces with better coal, which saves a good deal in the price."

* The examination in drawing can, where there is no Art Certificated Teacher, be held by the Science Class Committee, to whom the necessary papers will be sent.

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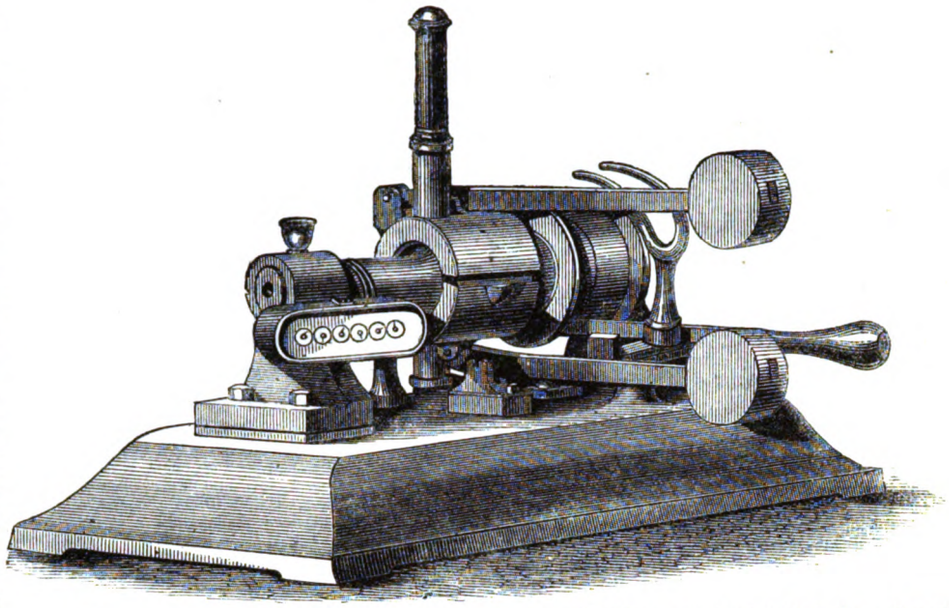
INGRAM AND STAPFER'S PATENT OIL TESTER.

INGRAM AND STAPFER'S PATENT OIL TESTER.



THE testing of lubricants has taxed the ingenuity of many inventors, several machines having been designed for that purpose. Until a recent period the specific gravity alone has been a guide to a knowledge of the lubricating quality of oil, but of late years the nearly interminable varieties of oil that have been introduced causes the hydrometer as a test to be nearly useless. Little toy-like instruments have been used to weigh the friction, all more or less very indefinite in their action. Heat is power, and anything that has a tendency to arrest motion reproduces heat, which we call friction; anything in the shape of a good lubricant prevents heat accumulating and reduces friction. Knowing this, the patentees of the invention under consideration naturally concluded that the oil which allows the greatest number of revolutions to be performed by a shaft with the lowest possible increase of the temperature of the bearings must be a good oil, and save power, which means, in a works, gold. The instrument we illustrate is being rapidly introduced by Messrs. John Bailey and Co., of the Albion Works, Salford, Lancashire, a firm well known for their indicators and testers of various sorts. The illustration, which is from a photograph, shows the instrument very clearly. A bed-plate, two pedestals, fast and loose pulleys, and strap, fork, two brass steps with weighted levers to produce friction, and an indicator to show the revolutions, and a thermometer to indicate the temperature produced, make the thing complete.

The exact money value of oil may be arrived at as follows:—Suppose a certain quantity of No. 1 oil on the machine shows 150deg., by being driven 10,000 revolutions, No. 2 oil shows 150deg., and 7,500 revolutions, or 25 per cent. less value; in addition to this practical way of attaining a result the machine may be driven to a higher temperature to see which oil produces the worst residuum. Of course it will be seen how valuable such an instrument is to consumers of oil, and to oil merchants and refiners, to enable cheap oils to be tested, and various mixtures experimented upon by the machine at various speeds for quick machinery and for heavy bearings. When the instrument is used for the latter oils it should be driven slowly, and the weights placed at the ends of the levers, and for quick machinery *vice versa*.

IMPROVED CALLIPERS.

STRAIGHT-edges, squares, and callipers, have always been the mechanic's companions and assistants in the manipulation of materials. They are his great helps in the construction of mechanical details and erection of works, whether they consist of stone, wood, or iron. Every mechanic knows (or ought to know) that the beauty and efficiency of all artifice increases in proportion as parts approach geometrical accuracy; these hand-tools, therefore, which enable him to make his work straight, parallel, square, or circular, are seldom out of his hands—in fact, they are indispensable adjuncts to the vice, lathe, and plane, and are to be found on almost every work-bench, and in every workman's tool-chest. The straight-edge and square are, of course, only applicable in obtaining plain surfaces and right angles, but callipers are more especially useful in ascertaining the parellelism of surfaces, the diameter and thickness of bodies. There are different sorts, known as outside and inside callipers, or, in other words, callipers which will measure outside and inside diameters. These commonly have their fingers made of flat steel, and when designed for taking outside dimensions are made in a semicircular form, so that the points only shall touch in gauging the work. The inside callipers are made straight, and in shop parlance are known as "leg callipers." The common method in constructing these has been to file the two pieces together, so as to get them exactly alike, and then, after finishing, to rivet them together with a round-headed rivet and washer, to such a degree as to allow opening and closing with a moderate degree of pressure. To get an exact measurement with these, the mechanic has to keep tapping one edge until the points are sufficiently closed to take in the diameter or thickness of the object. There are some objections to this description of callipers, as they spring, and can only be used with any degree of certainty in the hands of an expert mechanic who knows something of the sense of feeling and touch. Spring callipers are now very much used and liked. These are generally made from square steel, and have a screw passing through them, and a thumb-nut for adjusting the points.

The accompanying illustration represents improved callipers, patented by Mr. W. Pond, of Worcester, Mass. It will be observed that they are a combination of the ordinary and spring callipers. Being made of flat steel, and having the screw with a milled head at the side, no springing takes place when gauging a shaft, bolt, pulley, &c. The steel

spring is not part of the callipers, but is put round the joint and held by two pins. Should this spring be broken, the callipers can still be used as the ordinary ones, and a new spring attached at leisure. They are exceedingly neat in form, and are made from the smallest to the largest size. As every mechanic, engineer, and machinist appreciates a reliable and well finished pair of callipers, we have no doubt these so well improved by Mr. Pond will find their way into the hands of numerous workmen and experts. We take these particulars from the "American Journal of Mining."

THE WILSON RIFLE.

MR. WILSON, of Birmingham, has produced a new rifle, upon the bolt principle, for central fire cartridges. We are not at liberty, in consideration of the interests of the inventor, to describe fully at this moment the minutiæ of the breech arrangements; but it will be sufficient to say that lock, hammer, and all outside obstructions are done away with, and that the chamber is opened and closed in two direct motions, that the extractor is simple and trips the empty cartridge-case out of the barrel. The entire mechanism, except the trigger, is situated in and carried by the sliding bolt, which is so constructed that the action of the trigger, and consequently the discharge of the gun, is impossible, unless the bolt is fixed in its proper position. Security from accidental discharge is thus obtained. No other modification of the bolt, or needle-gun system, has approached this weapon for simplicity. The "Standard" states that on the 24th ult. this new rifle was tested at the Woolwich practice ground by the Small Arms Competition Committee in the following manner:—Two targets were made at 500 yards, with 20 shots each, by Private Crofts. The diagram made on the first was 1·92ft.; on the second, 1·32ft. Then for rapidity 20 rounds were fired in 50sec., the quickest firing as yet made with any small-bore or half-inch breech loader. Thirty more shots were personally fired in various ways by the members of the committee themselves. Two further targets of 20 rounds each at 500 yards were then made with the following diagrams:—The one, 1·94ft.; the other, 1·97ft. A strong wind was blowing during the shooting. After this sand was thrown over the closed breech-action trigger, and other parts, for the purpose of trying what effects would be produced by grit and dirt getting into the gun in service. Three rounds were fired under three conditions without any difficulty whatever. The breech arrangement was then opened, and the working parts of the gun internally sanded to make the test more severe. Three shots were again fired from the gun in this state without difficulty. This test was repeated, and the gun fired three times again without difficulty. Three damaged cartridges were then fired, and no injury to the gun occurred.

A further exhibition of the powers of this excellent small-arm took place at the Woolwich range with the most satisfactory results. One hundred and fifty rounds were fired in all. Twenty rounds were fired for accuracy. Direction of range N.N.E., fresh south-west wind blowing. A very good target was made, showing at 500 yards' shooting a mean deviation of 1·41ft. The rifle was fired, as on the previons occasion, by Private Crofts, who discharged, for rapidity, 20 rounds in 45sec., being the most rapid firing produced at the range by any breech-loader of either large or small bore. It was evident at the last trial, when the weapon was put, for the first time, into the serjeant's hands, that four or five seconds might have been saved in rapidity if the shooter had had any previous experience of the gun, and it appears to be pretty generally the opinion that thirty shots per minute could be realized. The mechanism of the arm worked without any impediment, and the gun was raised to the shoulder for each discharge. The arm complete weighs under 8½lb., and the barrel has six rifle grooves, of one turn in 35in. The cartridge used was the latest form made at the Royal Laboratory, with 70 grains of compressed powder, and bullet of 380 grains. The recoil of the gun is very slight. The action of the breech arrangement is, as we have already described, remarkably simple, and altogether the weapon is the most remarkable yet produced on the bolt or Prussian principle. The mechanism is self-locking and self-securing. The act of opening, which is one motion, clears away the old cartridge case, and the pulg or bolt can be detached from the breech in a moment without tools. The mechanism is composed of very few pieces, all of which can be produced by machinery.

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THE POLYTECHNIC INSTITUTION.

THE attractions of this popular place of instruction and amusement have just been varied by a judicious change in the programme. The managers have introduced an automaton figure representing Baron Kempelen's well-known automaton chess-player. The figure is placed in the principal hall, immediately under the figure of Leotard (who still goes through his sensational performances twice a day), and can therefore be well seen from all parts. The figure, on being wound up, plays a game of chess with a little boy, with much apparent intelligence, and with sufficient ability to beat his competitor. The figure afterwards hands to the little fellow with whom it has been playing all the pieces on the board, and performs the difficult feat of placing a knight on every one of the squares without diverging from the mode of movement laid down for it. Professor Pepper continues to interest his audiences with Faraday's beautiful discoveries. He also discourses on spiritual manifestations, pointing out the extensive imposture that has been practised on the public in the name of mesmerism and spiritualism. The professor illustrates his lecture with some startling illusions, such as the floating of stout ladies, heavy tables, and hats, in the air. Mr. Thomas Tobin—Professor Pepper's able coadjutor—gives entertaining and instructive sermons in stones, in the course of which he exemplifies, by means of some exquisitely got-up illustrations of England's cathedrals, abbeys, and ancient buildings generally, the progress this country has made in architecture. A well-timed and beautifully illustrated lecture by Mr. Thomas Baines, F.R.G.S., on Abyssinia and the Abyssinian Expedition, forms another prominent feature of the Polytechnic entertainment, which is well worthy of the patronage and support it continues to receive.

UTILIZATION OF SLAG, &c.

THE utilization of waste slag is a question which has had a large share of attention given to it. The last proposition with which we are acquainted is that of Mr. J. Hargreaves, of Appleton-within-Widnes, who has patented some improvements in this direction. The objects of the invention are twofold. They are, firstly, to utilize that waste material or product which rises to the surface of molten iron during its conversion into steel or soft iron when salts which yield oxygen on the application of heat are the agents employed, and which he terms steel slag; and, secondly, to utilize another waste material or product, called by him steel cinder, obtained during the manufacture of steel and soft iron when steel slag is used. The steel slag consists principally of carbonate, silicate, phosphate, sulphate, sulphite, sulphide, chloride, cyanide, and ferrocyanide of sodium or potassium, together with oxide of iron and oxide of manganese, and when chromate of soda or potassa are the oxidizing salts used in the manufacture of steel and soft iron from cast iron, there is also oxide of chromium present. The steel cinder has a similar composition, except that it contains more silica, oxide of iron, and oxide of manganese, sulphur, phosphorus, and their acids.

Mr. Hargreaves utilizes the said waste product as follows:—First, in the manufacture of glass, by the addition of and fusion with silica, lime, and oxides of lead and zinc or other substances tending to render the glass insoluble in water and unaffected by atmospheric influences; and, secondly, by dissolving the soluble portions of the steel slag or steel cinder by lixiviation or boiling in water. The insoluble impurities in suspension are allowed to settle to the bottom, the clear solution is then drained off, concentrated to dryness, and roasted, adding nitrate of soda, nitrate of potassa, or other oxidizing salt to oxidize any sulphide of sodium or sulphide of potassium that may be present. The material thus produced is used as a detergent in washing, and also for other purposes to which alkalies are applied.

Mr. Hargreaves also obtains carbonate of soda and carbonate or potassa or bicarbonate of soda or bicarbonate of potassa by passing carbonic acid through the solution obtained from steel slag and steel cinder, as mentioned under the second head of the invention. Or he adds bicarbonate of soda or bicarbonate of potassa to the solution to precipitate the silica and other impurities present. He then concentrates to dryness and roasts the material, and if the steel slag or steel cinder was produced when a salt of soda was used Mr. Hargreaves obtains crystals of soda, or makes bicarbonate of soda in the ordinary manner, or he concentrates to dryness and obtains soda ash. If a salt of potassa was used in producing the steel slag or steel cinder, the inventor obtains the ordinary potash or pearl-ash of commerce, or he still further exposes the potash or pearlash to the action of carbonic acid and obtains bicarbonate of potassa.

In the fourth place, the inventor obtains caustic soda or caustic potassa by boiling a solution of specific gravity 1100 or 1090 obtained from steel slag and steel cinder, with caustic or quicklime, and adding nitrate of soda or nitrate of potassa, or other oxidizing salt, to the solution to oxidize any sulphide of sodium or sulphide of potassium that may be present in the caustic solution. Or he oxidizes the sulphides by the jet processes invented by him in 1864, and now in common use for oxidizing crude soda liquors, and then concentrates by boiling until it will solidify on cooling, or he uses the caustic solution in the manufacture of soap, paper, and other materials without concentration.

Mr. Hargreaves has further ascertained that by passing the steel slag or steel cinder through incandescent carbon in the form of charcoal or coke he obtains the steel slag more free from oxide of manganese or oxide of iron, and the oxide of iron and oxide of manganese are reduced to the metallic state, and the salts of soda or potassa contained therein are rendered much more soluble. Therefore, when making carbonate of soda or potassa, or when making caustic soda or potassa, Mr. Hargreaves prefers to melt the steel slag or steel cinder in a blast furnace, or to fuse them in a reverberatory furnace together with coal or other carbonaceous matter, and then treat, as described, for the formation of carbonates and hydrates of soda or potassa.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of this Society on Tuesday evening, the 3rd instant, Mr. Charles Hutton Gregory, President, in the chair, sixteen candidates were balloted for, and duly elected, including, as members, Mr. William Douglass, Trinity Works, Penzance; Lieutenant Colonel John Pitt Kennedy, Consulting Engineer to the Bombay, Baroda, and Central India Railway Company; Mr. Richard Laybourne, late Locomotive Superintendent of the Monmouthshire Railway; Mr. William Henry Edward Napier, late a Resident Engineer on the Berlin-Gorlitzer and East Prussian Railways; and Mr. Josiah Timmis Smith, Engineer of the Hæmatite Steel and Iron Works, Barrow-in-Furness; and as Associates, Mr. James Binfield Bird, Cowes; Mr. William Gammon, Lambeth; Mr. Thomas Bland Garland, Valparaiso; Mr. William Hunt, Westminster; Mr. James Trubshaw Johnson, Lichfield; Lieutenant Colonel William Lawtie Morrison, R.E., Surveyor-General of the Mauritius; Mr. Patrick Ogilvie, Hambledon; Mr. Robert Sabine, Westminster; Mr. James Shaw, Leadenhall-street; Mr. Samuel Swarbrick, General Manager of the Great Eastern Railway Company; and Mr. Albert Vickers, Inverness-terrace. It was also announced that the Council, acting under the provisions of Section IV. of the bye-laws, had since the last announcement admitted as Students of the Institution, Benjamin Hall Blyth, M.A., Alfred George Brookes, Richard Ernest Brounger, William Augustus Kennedy Gostling, Arthur Henry Heath, Charles Assheton Whately Pownall, Percy Frederic Tarbutt, and Frederick Toplis.

MANUFACTURE OF OAKUM.

THE object of the invention we are about to describe is to prepare oakum from untarred or insufficiently tarred fibre, such as tow obtained from white or other ropes, or the shorts from dressing hemp or fibres derived from other sources, by impregnating it with a solution of tar dissolved in a suitable solvent, the latter being more easily evaporated than the tar, and then driving off and again collecting the volatile solvent if desired. It is the patented invention of Mr. J. E. Hodgkin, of Liverpool, and the solvent which he has found most advantageous for this purpose has been benzole. Other light oils of coal tar or the light oils derived from petroleum, bi-sulphide of carbon, or wood naphtha, however, may be employed. The simplest mode of applying the tar in solution is to steep the fibre in a mixture made by dissolving tar either cold or at a higher temperature in any of the above-named solvents, and then placing it in a close vessel and driving off the vapour of the solvent into a still so as to collect it for future use.

The apparatus employed for this purpose is the following:—In order to prepare the solution of tar for impregnating tow or other fibre, the tar and solvent (in such proportions that when dissolved the solution will be sufficiently fluid as to readily saturate or impregnate the tow or other vegetable fibres introduced into it with the desired amount of tar) are introduced into a mixing vessel which may be heated if desired. A shaft furnished with knives or beaters passes through the mixing vessel, and is supported in exterior bearings. The mixing vessel can either be made to revolve rapidly, the shafts and knives being stationary, or vice versa, the object being thoroughly to dissolve the tar without waste of the solvent by evaporation. When thoroughly mixed the solution is allowed to flow into another vessel in which by filtration (under pressure or by settling), the small insoluble portion of the tar (if any) is separated from the clear liquor. The tow or other fibre is placed in a steam jacketed chamber, the man-hole joint being then made tight; this chamber is then filled with the tar liquor, steam being admitted into the jacket in order to heat the tow and liquor, and thus thoroughly impregnate the tow. A piston may be arranged in the vessel and be caused to descend so as to squeeze the liquor out of the tow into a space arranged under a grating or false bottom in the inner impregnating chamber. The draining of the tar liquor from the tow or fibre in the impregnating vessel is usually all that is required unless it is desired to facilitate the process by pressure. When the tow is sufficiently free from the tar liquor the steam is turned off and the superfluous liquor is allowed to flow into a receiver. Hot air or steam is then admitted again to the jacket around the impregnating chamber, by which means the solvent with the tar in solution is driven off into a still, and there condensed by cold water or recovered in any other manner.

The tow is now evenly saturated with tar and contains an inappreciable quantity of the solvent; it is then removed from the impregnating chamber which is cooled ready for receiving the next batch of fibre. A few hours' exposure to a current of warm air renders the oakum fit for market, and it can then be finally carded. The superfluous tar liquor is discharged from the impregnating vessel into a suitable receiver or closed vessel connected by a pipe with an air condensing or force pump, and from the bottom of the closed vessel or receiver a pipe rises to the mixing vessel, so that by the application of pressure to the closed vessel or receiver by the action of the pump, the liquor is driven up into the mixing vessel again. The distilled solvent from the still also runs into the same mixing vessel by gravitation, and all that is required to prepare the apparatus for the next operation is to add as much tar as the previous batch of tow has taken up together with any slight loss of solvent which may have taken place. Warm air may be forced or drawn through the impregnated fibre after its saturation by any suitable means, the air being arranged to pass over with the vapour into the still, in which case the use of the steam jacket may be dispensed with in this part of the process.

Obituary.

WE announce with regret the death of Mr. Michael Lane, engineer-in-chief to the Great Western Railway Company, which occurred on the 27th ult., after a short illness. The deceased gentleman was engaged on the works of the Thames Tunnel in 1825, which was the commencement of a career of usefulness and honour. A few years later he became the resident engineer of the Bristol Docks, under Mr. Brunel. He was afterwards engaged on the Monkwearmouth Dock, Sunderland (north shore), the works of which he carried out. In 1840, Mr. Lane commenced his duties on the Great Western Railway, being engaged on the western division of that line. He was afterwards appointed resident engineer of the Hull Docks, but, in 1845, he rejoined the Great Western Company as superintendent of permanent way. At the close of 1860 Mr. Lane was made engineer-in-chief to the company, which office he retained up to the time of his death. Mr. Lane was a thoroughly practical man, and was greatly esteemed for his integrity and kindly disposition, which drew around him a large circle of friends and acquaintances who sincerely regret his loss. His funeral took place on Wednesday last, and his remains were followed to Kensal-green by a large number of the officers and staff of the Great Western Company, by whom he was highly respected.

WE regret also to announce the death of Mr. Stewart, the chairman of the Anglo-American Telegraph Company. He was taken ill while attending to business in the City on Wednesday week, and expired before he could be removed to his residence. Mr. Stewart held for many years the responsible position of secretary to the London and North-Western Railway.

MR. JOHN HERAPATH, the cousin of Mr. William Herapath, the celebrated chemist of Bristol, whose death we lately recorded, died on Tuesday week, at his residence, Catford Bridge, Kent. Mr. Herapath was engaged in completing his concluding volume of "Mathematical Physics" for publication when he caught a cold which, though it at first appeared to be slight, terminated in his death.

Correspondence.

SQUARING THE CIRCLE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Geometrical discussion should not be acrimonious, and I therefore only reply to your correspondent "A. W.," writing you on 17th current, that I wished to say no more of his letter of 13th January, in my rejoinder to it of 7th current, than to show from his calculations, and those of P. H. Van der Weyde, compared, how wide of

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truth the present method of calculating the area of a circle and the ratio of its diameter to its circumference leads its votaries. I hope it will satisfy him if I now say that the remainder of his letter, which I did not notice, was, as all such approximations must ever be, equally erroneous with that which I did.

I regret that your correspondent "Commander, R. N.," under date 23rd current, in your issue of today, has avoided the question put to him in mine of 14th current, by a reference to the preface of the "Nautical Almanack." That publication having been my companion over about 380,000 miles of the salt sea, I am not ignorant of its construction. But having proved the exact ratio of the diameter of a circle to its circumference to be 5 to 16, I wished to show that the ordinary value of 1 to 3.14159, &c., and its results can never be anything more than approximations wide of the exact truth, as are also the laws of Kepler, to the elucidation of which, in the "Nautical Almanack," they are applied. These laws are simply generalized theories, deduced by their author from the close life-long telescopic observations of Tycho Brahe and his predecessors. The most advanced astronomic minds are at present inquiring not only into the conclusiveness of some of Kepler's theories, but also into the truth of the philosophy of some of Sir Isaac Newton's generalizations on the subject of gravity, in the investigations of which the sublime theoretically approximative doctrines of Kepler so greatly aided him. To explain my meaning, I may be pardoned perhaps the following quotation from the eighth edition of the Encyc. Brit. Art. Ast., Vol. IV., page 61. "If the planets had no mutual attraction, and obeyed only the central force of the sun, the problem of determining the different circumstances of their motion would be one of easy solution, and each of them would accurately describe an ellipse on the plane of its orbit, according to the laws of Kepler. In consequence, however, of their mutual attraction, every planet is compelled to deviate more or less from its ellipse, so that when the matter is viewed with mathematical precision, the laws of Kepler belong only to an ideal system, and have no actual existence in nature." These and similar following passages show how unapt an argument against the correctness of my discoveries on the square of the circle and its proportional diametrical and circumferential values is the "Nautical Almanack." The fact is, that the sheet anchor in the construction of that periodical is actual telescopic observation recorded with precision by the astronomical clock and its accompanying electric chronograph.

For his own sake, I will only at present notice the letter of your correspondent, Mr William Hayden, of 22nd February, so far as to ask him whether he admits that the diagram in my letter of 7th current, shows that the four spandrils and the central square are together equal to two central squares of the value of F G H I, diagram No. 7, in my letter of 11th October last. In doing this, I would remind him that geometry is a science, not of appearance or of approximation, but of hard fact and indisputable truth.—I am, Sir, yours, &c.,

London, February 28. WILLIAM HARVEY.

Letter V.

Sir,—To Mr. Hayden I have to acknowledge an error in correcting the rule given by him for finding the circumference of a circle. I should have said, that half the difference between three diameters and the depth of a segment of a fourth of the circle, and three diameters and twice the depth of the segment of which the radius is the chord, added to his own rule, would give the true circumference.

Mr. Scutt is correct in saying that the rule given by me for finding the area of the circle is not new. I find it is a corollary from the calculations of Professor James Gregory, of Edinburgh, published in Padua in 1668, of polygons within and without the circle, which he carried up as high as 32,768 sides, at which point the polygons within and without became equal (of course impossible) to each other, and which he fixed upon as the approximative area and circumference of the circle, and to whom we owe our present representative decimals. Although the rule is the same, I claim in behalf of my own constructive problem that it embraces the area by a simpler, direct, and more conclusive proof, free from the taint of approximation, and is by so much a step in advance.

I thank "A. W." for his notice and calculation upon my constructive proof of the circumference (letter 4). I have reconsidered it, and reconstructed it upon a larger scale. It gives me 13 dia. 41 circumference, which is between 7-22 and 6-19ths, and in my objection to decimals and the decimal system altogether, I feel that I can only bow to a delicate mechanical manipulation, with fractional or angular expressions as final. When "Commander, R. N." insists upon the exact truth of the digital verbiage of decimals to be proved by "the fact that the computed positions of the celestial bodies agree exactly with their observed positions," does he reflect on the impossible pelicacy required of the observer? It is not the case of "there or thereabouts" to the tenth of a second or so, but something infinitely finer. In the first place, the chronometer must have corresponding divisions with the decimals; next, what mortal will we find endowed with perceptions so fine as to be able to decide the climax of those flying myriads? And what rate must muscular motion be, to reply to that mental decision, and fix it upon the yet unconstructed clock? Decimals are delusive, and chiefly remarkable for their own condemnation, by showing the enormous number of positions not divisible by ten, but which they persist in so dividing—the lading of water with a sieve—and the mis le failure they exhibit when applied to coins, weights, and measures. Great honour will be due to the mathematical St. George who shall arise and slay this decimal dragon, and release the natural system so long in chains, and which promises to be altogether devoured if he come not soon, by the percolation of French ideas amongst ourselves and other nations.—I am, Sir, yours, &c.,

March 2. JOSEPH A. NICHOLSON.

Sir,—In his letter of February 7, Mr. Harvey says "so as to form with a quarter of the central square 5 6 7"; but as it is not at all obvious that the three curved spaces 5 6 7 are a quarter of the central square, I must ask him for the proof thereof.—I am, Sir, yours, &c., THOS. C. HAINES.

Belfast, March 2.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—T. C.—S. B.—Messrs. C. M. and Co.—G. W. H.—H. C.—W. T. C.—G. G. P.—C. F.—R. B.—G. E. P.—W. H.—G. A. W.—J. H. P.—J. A. N.—F. W. P.—Messrs. J. B. and Co.—A. C. B.—R. I.—T. C. H.—J. N.—W. H. H.—R. L.—R. S.—W. T. F.—G. W. H.—R. T.—S. E.—J. A. A.—W. H.—B. F. S.—R. H.—D. C. J.—R. T.—B. D.—J. T. R.

Meetings for the Week.

MON.—Royal Institution of Naval Architects.—Ordinary General Meeting. A communication from the President on "The Antiquities of Frejus, in the South of France;" and Mr. H. W. Brewer on "The Mediæval Architecture of Central and Southern Germany," at 8 p.m.

TUES.—Royal Institution.—Mr. George Scharf on "Historical Portraiture," at 3 p.m.

The Institution of Civil Engineers.—Discussion upon Mr. Sandberg's paper on "The Manufacture and Wear of Rails," at 8 p.m.

THURS. — Royal Institution.—Mr. George Scharf, on "Historical Portraiture," at 3 p.m.

FRI.—Royal Institution.—Mr. Stanley Jevons, on "The Exhaustion of our Coal Mines," at 8 p.m.

Royal United Service Institution.—Lieut.-Colonel C. H. Owen, R.A., Professor of Artillery, Royal Military Academy, Woolwich, on "Modern Artillery as Exhibited in Paris in 1867," at 3 p.m.

SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

London Association of Foremen Engineers.—Mr. David Walker on "The Shrinkage of Cast Iron," at 8 p.m.

Naval, Military, and Gunnery Items.

WE are glad to hear that the ceremony of "drumming out" is, in future, to be dispensed with in the army, for it always seemed to us to savour more of honour than of dishonour.

FROM a return lately published, it appears that the sums included in the army estimates for 1868-69, on account of the military expenditure in the colonies, amount to £3,388,023. The total colonial contributions to be paid into the exchequer during the ensuing year amount to only £365,760.

IT is stated that the Papal Government have adopted the Remington breech-loader, and they have given out an order to the extent of 10,000; 5,000 of them are being made in Birmingham, and 5,000 in Belgium. All the barrels are to be made on Deakin and Johnson's punched steel process.

THE officer in command of the ram "Stonewall," now on her way to Japan for the navy of that country, writes that he arrived at Callao, January 23, and expected soon to sail for Honolulu. The ram successfully rounded Cape Horn, and it was hoped would be as successful in crossing the Pacific.

THERE appears to be some idea of reorganizing the Austrian naval forces in the Adriatic. Following the example of France and England, the Government of Vienna is said to intend to form an experimental squadron composed of five frigates (three of them iron-clad), two steam corvettes, and three gunboats. One division of this force would remain in the Levant, while the two others would perform evolutions at sea for the exercise and instruction of the crews.

THE Army Estimates for 1868-69 provide for the following as the number of the regular army:—British establishment, including depots in the United Kingdom of regiments in India, 6,894 officers, 13,091 non-commissioned officers, 116,665 rank and file; total, 136,650, being 595 fewer than in 1867. The establishment of Her Majesty's British forces in India to be paid out of Indian revenues is 3,592 officers, 5,318 non-commissioned officers, and 55,556 rank and file; total, 64,466, being 826 fewer than in 1867.

In order to expedite the work of fitting the "Hercules," at Chatham, a bridge of boats is about being constructed from the dockyard to that part of the harbour where the "Hercules" is lying, in order to facilitate the workmen proceeding to and from the vessel, and transporting the materials required in her fitment from the dockyard. The intended bridge will be constructed with the iron mortar boats laid up high and dry at Chatham dockyard ever since the close of the Russian war. Notices have been issued that the channel between the dockyard and that part of the harbour where the "Hercules" is lying will be closed to the passage of vessels of all kinds until further notice.

MESSRS. R. NAPIER AND SONS have launched a twin-screw "Monitor," built by them for the Dutch Government, and of 1,600 tons burden, builder's measurement. The dimensions of this "Monitor" are as follows:—Length over all, 187ft.; breadth 44ft.; depth, 11ft. 6in. The armour-plating on the sides of the vessel is 5½in. thick, with 10-in. teak backing, and an iron inner skin 1in. thick, supported by strong iron frames. The turret is on Captain Cole's system, plated with 8in. of armour, with 12-in. teak backing on a 1-in. inner skin. The vessel, which has been named the "De Tyger," is to be armed with two 300-pounder 12½-ton Armstrong guns. The engines, which are also made by Messrs. Napier, are of 140-horse power, nominal.

IN the Annual Musketry Returns for 1867-8, it is stated:—The Field-Marshal Commanding-in-Chief observes with satisfaction a marked improvement in the shooting of the troops, notwithstanding the reduction in the amount of preliminary instruction sanctioned by the existing musketry regulations, and, while fully disposed to give the new breech-loading arms all the credit to which they are entitled, he feels it due to commanding officers and others charged with the training of the men, to place on record his conviction that the gratifying progress which has been made this year is in no small degree attributable to the increased attention which has been bestowed on the instruction of the troops. The general results of the shooting of the several infantry battalions during the past and previous years will be found contrasted in the following table:—

Number of Battalions whose Shooting is							
Year	Very Good		Good		Moderate		Total.
1866-67	... 13	...	30	...	34	...	79
1867-68	... 40	...	25	...	10	...	75

And, although the practices from which "the figure of merit" is compiled is most satisfactory, his Royal Highness is compelled again to advert to the fact that the independent firing is frequently very indifferent, which he can only attribute to undue importance being attached to mere rapidity of fire, and to a want of attention to deliberate aim being taken by each soldier during the practice.

Miscellanea.

THE iron portion of the Exhibition building in the Champs Elysees has been sold to a company of contractors for the sum of £60,000; it is not yet known what is to be its future destination.

THE number of visitors at the Patent Office, South Kensington, for the week ending February 29, was 3,018; total number since the opening of the museum, free daily (May 12, 1858), 1,253,598.

THE "Lewiston (Maine) Journal" states that a gentleman residing at Auburn has this winter made use of his large hothouses for the culture of what genteel young ladies in the country call "hen fruit."

THE Right Hon. H. T. L. Corrie, M.P., First Lord of the Admiralty, has kindly consented to preside at the annual meeting of the National Lifeboat Institution, which is to be held on Tuesday, the 10th inst., at the London Tavern, Bishopsgate-street.

AN exhibition of the works of living artists, Dutch and foreign, is announced to open on September 7, in the present year, at Amsterdam, and to close on October 5, unless the directors see reason for extension of the time.

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AT the monthly meeting of the London Association of Foremen Engineers, to be held at the George Hotel, Aldermanbury, on Saturday next, the 7th inst., Mr. David Walker will read a paper on "The Shrinkage of Cast Iron." The sitting opens at 8 p.m.

IT may be convenient to persons who have to send old letters for literary purposes to be informed that they may be sent by post under the usual conditions of book postage, at 1d. for 4oz., and need not be sent as letters at 1d. for half an ounce.

THE number of visitors at the South Kensington Museum during the week ending February 29, were:—On Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 9,003; Wednesday, Thursday, and Friday (admission, 6d.), from 10 a.m. till 4 p.m., 1,436—total, 10,439. Average of corresponding week in former years, 10,615. Total from the opening of the museum, 7,220,028.

THE "Niagara Falls Gazette" says that workmen are engaged in putting cables over the river for the new suspension-bridge at that place. The ice bridge, instead of being a formidable rival, is a most valuable aid in this work. The first wire cable was thrown across from the Canada side on Monday. It is a 2-inch wire rope, and is intended as the pioneer of the large cable, which will be thrown over the chasm when milder weather comes.

THE Société Agricole of Brabant announces a great exhibition of cattle and implements, to take place in Brussels in the middle of the month of June next. The mechanical portion of the exhibition is to be universal. By a royal decree there is to be a lottery established for the purchase of implements, which are to be distributed by lot amongst the subscribers. This is, we believe, the first time that a lottery has been established in the interest of agriculture.

MR. E. HOLLAND, M.P., of Dumbleton-hall, was lately summoned for allowing a locomotive engine of his to travel on the turnpike road between Ashchurch and Evesham without the owner's name and residence being painted thereon. Mr. Winterbotham, who appeared for Mr. Holland, admitted the offence, and expressed regret that he should have infringed his own Act of Parliament. The hon. member was fined 2s. 6d., and 11s. expenses. The incident created much merriment in court.

AT the seventh meeting of the present session of the Royal Geographical Society, Sir R. I. Murchison, Bart., president, in the chair, the following new Fellows were elected:—Captain Edward Baynton, N. Cork, W. R. Dalziel, A. Gillett, D. Haysman, Henry Kingsley, R. L. Middleton Kitto, J. W. Miers, M. L. Mavrogordato, J. E. C. Pryce, Hon. Edward Stirling, and J. W. S. Wyllie. A paper was read on the Geographical Results of the Abyssinian Expedition, to January 22, 1868, by Clements R. Markham.

AT last week's sitting of the Academy of Sciences, M. Le Verrier, in a letter, gave some further information about the 96th telescopic planet discovered at Marseilles on the 17th ult., stating that on the 20th it had been observed at Paris by M. Loewy with the great meridian instrument. M. Delaunay, after M. Le Verrier's letter had been read, expressed his regret that he (M. Le Verrier) should persist in refusing to mention the names of the observers who discovered small planets at the Observatory of Marseilles, and informed the Academy that the young observer who had discovered the 96th planet was M. Borelly.

AT the general monthly meeting of the Royal Institution of Great Britain, held on Monday, March 2, 1868, Sir Henry Holland, Bart., president, in the chair, F. D. Banister, Esq.; P. H. Berthon, Esq. Miss Martha Conway; Mrs. Ernest Hankey; Charles Hart, Esq.; Mrs. Henry Huth; Benjamin Isaac, Esq.; Morton Latham, Esq.; Mrs. Le Breton; Robert Longsdon, Esq.; Alexander Macmillan, Esq.; W. I. Marter, Esq.; Thomas Parry, Esq., M.P.; Mrs. Frederick Pollock; Robert Prance, Esq; Miss Edith Prance; Edward Smirke, Esq.; J. P. Stocker, Esq.; C. H. L. Woodd, Esq., were elected members of the Royal Institution.

AT the last meeting of the Royal Horticultural Society, the exhibition exceeded in the quantity and beauty of subjects any hitherto recorded. Orchids supplied the most attractive articles. The varieties of Cattleya were most lovely, but far the finest Orchid was Oncidium macranthum, it is believed from New Granada, which came from the collection of Lord Londesborough. Mr. W. Wilson Saunders, F.R.S., presided, before an unusally large attendance of the fellows, and the following candidates were elected new fellows, viz.:—Mr. W. Adams, Mrs. Brown, Mrs. Forbes, Lieut. General Hay, Mrs. Jones, Mrs. Loveland, Dr. H. R. Madden, Geo. Thomas Selby, &c.

IT appears that at the close of 1867 four miles and 5,035ft. of the Mont Cenis Tunnel had been completed, leaving two miles and 4,018ft. still to be pierced. The distance pierced in 1867 was 5,040ft., as compared with 3,416ft. in 1866, 4,079ft. in 1865, 3,626ft. in 1864, 2,673ft. in 1863, 2,076ft. in 1862, 1,210ft. in 1861, 1,144ft. in 1860, and 2,889ft. in the preceding years. The outlay made upon this remarkable and important work (which has now been more than ten years on hand) amounted at the close of 1867 to about £1,700,000. It is now hoped that the tunnel will be completed in 1871. Its length when finished will be seven miles 3,773ft., and its total cost will be about £2,500,000, or something more than £300,000 per mile.

THE "Nord" gives a curious calculation as to the proportion in which rewards were distributed to the exhibitors of France. England, Belgium, Austria and Russia, at the Universal Exhibition. France had 15,025 exhibitors, of whom 9,122 were distinguished either by medals, or honourably mentioned—that is 60 per cent.; Great Britain, 6,176 exhibitors, 1,026 received rewards—proportion, 26 per cent.; Austria, 2,094 exhibitors, 916 nominated, &c—43 per cent.; Prussia, 2,249 exhibitors, 485 nominated—21 per cent.; and Belgium, 50,226 exhibitors, 18,840 of whom received recompenses—that is, 37 per cent. on the whole. Therefore Belgium, for the merit of her industrial productions, took the second place of honour.

THE average number of houses supplied last year by each of the London water companies, and the average daily supply of water in gallons, respectively, was as follow:—Chelsea, 26,875 and 8,087,258; West Middlesex, 36,881 and 8,816,486; Southwark and Vauxhall, 71,558 and 13,629,758; Grand Junction, 27,190 and 9,533,432; Lambeth, 38,320 and 8,975,533; New River, 113,462 and 23,790,667; East London, 92,652 and 19,298,241; Kent, 34,504 and 6,468,873. Thus, from the Thames, 200,824 houses were supplied with 49,042,467 gallons daily; and from the Lea and other sources 240,618 houses were supplied with 49,557,781 gallons daily. In the aggregate, the London companies supplied 441,442 houses with 98,600,248 gallons of water on an average daily. The quantity used for domestic purposes, or for house supply, was about 81,033,800 gallons, or 26·3 gallons per head of population.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES—2235, 2264, 2266
BUILDINGS AND BUILDING MATERIALS—None.
CHEMISTRY AND PHOTOGRAPHY—2239, 2259
CULTIVATION OF THE SOIL, including agricultural implements and machines—2191, 2210, 2251, 2260
ELECTRICAL APPARATUS—2192, 2221, 2241
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2201, 2202, 2208, 2209, 2211, 2214, 2219, 2242, 2243, 2244
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—2213, 2237, 2238, 2250
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—None.
GENERAL MACHINERY—2218, 2229, 2233, 2236, 2246, 2253, 2255, 2261
LIGHTING, HEATING, AND VENTILATING—2188, 2194, 2196, 2199
METALS, including apparatus for their manufacture—2189
MISCELLANEOUS—2193, 2212, 2215, 2220, 2224, 2225, 2226, 2230, 2231, 2232, 2240, 2247, 2248, 2252, 2256, 2257, 2265, 2267
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2207, 2217, 2234, 2262
SHIPS AND BOATS, including their fittings—2204, 2205, 2223, 2254
STEAM ENGINES—2245, 2249
WARFARE—2190, 2216, 2227, 2228, 2263

2186 E. RAVENSCROFT. *Improvements in lamps.* Dated July 27, 1867.

This invention relates to lamps in which flat wicks are principally employed, and consists of the arrangement of the wicks, wick holders, and burners of the said lamps. In arranging the wicks, wick holders, and burners of lamps, according to this invention the patentee employs by preference three of the flat wicks, wick holders, and burners, and arranges them radially, so that the plane of each wick, wick holder, and burner forms an angle of 120deg. with the wick, wick holder, and burner on either side of it. The burners may open into each other, or they may communicate separately with the reservoir. By arranging the wicks, wick holders, and burners in the manner described, an equal illumination is obtained on all sides of the lamp, which is not the case with lamps having one flat wick, wick holder, and burner. The invention is especially applicable to lamps for railway carriages, but also to lamps of other kinds.—Patent completed.

2188 W. L. L. LEAVER and A. SMALLEY. *An improved method of lighting house and other fires.* Dated July 29, 1867.

First, the inventors fix on or apply to some convenient part of the gas tubes in the house, building, or office (as may be required), one end of an elastic flexible tube made of any material found most suitable, and terminating at the other end in a metal extremity, which extremity is made with one or more gas jets or burners. Second, this part of the invention containing the gas jets or burners is then put in the place where the fire is required to be lighted or kindled, the gas being ignited in the jets or burners, and the coal or combustible being placed so that the flame from the said jets or burners may come in contact with it till the fuel is sufficiently ignited, when the apparatus may be removed.—Patent abandoned.

2189 T. GREENER and W. ELLIS. *Improvements in the manufacture of iron, and in the production of felting for improving the quality and yield of iron in the process of reduction.* Dated July 29, 1867.

The patentees claim, first, the use for the bottoms of heating or mill furnaces of ores or substances containing oxide of iron, or the equivalents of such substances, in the manner descrit ed. Second, the method described of securing the cinder obtained from the iron in the heating furnace by a dry bottom, and the use of such cinder for "felting" for puddling furnaces, alone or combined with other substances, as described.—Patent completed.

2190 A. M. CLARK. *Improvements in projectiles.* (A communication.) Dated July 29, 1867.

This invention relates to the application of a pasteboard plug which is moulded in the required form before its introduction into the projectile. The pasteboard, being strongly compressed in all ways, will not be acted on by the gases, and will retain its original form even after the ball has reached its destination.—Patent completed.

2191 W. R. LAKE. *Improvements in machinery for hulling rice and other grains.* (A communication.) Dated July 29, 1867.

This invention relates to mechanism for hulling rice and other grains or seeds, and consists in combining with a stationary grooved or ribbed plate or plates an endless movable apron made up of a series of ribbed or corrugated plates. The invention is not described without reference to the drawings.—Patent completed.

2192 G. DAVIES. *Improvements in insulators for telegraphic wires.* (A communication.) Dated July 29, 1867.

The patentees claim, first, the use of paraffin as an insulating medium in the construction of telegraphic insulators by immersing the parts therein whilst in a heated state, substantially set forth. Second, the use of blown glass as an insulating medium in the construction of such insulators. Third, the improved construction of telegraphic insulator particularly described. Fourth, placing the points of the arms or prongs of the wire holder of telegraphic insulators nearer to the lower edge of the metallic outer casing or shell than any other part of the holder is to any other part of the said casing or shield, for the purpose of preventing the deleterious effects of lighting thereupon, substantially as described.—Patent completed.

2193 P. G. B. WESTMACOTT. *Improvements in cranes and apparatus for raising, hauling, and lowering weights.* Dated July 29, 1867.

The patentee employs a chain pinion or drum which receives motion when required by means of the auxiliary power; it may be by gearing, or connecting it with a wheel round which an endless hand chain passes, or in other ways the chain pinion or drum may be drawn by the auxiliary power. The hoisting chain of the crane is arranged to pass alongside of the chain pinion or drum, and when the auxiliary power is to be employed, it is deflected from its direct course by a movable guide pulley, mounted on a hand lever, so as to cause the chain to bear against the chain pinion or drum, and to gear with it, the links of the chain being held by suitable recesses and projections on the face of the pinion or drum. When the auxiliary power is not required, by shifting the guide pulley the chain is allowed to pass clear of the pinion or drum.—Patent completed.

2194 D. HODGE and R. C. WITTY. *Improvements in apparatus to be used in making gas from petroleum and other liquids.* Dated July 29, 1867.

Here the patentees employ a cylindrical retort of cast iron filled with fragments of firebrick, &c. The retort is set in a furnace, so that it may be heated uniformly all over. Near one end of the retort is a nozzle through which the petroleum is introduced from a cistern above; the quantity admitted is regulated by the means hereinafter described. The petroleum or liquid passing in amongst the heated firebrick in the retort becomes converted into permanent gas, which is led off at the other end of the retort into a washing vessel, which is a cistern closed at the top, and having in it partitions dipping down into water. The gas entering at one end of the washing vessel has to force itself down under these partitions, and through the water, to get to the other end of the washing vessel, whence it is led away, and in this manner any petroleum which escapes conversion into gas is separated and re-collected. From the washing vessel the gas is conducted into a small gasometer, into which, also, the gas service pipe opens. On the top of the gasometer a small wheel bears, the axis of which is in connection with a lever on the plug of a stop-cock which regulates the flow of petroleum or liquid to the retort, so that, as the gasometer fills and rises, it moves this lever, and with it the plug of the stop-cock, and so diminishes and gradually shuts off the supply of liquid.—Patent completed.

2195 J. H. WYATT. *Improvements in the construction of studs, buttons, solitaire studs, and the like.* Dated July 29, 1867.

This invention consists in the construction of studs, buttons, solitaire studs, and the like, so that they are capable of carrying or confining as many or as few folds of linen, or other material, as the wearer may desire. The invention, as applied to a collar stud, is as follows:—The stud is formed in two parts, the top and bottom, each carrying a tubular piece of metal, &c., fitting one into the other. The inventor places a helical or spiral spring in one tube, which is secured at both ends to the top and bottom piece; as the folds of linen are placed over the top of the stud, the spring expands, according to the thickness of material, and yields and presses against the said linen, so as to prevent the same from leaving the stud.—Patent abandoned.

2196 B. F. STEVENS. *Improvements in burning petroleum and other hydro-carbon liquids for the production of heat and light, and in the apparatus or means employed therein.* (A communication.) Dated July 29, 1867.

This invention consists, first, in so placing the apparatus for producing a mixture of hydrocarbon spray and air, relatively to the heat produced by the combustion of such mixture, that the apparatus itself will not be subjected to the action of the heat, and will, consequently, not be liable

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to be clogged or rendered unserviceable by the deposition of solid carbon or of tar, which depositions have been discovered by extensive experiments always to follow when the apparatus is itself subjected to heat. Second, of a peculiar adaptation of means for adjusting the relative quantities of steam and liquid hydro-carbon employed, so as to obtain the best economical result; and, third, of a mode of effecting a thorough mixture of hydro-carbon liquids with air to be used as illuminating gas.—Patent completed.

2197 A. HOLLOWAY. *A new or improved elastic clasp or lock suitable for pocket-books, purses, wallets, or any kind of leather cases.* Dated July 30, 1867.

This elastic clasp is composed of an oblong box for the upper part, and a tongue or slide of metal acted upon by a spiral spring, or springs, which gives the elastic property, which forms the principal feature of the invention. The catch or hook of this slide is formed by cutting a hole in the slide in the shape of a horse-shoe or shield, the tongue of metal forming the interior of the hole being the hook or catch for fastening it to the lower part of the clasp. The lower part of the clasp is composed of a flat plate of metal, with a small staple or bow riveted in the side of the above-named plate, which forms the lower half of the said clasp; under this staple the tongue of metal forming the centre of the horseshoe-shaped hole in the side of the upper parts of the said clasp passes for fastening the two parts together.—Patent abandoned.

2198 A. WATT. *An improved fertilizing compost.* Dated July 30, 1867.

This invention consists in forming a compost for horticultural and other like purposes by the employment of glycerine. To carry out the invention the patentee proceeds as follows:—He takes peat, rotted fibres, loam, leaf mould, or other fertilizing substances, to which he adds glycerine, or a solution of glycerine, the object of which is to keep the soil in a moist state for a longer period than would be the case when water alone is employed.—Patent completed.

2199 J. B. A. MENAGE. *Improvements in the construction of the lamp commonly called the Moderator Lamp.* Dated July 30, 1867.

This invention consists, first, in dispensing with the moderator rod, and using a simple oil tube for the oil to pass up to the burner, without any rod within it, and in regulating the supply of oil to the burner by contracting the diameter of the oil tube at the upper end thereof to a suitable extent to regulate the supply that shall be delivered to the burner. Second, in fixing to the lower end of the oil tube an inverted cup, into which is fitted another cup, and this latter cup is provided with a disc of wire gauze (or a plate perforated with very small holes); the latter cup operates as a filter through which the oil must pass before it can ascend into the oil tube, whereby the oil is filtered, and is wholly or partially freed from the impurities which may have collected in the oil reservoir. —Patent completed.

2200 J. JONES. *An improved chemical or compound for extinguishing fires and destroying explosive fire-damp in coal mines.* Dated July 30, 1867.

The patentee takes cyanides and oxides of manganese, magnesium, iron, sodium, potassium, carbon, or any other oxides or cyanides, muriatic acid, chloric acid, sulphuric acid, nitric, carbonic, acetic or any other acids; caustic liquor, caustic soda, caustic lime, iron, copper, potass, or any other caustics; ammonia, lime, soda, carbon, potass, or any other alkalies, or what these separately or together are composed of or produce, whether they be gases, liquids, or solids mixed in a suitable quantity of water. He selects one or more of the said articles in quantities of each as circumstances may require for extinguishing any particular kind of fires, such as cotton or other mills, buildings, or materials, oil warehouses, gunpowder magazines, greek fire, fires of sulphur, and phosphorus, in the process of melting metals, and for destroying explosive firedamp in coal mines, or for preventing combustion of the various aforesaid inflammable materials. He keeps the aforesaid articles separate from each other, and from water by means of separate vessels, distinct compartments, or by any other means, till used or required for use.—Patent completed.

2201 W. GADD and J. MOORE. *Improvements in looms for weaving.* Dated July 30, 1867.

Here the front of each shuttle box, or a part thereof, is free to turn upon a pin at or near its end farthest from the yarn, and such movable fronts are on their inner surfaces next the shuttle somewhat of the form of the "swell." These movable box fronts, or parts thereof, are held in position by springs with stops, which may be adjustable, to prevent the ends of these movable parts next the yarn from being pressed in too close, so as to prevent the entrance of the shuttle. By these means the shuttle may be held close to the box back during the whole time of its delivery with a gentle pressure, and its motion when thrown may be direct across the reed. These movable fronts or portions thereof thus also act on the shuttle as the ordinary "swells."—Patent completed.

2202 J. HAWORTH and E. HAMER. *An improvement in rollers used in machinery for doubling cotton and other fibrous material.* Dated July 30, 1867.

This invention consists in substituting rollers made of stoneware or earthenware for the wooden rollers. The stoneware or earthenware rollers are turned up true before being glazed or enamelled, a hole being made in the centre of each roller into which fits a cast-iron axis.—Patent abandoned.

2203 J. H. BROWN and W. BULL. *Improvements in the manufacture of hats, caps, bonnets, and other coverings for the head, and the foundations thereof, or similar articles, and in the means and appliances for producing the same.* Dated July 30, 1867.

Provisional protection has not been granted for this invention.

2204 A. MURRAY. *Improvements in apparatus for hauling vessels or other heavy bodies into deep water.* Dated July 30, 1867.

Here one improvement provides for the use of one or more powerful capstans, windlasses, or crabs worked by steam or other power on board of a vessel other than the stranded vessel, and which other vessel is to be placed between the stranded vessel or heavy weight to be moved, and one or more heavy anchors laid out in the direction in which it may be desired that these should be moved, and the improvement consists in placing the capstans, windlasses, or crabs on the same base plate with the bollards or bolts or apparatus to which the towing ropes or cables from the stranded vessel or heavy weight are attached, or in connecting these parts together by plates or bars, so that, when the strain in opposite directions is brought upon them, it will not pass through the framework or component parts forming the structure of the vessel in which they are placed.—Patent completed.

2205 C. MAYO. *Improvements in propelling and steering vessels.* Dated July 30, 1867.

According to this invention, in order to apply the motive power under the most advantageous conditions, it is proposed to make one or more tunnels passing through the vessel from before aft, in such a position that the axis of the tunnel or the resultant, in case of more than one, shall pass through the centre of resistance in a direction parallel to the surface of the water. And it is further proposed to place the propelling instrument (which the patentee prefers to be a screw in the tunnel revolving on an axis coincident with that of the tunnel) as near as may be to the centre of gravity of the vessel.—Patent completed.

2206 A. JAMES. *Improvements in needle-cases and wrappers.* Dated July 30, 1867.

One part of this invention consists of a needle case made of paper, and pasted in the form of a flat tube open at both ends. One end of the flat tube is cut away at one side, and the remaining side is made of a nearly semicircular figure, and constitutes a flap. When the flat paper tube is folded near its middle, the before-mentioned flap can be inserted in the open end of the tube, thus forming a flat case.—Patent completed.

2207 S. M. MARTIN and S. A. VARLEY. *Improvements in signalling upon railway trains, parts of which apparatus are applicable to electric telegraphs generally.* Dated July 30, 1867.

This invention relates to improvements in the arrangement and construction of parts of the apparatus and galvanic batteries for electrical train intercommunication, described in the specification of a former patent, granted to the present patentees, dated April 5, 1866 (No. 966). The patentees make the connections between vehicle and vehicle by means of spring hooks-and-eye couplings; the hooks are made by preference of steel, and the eyes of malleable cast iron, and may be galvanized for their better preservation. The spring hooks grip the eyes when the connections are coupled up, and are provided with a stop to prevent the hooks from being opened beyond a certain fixed amount, in order that they may not be unduly strained; or they are so constructed that they open and allow the eye to be pulled out if subjected to undue violence. To economize electric force, and at the same time to give a heavy blow upon the bell, they construct an apparatus which they call an electric lock. In this apparatus the attraction of a soft iron armature which takes place when the circuit is closed liberates a light lever, which, in its fall, liberates a second lever, and this second lever knocks away a detent, liberating a heavy hammer actuated by a powerful spring. As the apparatus just described is somewhat complex in its construction, they prefer, in most cases, to employ a modification of it, which may be employed either as a continuous ringing bell, or for liberating a detent and releasing a hammer actuated by a spring. They construct the electro-magnets which form part of and actuate the alarums in the following manner:—They take a piece of soft iron of a suitable size and length for the core, and flatten it out in the centre. They drill a hole through the flattened portion, and wrap insulated wire round the soft iron core. The two extremities of the soft iron core are usually connected by a soft iron bridge. The central portion is now divided, or very nearly so, and a piece of soft iron is mounted on an axle, and moves just freely in the space in the centre of the electro-magnet. This axle passes through the centre of a metal bar, which they call the striking lever, and to which it is attached. A hammer is attached to one end of the striking lever, and a balance weight slightly heavier than the hammer to the other. The normal position of the striking lever, and the piece of soft iron working in the centre of the electro-magnet, is nearly at right angles to the core of the electro-magnet when the circuit is open. When the circuit is closed, the piece of soft iron mounted on the axles arranges itself in the same direction as the core of the electro-magnet, moving nearly a quarter of a circle, and causing the hammer to strike a bell; the striking lever may be made to knock away a detent and release a heavy hammer actuated by a powerful spring. To make this alarum ring continuously when the circuit is closed, the balance weight at the lower end of the lever, just previously to the bell being struck, raises a lever which they call the make and break lever, and divides the circuit. The striking lever now assumes a vertical position, and an arm projecting from it comes in contact with the make and break lever, and forces it into contact with an insulated piece of metal, and again closes the circuit. The make and break lever is mounted on an axle, and is either a permanent magnet, one pole of which works between two pieces of soft iron, or it is made of soft iron, and works between the poles of two permanent magnets.—Patent completed.

2208 B. DOBSON and J. COCKER. *Improvements in machines for spinning and doubling.* Dated July 31, 1867.

This invention is not described apart from the drawings. —Patent completed.

2209 B. DOBSON and W. SLATER. *Certain improvements in carding engines.* Dated July 31, 1867.

This invention relates to the carding engines, for which letters patent were granted to G. Wellmann, September 11, 1860 (No. 2190). In those carding engines the top flats were raised and lowered by a cam, or by a series of curves on the face of the lifting wheels acting on pins in the slides in the radial arms. Now, this invention consists in dispensing with these cams or curves and pins, and lifting the top flats by a bowl on the lifting wheel acting on a curved surface on the slides, which are drawn down by springs as soon as the bowls have passed; by these means the top flats are rapidly raised and lowered again into their proper working place, and thereby better work is produced and time saved. Another part of the invention consists in the application of a ratchet wheel to the cross driving shaft, and a catch to the radial arm, to prevent the said shaft from moving in the wrong direction.—Patent completed.

2210 M. PUDDEFOOT. *An improved plough.* Dated July 31, 1867.

This invention consists in giving to the plough beam a short bend or shoulder near the middle of the furrow, a few inches in front of the mould board, so as to reach an inch or two over the unploughed land, and leaving room for a wheel to pass between the beam and mould board along the furrow, a hole being formed in the beam towards the hinder part of the mould board for the axletree. One handle is fixed to the mould board in like manner to the share, and the other, together with the colter, to the beam for light land, employing for heavy work a strengthening bar and brace connecting the front of the beam axletree and mould board. The said axletree is passed through the beam at one end, and the bar brace and mould board through the other, or otherwise; two small wheels fixed to the beam are also to be employed on wet or boggy land, as also irons similar to colters for breaking the clods before the colter comes to the next furrow; and for preventing the fall or flying off of the plough, in connection with which a drill is employed for sowing the seed.—Patent abandoned.

2211 M. J. FEARNLEY and C. SMITH. *Improvements in looms for weaving.* Dated July 31, 1867.

This invention consists, first, of an improved positive "taking up motion" for enabling the fabric to be wound on the cloth in a perfect and regular manner. The patentees employ the ordinary ratchet wheel, driven by a propelling catch from the slay sword, and fix to the shaft of the ratchet wheel, or cast to its boss, a toothed wheel gearing into a toothed wheel working on a stud in a lever connected by a rod to a bar or rod resting on the cloth in the cloth beam. To the boss of the last wheel is fixed a plain wheel or plate carrying a number of catches, catching into a second ratchet wheel fixed to a shaft working in a stationary bearing, which shaft is geared by pinions and toothed wheels with the shaft of the cloth beam, and as the beam increases in diameter the plate and catches rise with it. When the loom is working, the ordinary ratchet wheel gives motion by the gearing to the plate and catches, and turns the second ratchet wheel, gearing, and cloth beam, and as the cloth increases in diameter, the plate and catches are raised so as to cause the catches to take less and less of the teeth of the second ratchet wheel, until the beam has attained its full diameter, and thus enable the taking up to be uniform and positive. Second, for "letting off" motions, the yarn beam has to be gradually increased in speed as the yarn is wound off, and, when desired, the foregoing arrangements can be applied to the yarn beam by simply reversing their actions.—Patent completed.

2212 J. M. HOCKING. *Improvements in the means and apparatus for condensing noxious smoke and vapours.* Dated July 31, 1867.

Here the noxious smoke and vapours are drawn by an air pump, worked by steam or other power, from the furnace of furnaces through a pipe or pipes connected with such furnace or furnaces into one or more air-tight cylinders or cisterns partially filled with water; if more than one, then they are connected together by flues or pipes inserted in such cylinders or cisterns. Into and within each of such cylinders or cisterns the patentee inserts a spindle, and on the spindle within the cylinder or cistern he connects discs or fans, spokes or projections, which can be made of metal, and have other projections, angular or otherwise, formed on one or both surfaces. During the passing of the noxious smoke and vapours from the furnace or furnaces through the cylinder or cistern of water, the spindles upon which the discs, fans, spokes, &c., are fixed are made to revolve in the water within the cylinders or cisterns. These discs, fans, spokes, &c., when revolving, powerfully agitate the water, thereby arresting and separating the ores, particles of ores, metallic fumes, or mineral acids, contained in the said noxious smoke or vapours, and condense or cause the deposit of the same on the bottoms of the cylinders or cisterns.—Patent completed.

2213 G. GORDON. *Improved processes and apparatus to be used in the manufacture of sugar, and in sawing, cutting, or forming the same into cubes for use.* Dated July 31, 1867.

This invention is not described apart from the drawings. —Patent completed.

2214 W. R. LAKE. *An improved machine for manufacturing weavers' harness.* (A communication.) Dated July 31, 1867.

This invention is not described apart from the drawings. —Patent completed.

2215 J. C. C. AZEMAR. *Improvements in boxes or apparatus for holding pieces of paper or other material for use or distribution.* Dated July 31, 1867.

Here a loose board has two bands attached to it, which bands are carried up over rollers, and have weights attached to their ends. The under side of the board has a spring attached thereto which exerts a counter action against the weights, so that the board which carries the paper is always forced up with about the same amount of power. These parts are enclosed in a box, the lid of which has an opening at the front; this opening, together with an opening at the top of the front side of the box, allows the top piece of paper to be withdrawn. The underside of the lid becomes thinned towards the front, so as to exert a gradual diminution of pressure.—Patent completed.

2216 C. E. BROOMAN. *Improvements in firearms.* (A communication.) Dated July 31, 1867.

This invention is described and illustrated at page 124 of the present volume of this journal.—Patent completed.

2217 J. SAXBY. *Improvements in the construction of locking apparatus for governing the movement of railway points and signals, and in the mode or method of applying, combining, and actuating such apparatus.* Dated July 31, 1867.

We cannot here devote space to the voluminous details of this invention.—Patent completed.

2218 W. SNELL. *An engraving machine.* (A communication.) Dated August 1, 1867.

This invention consists, chiefly, in a method of combining with a graving tool or bit a stylus or tracing point, and a holder, to support the plate or object which is to be wrought upon, so that, as the tracing point is made to follow the lines of the pattern, corresponding motions will be imparted to the graver or bit, and a fac simile of the same, or a changed scale of proportions of the pattern, will be produced upon the surface of the object to be wrought upon.—Patent completed.

2219 F. A. CALVERT. *Improvements in machinery and apparatus for cleaning and preparing fibrous substances, and for opening twisted yarns and woven fabrics.* Dated August 1, 1867.

This invention relates to a former patent granted to the present patentee, dated March 24, 1866 (No. 869). In the specification of the said patent, referring to the machin e

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for cleaning and preparing wool, cotton, &c., the patentee described a series of lifting bars and combs, acting in combination with the main toothed drum, or fine comb cylinder. Now, the present improvement consists in dispensing with the lifting of the said comb bars, and employing in lieu thereof one or more swivel bars, or revolving rollers, to which the toothed combs are attached. Also referring to the machine for preparing fibrous substances, and for opening twisted yarns, and woven fabrics, he described a series of blades and combs actuated by cams, and guided in slots. Now, the present improvement consists in making the combs to vibrate on centres, instead of lifting them, as heretofore.—Patent completed.

2220 J. H. JOHNSON. *Improvements in umbrellas.* (A communication.) Dated August 1, 1867.

The patentee claims, first, constructing umbrellas with a surrounding gutter, and discharge spout of flexible material, as described. Second, the peculiar combinations and arrangements of apparatus in connection with a flexible gutter and discharge spout attached to an umbrella for the purpose of opening and closing such gutter by the act of opening and closing the umbrella, and permitting of the folding up of the gutter and supports with the cover of the umbrella, as described. Third, the peculiar construction and arrangement of supports for the aforesaid flexible gutter, whereby such gutter is rendered self-opening without the necessity for special cords or appliances attached to the umbrella mechanism, as described.—Patent completed.

2221 F. H. HOLMES. *Improvements in apparatus for the production of the electric light.* Dated August 1, 1867.

This invention has for its object the production of the electric light with a reduced speed of rotation, or the increasing the intensity of the light with the same speed of rotation now adopted. According to one part of this invention it is proposed to place round the axis or shaft of an electro-magnetic machine a series of armatures, varying in number from, say, sixteen to forty, such armatures being all disposed parallel with the shaft; a corresponding number of electro-magnets are fixed to a frame which surrounds the armatures above referred to. Or the inventor places round the main shaft, and parallel with it, from sixteen to forty electro-magnets, and attaches to the frame which surrounds them a corresponding number of armatures. In either case he obtains the electric light by a velocity of revolution of the shaft ranging from 400 to 60 revolutions per minute, which is a much lower rate. Another part of the invention consists in winding on the electro-magnets, and on the armatures, or on the electro-magnets only, a double or treble set of coils of either flattened or round wire, for increasing or diminishing the light by increasing or diminishing the power of the electro-magnets, since the current which produces the magnetism can by this arrangement be passed through the whole of the wire (namely, the compound coil), or through either of the simple coils.—Patent abandoned.

2222 D. D. KYLE. *Communicating or signalling in and with railway trains.* Dated August 1, 1867.

Provisional protection has not been granted for this invention.

2223 R. B. BOYMAN. *Improvements in the machinery for propelling vessels and aerial conveyances by reaction.* Dated August 1, 1867.

This invention is not described apart from the drawings. —Patent completed.

2224 J. QUIN. *Improvements in the preparation of hose for conveying water, which improvements are also applicable for the preparation of woven fabrics for cart covers and other similar purposes.* Dated August 1, 1867.

This invention relates to the manufacture of seamless woven flax hose pipes, cart sheets, sail cloth, or other fabrics composed of flax, cotton, hemp, or an mixture of two or more of such materials, and consists, first, of a special mixture or preparation in which the yarn previously to weaving (or the cloth after it is woven) is steeped for preventing the rotting or decay of the fibre from damp or otherwise, and also to prevent the deleterious action of the sulphur upon such fabrics during the steaming process after they have been coated with the compounds. Secondly, the invention consists of a preparation of india-rubber and other materials, to be applied as described, to one side of the hose or fabric to render the same waterproof and pliable. And, thirdly, in a special solution or preparation to be applied to the reverse side of the hose or fabric to further protect the same against rotting.—Patent completed.

2225 R. NEWHALL. *Improvements in the manufacture of cases, enveloped, or wrappers for needles and pins.* Dated August 1, 1867.

This invention consists in making the cases, &c., for holding certain quantities of needle, or pins, say, for example, quarter packets or hundreds, by cutting out all the parts which subsequently form the case in one piece of paper, previously outlined to the shape, if desired, without any separation of such parts. The blank thus produced presents an oblong centre, two side wings and top and bottom flap pieces, one or both of such flaps having pointed or curved ends; each of the side wings are then slit or cut in their width into three parts, and the top and bottom flaps are also indented with a slit. The parts may now be folded inwards, the two centre portions of the side wings being closed and secured upon each other, the remaining parts of the side wings merely folding so as to be easily opened for the readier exhibition or withdrawal of the needles or pins.—Patent completed.

2226 W. R. LAKE. *Improvements in pocket knives.* (A communication.) Dated August 1, 1867.

This invention is not described apart from the drawings. —Patent completed.

2227 W. R. LAKE. *Improvements in breech-loading fire-arms.* (A communication.) Dated August 1, 1867.

This invention is not described apart from the drawings. —Patent completed.

2228 W. TRANTER. *Improvements in firearms.* Dated August 1, 1867.

This invention has reference to two former patents dated respectively July 20, 1865 (No. 1889), and August 17, 1866 (No. 2113), and consists, first, in elongating the screw for closing the rear end of the plunger by forming a tube with a hook at the front end thereof, for retaining the pin, in order to prevent its falling accidentally, and igniting the cartridge after it has been inserted in the barrel. By this arrangement the gun can be carried with safety when loaded, and, when required to be fired, it is only necessary to turn a projection formed on the screw into its position towards the right hand, thereby removing all impediment to the action of the striking pin. The projection is furnished with a spring and stud for retaining it in either of its positions. The front part of the stud or block on the striking pin is suitably formed for entering the hook and sliding out of it when required. And the invention consists, secondly, in a modification of the thrower for throwing out the cartridge case, and also of the plunger for acting in connection therewith. The plunger has a groove formed in the under side to within a short distance of the end, thereby forming a projection or shoulder adapted to catch upon the short end of the thrower, which is filed away on one or both sides for enabling it to slide in the groove of the plunger. A portion of the metal of the plunger is removed at the rear end of the groove to admit of its turning on its axis free of the short arm of the thrower.—Patent completed.

2229 J. E. NELSON. *Improvements in apparatus for conveying passengers and goods through the air.* Dated August 1, 1867.

Here the inventor employs a frame in the form of a circular disc, from the centre of which a portion is removed. This frame he makes hollow, and fills with gas, so as to give a certain amount of buoyancy to the frame. To this frame a car for receiving the passengers and goods is suspended, and below the car there is hung a weight which, by tackle, is capable of being moved fore and aft, so as to adjust the position of the centre of gravity in such manner that, when the apparatus has been carried up to a distance from the earth, and is then set free, the apparatus, as soon as it commences to fall towards the earth, may assume a more or less inclined position, dependent on the distance of the centre of gravity from the centre of the frame. The inclination thus given to the apparatus will cause it, as it descends, to skim through the air, gathering lateral velocity instead of falling directly to the earth. There are various other features described in the specification.—Patent abandoned.

2230 S. HIGGS. *Improvements in miners' safety lamps.* Dated August 1, 1867.

Here the gauze of the ordinary Davy lamp is encased in a tube made partly of glass and partly of gauze. This tube or casing forms of itself a separate safety lamp, and encloses the whole of the Davy lamp. Instead of the ordinary wick, a flat plaited wick dipped in a preparation of tallow is substituted.—Patent abandoned.

2231 J. BIRCH. *Improvements in machinery to be employed in the manufacture of wax vesta matches, and for other purposes.* Dated August 1, 1867.

This invention consists of certain new arrangements or combinations (the details of which we cannot produce here) of the parts of machinery for cutting into the required lengths the tapes or wax threads for vesta matches, and delivering the cut-off lengths into laths or supports preparatory to dipping the ends of the same into the composition with which they are required to be tipped. —Patent completed.

2232 J. POOLE. *Improvements in forming shafts, rollers, drums, and wheels with india-rubber surfaces.* Dated August 2, 1867.

Here the inventor divides the metal axis into two parts, or forms the same with an opening through the centre, extending from journal to journal; through this opening he passes a thin sheet of vulcanized india-rubber, which he turns or rolls up upon the metal. He then rolls the remainder of the sheet around the axis, and fastens the opposite edge, which is tapered, by screwing or otherwise. And in order to prevent the rubber from elongating he fixes metal collars upon the ends of the shafts. Other methods are included in the specification.—Patent abandoned.

2233 F. L. H. DANCHELL. *Improvements in machinery and apparatus for preparing, shaping, and drying peat and other substances.* Dated August 2, 1867.

The nature of this invention consists, first, in the general arrangement of the machinery for macerating or preparing the peat, or other vegetable or mineral substances, for forming it into discs or blocks, and delivering the same into troughs which are deposited by trucks, tramways, and guide rollers on the ground, on which they are left to dry by exposure to the atmosphere. Second, in the general arrangement of the machinery for preparing the peat, or other vegetable and mineral substances, for forming it into blocks, and delivering the same on to a series of endless travelling bands, by which the blocks are moved to and fro in a drying stove, and turned over at each end thereof; also in the arrangement of apparatus described for distributing heated air or currents of air in the drying stove.—Patent abandoned.

2234 J. EDWARDS. *Improvements in machinery or apparatus for actuating and locking railway points and signals.* Dated August 2, 1867.

This invention consists in the application and use of screws as the main movers, instead of levers, as at present. —Patent completed.

2235 B. HARLOW. *Improvements in boilers or apparatus applicable to the generation of steam, and to other purposes.* Dated August 2, 1867.

The patentee claims the use in boilers or apparatus for the generation of steam, &c., of double tubes, or broad flat tubes, arranged, formed, or constructed, as described. Second, the construction of hollow double fire bars with one joint or connection only at each end, as described.—Patent completed.

2236 J. H. JOHNSON. *Improvements in hydraulic lifts, and in the mode of operating the same.* (A communication.) Dated August 2, 1867.

This invention consists, first, in the use of an open or slotted column within which a flexible metallic packing band or blade is fitted, in order to close the said slot, such packing being opened and closed again as required by an arm connected with a double piston which is caused to ascend inside the column by water pressure acting from below. The slot or opening in this vertical column is closed as fast as the piston rises by the before-mentioned internal flexible metallic packing blade, which is withdrawn from the slot (so as to open the same) at the part contained between the two pistons, in order to allow of the passage of the connecting arm to which the platform or platforms of the lift is or are to be attached. Another part of this invention consists in working hydraulic lifts in which a pressure of water is required by the aid of what is known as the Giffard injector, in lieu of by a force pump, or other like means of obtaining fluid pressure.—Patent completed.

2237 E. T. MARLER. *Improvements in the method of, and apparatus for, clarifying sugar, which improvements are also applicable to other similar purposes.* (A communication.) Dated August 2, 1867.

According to this invention jets of steam are introduced or applied in such manner as to be thoroughly disseminated through a body of highly heated saccharine juices in combination with Fuller's earth, animal charcoal, or other suitable defecating medium.—Patent abandoned.

2238 J. DEWAR. *Improvements in preserving substances for food.* Dated August 2, 1867.

Here the patentee preserves meat, fish, game, poultry, and eggs in a condition suitable for food for a length of time by subjecting them to the action of an aqueous solution of sulphurous acid in a special manner, as described. He employs a stronger solution than usual, and exposes the substances to it for a longer period than has hitherto been practised.—Patent completed.

2239 E. A. KIRBY. *An improved system of dispensing medicines and preparing drugs therefor, together with an improved portable miniature dispensary, and instrument case applicable to such system.* Dated August 2, 1867.

Here, according to one part of the invention, instead of keeping the drugs (whether fluid or solid) in bottles &c., containing indefinite quantities, as now invariably practised, the patentee encloses the drugs separately (either in a fluid or finely powdered state) in small air-tight envelopes or cases of gelatine, or other suitable material, each containing a certain definite or ascertained quantity or dose of the pure drug, the said envelopes or cases being enclosed in glass tubes, bottles, or other receptacles, duly labelled with the name of the drug, and the number of grains, minims, or other exact quantity, contained in each envelope or case.—Patent completed.

2240 W. HORTON. *Improvements in forge hammers.* Dated August 2, 1867.

This invention relates to such forge hammers as are used in the manufacture of tools, cutlery, &c., and consists, principally, of an arrangement whereby the hammers are raised vertically in slides by cams compressing spiral or other springs, which, by their reaction, increase the force and momentum of the blow given by the hammers when released by the cams.—Patent abandoned.

2241 T. ALLEN. *Improvements in submarine telegraph cables, and in the mode of joining the same.* Dated August 2, 1867.

The patentee claims, first, the combining of iron or steel and copper wires in submarine telegraph cables in such relative proportions as to obtain the maximum of conductibility (for the sectional area of the conductor) with the minimum amount of iron or steel consistent with the desired breaking strain—that is to say, that the ratio of the iron or steel to the copper shall not be more than two to one, and it may be as one to one, as one to two, or as one to three. Second, the joining of submarine telegraph cables substantially by the means and in the manner described.—Patent abandoned.

2242 J. G. TONGUE. *Improvements in brakes for cotton lappers or scutchers.* (A communication.) Dated August 2, 1867.

This invention consists, first, in a stationary shoe secured to the back girt or cross rail of the machine, or other suitable support, in combination with a friction pulley arranged beneath it and swinging yoke, the upward motion of which brings the friction pulley into contact with the shoe to check the motion of the pulley, while the downward action of the yoke releases the pulley from contact with the shoe, and allows the pulley to turn. The second part of the invention in this connection consists in a peculiar construction of the swinging yoke, composed of a shield and bell-shaped lever or arm, between which two devices the friction pulley before referred to is situated. The third part of the invention comprises the swinging yoke shield, constructed to cover and protect the gear, operating in connection with the brake, and so as to form a bearing or support for the shaft of the pinion to which the friction pulley is secured. The fourth part of the invention includes a connecting rod or link combined with a foot lever, and weighted arm or lever, and whereby the brake is more effectually kept under the control of the operator. The fifth part of the invention includes a combination of the said shield gear arranged therein, friction pulley, stationary shoe, and sundry levers and weight or weights, constituting an entirely which gives to the brake a more perfect and controllable action.—Patent completed.

2243 J. SMITH. *Improvements in machinery or apparatus for bucking, bleaching, and cleansing textile fabrics and other fibrous materials.* Dated August 3, 1867.

In performing this invention the patentee makes use of a closed vessel or kier, furnished as usual with a grid, on which the fabrics or fibrous materials are placed; the upper and lower ends of the kier are connected by an external pipe, to which an apparatus is applied for heating the bleaching liquid contained in the pipe to a higher temperature than that in the kiln, in order to produce a constant circulation through the kier. The heating apparatus he prefers to use consists of an annular tube forming part of the pipe connecting the upper and lower ends of the kier, within which annular tube is introduced a perforated gas pipe, so arranged as to apply the oxy-hydrogen gas flame as the heating medium; but he does not intend to limit himself to the use of gas for heating the bleaching liquid.—Patent completed.

2244 J. and T. ELCE. *Improvements in machinery for spinning and doubling.* Dated August 3, 1867.

This invention is applicable to the self-acting mules in which the cam shaft is driven by positive gearing. The improvements consist in fixing a disc or other equivalent having two studs and bowls to the cam shaft, and in applying a spring so as to act on the said studs and bowls, whereby the cam shaft is brought into and held in its proper position after a change has been made. By this arrangement the cams are brought into the required position for separating instantaneously the two halves of the clutch box by which the cams are driven, thus preventing the points of the teeth of the clutch box from catching, and the consequent noise and wearing away of the teeth. —Patent completed.

2245 C. D. ABEL. *Improvements in combined gas and air engines.* (A communication.) Dated August 3, 1867.

The patentee claims, first, an improved arrangement of mechanism for imparting the motion of the piston rod to the engine shaft. Second, an improved mechanism for actuating the slide valve, and for raising the piston before the commencement of the up-stroke. Third, an improved construction of the slide valve, operating in combination

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with the several gas and air passages in the cylinder and valve cover. Fourth, an improved construction of water jacket with provision for effecting the circulation of water therein. Fifth, improved mechanism for imparting the motion of the piston rod directly to a mill shaft by an endless band, all as described. The specification of this invention is too elaborate to be quoted here in detail.—Patent completed.

2246 R. BEWLEY. *Improvements in rotary pumps for raising water or other liquids.* Dated August 3, 1867.

Here, the case within which the revolving disc or impeller works for forcing the water, &c., admitted at its central part out through its circumference, as required, is constructed with an annular groove or space adapted to receive an annular ring, which is formed round the circumference of the revolving disc, the outer and inner circumferences of which ring, and the parts of the case in which the same works, are turned and bored to a truly cylindrical form. By this means a practically water-tight joint is obtained, without the risk of undue friction from the contact of the working parts. The parts of the case on each side of the groove or annular space in which the disc revolves (in which parts are formed the passages for admitting the water into the discs at its central part, and those for delivering it therefrom at its circumference) are respectively furnished with radial partitions, in order to prevent loss of power in giving rotary motion to the water. The case is also constructed with one movable side, in order to admit of the disc being taken out of the case and reinserted as required, without the necessity of disconnecting the pump from its supply and delivery pipes. This movable side is provided with a stuffing box through which the shaft of the revolving disc works. The revolving disc is constructed as above stated with a ring adapted to fit and work in a corresponding cylindrical space formed in the case, and has the requisite water passages formed in such ring, instead of being made as usual to extend from the circumference to near the centre of the disc, and these water passages formed in the ring have air in volute or other suitable curvature adapted to coincide as nearly as practicable with the direction of motion of the ends of the passages. These passages through the ring of the disc are made of an uniform cross section throughout, and they are proportioned in area to the quantity of water, and the height to which it is required to be raised by the pump; also to the speed at which the pump is to be worked.—Patent abandoned.

2247 C. TOUAILLON. *A new and improved means of utilizing all the parts of all sorts of feathers.* (A communication.) Dated August 3, 1867.

We cannot here give space to the details of this invention.—Patent completed.

2248 J. RUSSELL. *An improved system of flattening and straightening saws and similar plates or blades of steel during the process of hardening.* Dated August 3, 1867.

Here the patentee makes the blades or plates of steel red hot, as usual, and immerses them in oil, but before they become cold the bends, buckles, or twists, are taken out of them by placing them between strong surface plates and submitting them to great pressure.—Patent completed.

2249 A. BUDENBERG. *Improvements in apparatus for registering the pressure of steam in steam generators, and the pressure in hydraulic presses and other vessels or chambers, which improvements are also applicable to registering pressure and vacuum in steam engines, the vacuum in condensing apparatus, also to registering the combined pressure of the steam or other power employed to give motion to an engine, and the speed of such engine or other machinery, also to registering barometrical variations.* (A communication.) Dated August 3, 1867.

This invention is not described apart from the drawings.—Patent completed.

2250 J. F. and F. FENTON. *A new coffee injector.* Dated August 3, 1867.

This invention is not described apart from the drawings.—Patent abandoned.

2251 W. R. GRACE. *Improvements in harrows.* (A communication.) Dated August 3, 1867.

This invention consists, chiefly, in the use of a weighted roller in combination with the draught beam and frame in which the harrow teeth are secured. The roller is carried by an arm hinged to the draught beam, and the harrow frame is arranged to turn upon a central pin or stud projecting from the said beam, which is provided with an anti-friction roller arranged to run upon the top of the frame and keep the harrow level while in motion. The weighted roller bearing upon the frame causes the teeth of the harrow to enter the ground more deeply on one side of the centre of the frame than on the other side, and as the harrow is drawn forward, a rotary or circular motion is imparted to the frame around its centre.—Patent abandoned.

2252 J. T. HATFIELD. *Improvements in watch cases, which improvements are also applicable to locket and miniature cases.* (A communication.) Dated August 3, 1867.

The patentee claims, first, forming watch, locket, and miniature cases from hard rubber or gutter-percha, or other similar elastic, hard, or horn-like substance, by moulding the same in dies, substantially as set forth. Second, forming watch, locket, and miniature cases made of hard rubber or gutta-percha, or other similar elastic, hard, or horn-like substances, whether plain, embossed, or inlaid with metals or other substances.—Patent completed.

2253 G. W. DINSDALE. *Improvements in the construction and manufacture of traps for water-closets, drains, and other purposes.* Dated August 3, 1867.

The patentee claims, first, the construction of D or similarly shaped traps in two parts, the dip or inlet pipe being either formed as part of the shell or body, or in combination with the cover of the trap, as described. He also claims the construction of D or similarly shaped traps of earthenware in one or two parts, as described. Second, he claims the manufacture of D or similarly shaped traps by casting them complete in moulds with the dip and inlet pipe and outlet passage forming part thereof, the top or cover being cast or formed therewith, or separately therefrom, or in combination with the top or cover, as described.—Patent completed.

2254 W. W. HUGHES. *Improvements in apparatus for propelling vessels and pumping or raising water.* Dated August 3, 1867.

This invention relates to hydraulic pressure wheels to be driven by steam or other power for propelling vessels by forcing the water on which the vessels float through a tube or tubes having outlets at their sterns or sides below the surface of the water, as near to the line of the keel as may be found most convenient. Besides propelling, the apparatus is applicable for turning or stopping the vessels, as may be required, and also for pumping and raising water.—Patent completed.

2255 W. WILSON. *Improvements in felting machines.* (A communication.) Dated August 3, 1867.

This machine is composed of rollers, preferably conical rollers, revolving in the same direction, and mounted side by side on axes. The hollow between the rollers forms a bed on which the articles to be felted rest, whilst they are acted on by felters, either grooved or plain, which are above the rollers, and are rocked to and fro across the bed formed between them. The hat bodies, &c., to be felted are rolled up in a cloth and laid on the rollers, and as the rollers revolve, the felters are rocked to and fro. The rocking felters can be raised or lowered from the bed to diminish or increase the pressure on the work. The revolving rollers which form the leg for supporting the work are, by preference, partially immersed in hot water.—Patent completed.

2256 J. ANGUS. *Improvements in lamps burning with oils and other fluids.* (A communication.) Dated August 5, 1867.

This invention has for its object to prevent the explosion of lamps burning with volatile oils, or other volatile fluids, and consists in providing a tube, channel, or passage, either formed in one with or separate from the lamp, and passing down from the top to the bottom thereof. Both ends of the tube or passage are open, the lower end communicating with the interior of the lamp, while the upper end communicates with the external atmosphere, and is by preference surrounded by a small cup or reservoir formed in or upon the upper part of the lamp. The lower part of the lamp is filled with water in which the lower end of the passage is consequently immersed, and the volatile oil or other fluid floats on the top of the water. By this arrangement it will be seen that any increase of pressure in the lamp will relieve itself by forcing the water up the passage and out of the open end thereof and into the cup or reservoir, and thus any dangerous accumulation of pressure will be prevented.—Patent abandoned.

2257 L. V. HUE and C. ROZIERE. *Improvements in the means of moulding the subjects in glass or crystal for ornamenting them inwardly.* Dated August 5, 1867.

This invention consists, first, in a method of ornamenting glass by means of engraved or chased stamps or punches, which are applied on the hot glass, and the imprisonment of these ornamentations by covering them with other pieces of glass suitably fused, soldered, or welded on to the ornamental ones. Second, in the application of this method of ornamentation to the manufacture of all kinds of articles made in moulds by the press. Third, in the application of the same method to the manufacture of all kinds of articles made with blown cylinders, "manchons soufflés." Fourth, in the application of this same ornamentation to articles blown and doubled with an envelope "paraison" of white or coloured glass. Fifth, in the composition of boxes with mechanical stamps or punches, the said stamps being internal, that is to say, in the box; or external, that is to say, on the periphery of the box. Sixth, in the composition and arrangement of the mould for making lustre plates or liddle drops in two parts welded together and ornamented in the thickness of the glass.—Patent completed.

2258 J. DALE. *A refrigerator for cooling wort.* Dated August 5, 1867.

Provisional protection has not been granted for this invention.

2259 W. J. PUGHSLEY. *Improvements in obtaining sulphuric acid from the refuse pickle or liquor used in wire and galvanizing works.* Dated August 5, 1867.

In carrying out this invention the patentee proceeds as follows:—He places the used or refuse "pickle" or "liquor," when no longer fit for use, in a suitable vessel, and allows it to remain therein a sufficiently long time to permit such impurities as will settle at the bottom of the vessel to do so; the "pickle" or "liquor" will then become clear. He then conveys the clear liquid into a leaden pan placed on iron plates, with such brickwork as is necessary to support and protect the leaden pan, and by means of heat he concentrates this slowly until it has attained a specific gravity of about 1.250. After this he runs the liquid into vessels lined with lead, and allows it to remain therein four or five days to crystallize. The crystals thus obtained are sulphate of iron (commonly called "copperas.") He removes the crystals and puts the "mother liquor" again into a leaden pan, and evaporates as before to a suitable strength. The liquid is then run into another vessel and allowed to crystallize, as before. After this the liquid will be sulphuric acid of a sufficient strength and purity to be used as "pickle" or "liquor."—Patent completed.

2260 A. C. BAMLETT. *Improvements in reaping and mowing machines.* Dated August 5, 1867.

This invention consists, first, in giving motion to the chains or straps of self-swathe-delivery reapers by mounting a horizontal (or nearly so) spindle over the knife eye, and connecting it by gear to the chain rollers, the crop being delivered over the bottom bearing of the horizontal spindle. Second, in driving the reel (or its equivalent) in self-delivering sheaf reapers at different speeds, so as to regulate the size of the sheaves. The patentee uses two or more sets of pulleys provided with chains or straps, one set of pulleys being fixed on the reel shaft, the other set loosely on the main or other convenient shaft, and they are engaged and disengaged by a clutch movement. The pulleys are of different diameters, thus driving the reel or its equivalent at different speeds, which regulates the size of the sheaves. Third, in grass-mowing machines he mounts the intermediate spindle and the crank spindle on one bracket, which bracket is mounted in bearings attached to the frame of the machine, the bearings of the intermediate spindle forming a hollow spindle by which the bracket is mounted on to the frame. A second bracket, which carries the cutter bar, is mounted on the bracket already mentioned; or the second bracket may be made to carry both the cutter bar and the crank spindle. In order to take the weight of the finger bar and shoe off the ground, he uses a lever with a balance weight attached. To raise the cutter bar higher off the ground, he connects the regulating lever to the steerage pole by a double link-piece, so that when the cutter bar is raised, the frame will be raised as well, thus allowing the cutter bar to be raised higher than hitherto.—Patent completed.

2261 C. DE NEGRI. *Improved machinery for reducing wood to shreds to be used in the manufacture of paper pulp.* Dated August 5, 1867.

This machinery consists of two or more knives, straight-edged, and revolving rapidly on an axis parallel to the cutting edges and grain of the wood which is to be reduced. The wood is previously cut into pieces of an uniform length, slightly exceeding that of the knives, and the pieces are held in an oblong rectangular trough, open at the ends by means of a false side and wedge, the movable side and the fixed side opposite to it being furnished with pyramidal spikes, and advanced to the knives at a regular speed by a screw driver, or by level gear in connection with the knife shaft. The trough slides backwards and forwards between V's in a direction at right angles to the axis of rotation of the knives, so as to clear the revolving shaft, and so that the knives may barely clear the sides and bottom of the trough.

2262 J. G. TONGUE. *Improvements in the manufacture of wheeled and other carriages or vehicles.* (A communication.) Dated August 5, 1867.

This invention consists in making the body and other parts making up the outside or shell; also the seats, and, if desired, the wheels or running gear of a carriage or other wheeled vehicle, likewise the panels, dash-board, and, if desired, runners of a sleigh, of hard rubber or vulcanite, whereby durability and elegance is secured to the vehicle with comparatively little trouble or expense, and the carriage or other vehicle may be constructed with neatness and dispatch.—Patent completed.

2263 G. SCHNEIDER. *Improvements in breech-loading fire-arms.* Dated August 5, 1867.

This invention relates to that class of arm technically known as the breakdown. The first improvement has reference to the mechanism for maintaining the arm closed. For this purpose the patentee makes use of a bolt adapted to slide backwards and forwards in the breech-piece by means of a lever, which bolt, when the arm is closed, enters a cavity formed under the barrel or barrels. A spring is employed to keep the bolt in position. The second improvement under this head has reference to the pistons which strike the cartridge to produce its ignition. Hitherto these pistons have been raised by a spring (generally a helical spring) coiled round the piston. By this improvement the patentee raises the piston automatically by the closing of the gun without the use of springs, or any additional complication. The invention relates, second, to that class of arm in which the barrels and stock are rigidly connected, and the first improvement has reference to the movable breech-piece and its accessory parts. The next improvement has reference to the extraction and expulsion of the cartridge, which is effected in one single operation. For this purpose the patentee makes a perforation through the breech of the gun, in such a position that, after the extractor has drawn the cartridge entirely out of the barrel, whether it be charged or exploded, it will fall from the arm through such perforation.—Patent completed.

2264 J. HEATON. *Improvements in blast furnaces.* Dated August 5, 1867.

The patentee claims obtaining the desired draft or blast in blast furnaces by continuing the upper part of such furnaces into a chimney of the required height with openings for the feeding of the charges, substantially as described.—Patent completed.

2265 W. PRANGLEY. *Improvements in apparatus employed in athletic exercises.* Dated August 5, 1867.

Here two fixed uprights are used, which may be the two side posts of a door, or a gate, or they may be fixed for the special purpose of this invention. These uprights are required to be of greater height than the persons exercising between them. Across from upright to upright are two horizontal bars, which can readily be placed and retained at any desired height from the ground, according to the height of the person who for the time is taking exercise, the ends of such cross bars being received in brackets or sockets fixed or secured to the two uprights. One of these cross bars is for the hands of the person exercising. From the other cross bar two stirrups are suspended by elastic vulcanized springs (with handles) of a strength of elasticity adapted in each case to the person who for the time is using the apparatus.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated October 28, 1867.

3029 G. Smith, Liverpool, brass and Britannia metal finisher. Improvements in marking boards used in the game of billiards, parts of which are applicable to registering the number of persons passing through pay-gates or conveyed by vehicles.

Dated December 7, 1867.

3482 P. R. Hodge, Adam-street, Adelphi, Strand, civil engineer. Improvements in machinery and apparatus for heating and forming metals for railway wheel tyres.

Dated January 30, 1868.

326 E. T. Mainwaring, Tipton, Staffordshire. An improved bale or metallic tie.

Dated January 31, 1868.

338 E. Andrews, Huddersfield, tailor. Improvements in trousers and breeches or other similar articles of wearing apparel.

Dated February 1, 1868.

353 A. Clark and A. van Winkle, Great Wild-street, London, soda apparatus manufacturers. Improved apparatus for manufacturing and storing aerated waters, and for transferring these and other liquids from one vessel to another. (Partly a communication.)

Dated February 4, 1868.

271 J. H. Johnson, Lincoln's Inn-fields. Improvements in the treatment of compressed or embossed wood. (A communication.)

Dated February 7, 1868.

419 W. Haun, Hetton Colliery, Durham, secretary to the Hetton Coal Company. Improvements in safety lamps.

Dated February 8, 1868.

[illegible]8 A. Philipp, Manchester. An improved apparatus [illegible] employed as a combined cigar, ash, and light holder, a[illegible]nist or other game marker.

[illegible] J. Howard, agricultural engineer, and F. T. Bousfield, engineer, Bedford. Improvements in the construction of steam boilers.

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432 W. Cowan, Edinburgh, gas meter manufacturer. Improvements in the construction of the cases of gas meters.

434 H. Woodward, Hammersmith, mechanical engineer. An improved knife cleaner.

438 W. T. Sugg, Vincent Works, Vincent-street, Westminster. Improvements in valves.

439 W. B. Marston, Leeswood Vale Oil Works, near Mold, Flintshire. Improvements in lamps and apparatus for lighting railway carriages.

441 N. C. Szerelmey, Belgrave-road, Pimlico. Improvements in preserving wood.

Dated February 10, 1868.

445 W. Burgoyne, Cambridge-street, Birmingham, builder. Improvements in the construction of letter and invoice holders and sorters.

446 W. R. Lake, Southampton-buildings, Chancery-lane. An improved machine for scouring and cleaning grain. (A communication.)

447 F. Barnes, Southampton, surgeon, and D. Hancock, High Wycombe, Buckinghamshire, gas fitter. A new or improved method of, and apparatus for, working and communicating motion to signals on railways.

448 G. Jessop and B. Senior, Batley, Yorkshire, overlookers. Improvements in machinery for preparing wool and other fibrous substances for spinning, commonly known as the condenser carder.

449 C. E. Brooman, Fleet-street, City, patent agent. Improvements in combined pen and ink holders or fountain pen holders. (A communication.)

451 H. C. Tucker, Staverton, Devonshire, surveyor. Improvements in apparatus for shearing and clipping sheep and other animals.

452 H. Schlotter, Kostritz, near Gera, Reuss, Germany. An improved method of, and apparatus for, raising water.

453 J. Tansley, Bedford, cabinet maker. Improvements in apparatus for working the rollers of blinds, shutters, and maps.

Dated February 11, 1868.

454 H. A. Dobson, Knightsbridge, Westminster. An improved carriage spring.

455 T. J. Clanchy, Cheetham, near Manchester. Improvements in matches and fuzees.

457 C. M. Holland, Tan-y-Bwlch, Merionethshire. Improvements in the construction of the permanent way of railways and tramways.

458 J. W. Melling, Wigan, Lancashire, engineer. Improvements in machinery for cutting or excavating coal and other minerals.

459 C. and L. Vezhulst, Manchester, merchants. Improvements in the arrangement and construction of fireplaces. (A communication.)

460 J. R. Stoney, Leeds, engineer. Improved appliances for the consumption of smoke, and the economizing of fuel in steam boiler and other furnaces.

461 W. Pickard, Farsley, near Leeds, overlooker. An improvement in woollen condensing machinery.

463 G. Seamer, Milk-street, City, silk and velvet manufacturer. Improvements in the manufacture of silk fancy weavings.

464 F. Schafer, Piccadilly, manufacturer. A new or improved apparatus for testing eggs.

465 A. Brin, Rue des Acacias, Paris, civil engineer. Certain improvements in apparatus for generating and applying gas from air and hydrocarbon fluids for lighting and heating purposes.

466 J. S. Williamson, West Hartlepool, Durham. Improvements in drying machinery, useful for drying corn and other vegetable substances.

467 W. E. Newton, Chancery-lane. An improved apparatus for saving life in cases of shipwreck. (A communication.)

468 W. T. Woolley, Lever-street, St. Luke's. Improvements in locks or fastenings for purses, pocket-books, bags, and other articles.

469 J. Wenden, Alfred-street, Roman-road, Barnsbury, and S. P. B. Fussell, St. James's-road, Holloway, artists in stained glass. An improved process for ornamenting glass.

470 S. C. Lister, Manningham, Yorkshire. Improvements in looms for weaving cut pile fabrics.

Dated February 12, 1868.

475 R. Young, Glasgow, engineer. Improvements in apparatus for training, levelling, and dressing millstones.

476 R. C. Ross, Manchester. Certain improvements in mechanism or apparatus to be employed for cutting paper, pasteboard, textile fabrics, and similar substances or materials.

477 W. G. C. Hudson, Barbara-street, Arundel-square, Barnsbury, Islington. Improvements in revolving stands for culinary purposes. (A communication.)

478 S. B. Tucker, Parliament-street. Improvements in cartridge boxes or holders. (A communication.)

479 W. Wootton, Westminster Bridge-road, Surrey. Improvements in envelopes.

480 H. B. Condy, Battersea, Surrey, manufacturing chemist. Improvements in the manufacture of acetic acid, and in the preparation of materials to be used in the said manufacture.

481 J. G. Willans, St. Stephen's-crescent, Middlesex. Improvements in the manufacture of iron and steel.

Dated February 13, 1868.

483 S. Seville, Lees, Lancashire. Certain improvements in machinery or apparatus to be employed for sizeing and balling yarns and threads.

484 W. G. H. Taunton, Liverpool, engineer. Improvements in the construction of pumps, and in mechanism employed in working the same.

485 R. George, Kilburn, Middlesex. Improvements in gas stoves for heating and ventilating.

486 F. Grenier, Rue de la Coutellerie, Paris, civil engineer. An improved kneading apparatus.

487 W. E. Doverna, Liverpool. A new or improved fastener, applicable as a substitute for buckles and such like purposes.

488 J. Wood, Kenwick, Cumberland, civil engineer. Improvements in indicating the position of railway points, and in the apparatus or means employed therefor.

490 F. Tolhausen, Boulevart Magenta, Paris. New or improved processes and machinery or apparatus for brush making. (A communication.)

491 W. Woodfield, Redditch, needle manufacturer. Improvements in papering needles or making up packets of needles for sale.

497 G. Roberts, New Tothill-street, Victoria-street, Westminster. Improvements in candles.

495 W. R. Lake, Southampton-buildings, Chancery-lane. An improved mode of, and apparatus for, extracting and condensing the volatile portions of ores. (A communication.)

494 W. R. Lake, Southampton-buildings, Chancery-lane. An improved whip holder. (A communication.)

Dated February 14, 1868.

496 H. A. Bonneville, Sackville-street, Piccadilly. Certain improvements in compound of aniline colours. (A communication.)

497 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in moderator or carcel lamps. (A communication.)

498 A. Lemasson, Rue Lagille, Paris. Improvements in the construction of dials or indicators for showing the distance travelled by cabs and other public conveyances, and the fares due for the same.

499 J. Steele, sugar refiner, and J. Hastie, engineer, Greenock, Renfrew. Improvements in apparatus for conveying and treating animal charcoal and sugar.

500 J. P. Lack, Basinghall-street, City. Improvements in albums, scrap, and other similar books. (A communication.)

503 G. V. Wisedill, Upper-street, Islington, jeweller. A new or improved ring for keys, and other useful purposes.

Dated February 15, 1868.

505 J. S. Raworth, Manchester, engineer. An improved mode of connecting and disconnecting revolving cylindrical surfaces.

506 R. Martin, Park-terrace, Horsham, Sussex, artist. An improvement in treating and deodorizing oils.

508 D. Whittaker, Blackburn. Improvements in healds or heddles, and other parts of looms, and in machinery or apparatus connected therewith.

509 W. Easterbrook, Albert-road, Kilburn, Middlesex, engineer. Improvements in machinery or apparatus for actuating, locking, interlocking, and controlling railway points and signals.

510 W. J. Bennett, Little Smith-street, Westminster, manager, and J. Jobson, Vauxhall Bridge-road, builder. Improved apparatus for separating the solid and watery particles of slop and sewage.

511 E. Cottam, Battersea, Surrey, engineer. Improvements in breech-loading firearms.

512 B. Farmer, Barrow-in-Furness, Lancashire. Improved breaking and crushing and hammering machinery, useful for crushing stone and minerals and hammering iron, steel, brass, copper, and other substances, and in forming wrought-steel bells.

514 J. Barlow, Queen's-street, Oxford-street, coach ironmonger and plater. Improvements in carriages. (Partly a communication.)

Dated February 17, 1868.

517 J. Clark, iron planer, and T. Vicars, Liverpool. An improved tobacco box and tobacco cutting machine combined.

518 W. H. Tasker, Bradford, glass blower and manufacturer. Improvements in, or applicable to, machinery for spinning and twisting fibrous substances.

519 A. H. Brandon, Rue Gaillon, Paris. Improvements in breech-loading firearms and cartridges, (A communication.)

520 J. P. Worrall, Orsdall, Lancashire. Certain improvements in the treatment of fabrics for the purpose of imitating skins of animals.

521 W. H. Wilkinson, Southampton-buildings, Chancery-lane. An improved system of type composition and mode of constructing and arranging the type cases for the same.

522 W. Lincoln, Southampton-buildings, Chancery-lane. An improved lamp burner.

523 J. G. Taylor, Boulevart de Strasbourg, Paris, manufacturer. Improvements in puzzles and puzzle chains, and in the applications thereof.

524 F. Chevassu, Rue d'Aboukir, Paris, merchant. An improved shirt.

525 J. Walker, Poole, Dorsetshire. Improvements in the manufacture of ornamental tiles, slabs, bricks, and other articles.

Dated February 18, 1868.

529 L. Wollheim, Gloucester-gardens, Hyde Park. Improvements in apparatus for barometrical and thermometrical purposes.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated February 19, 1868.

553 W. R. Lake, Southampton-buildings, Chancery-lane. An improved process of seasoning and preserving wood. (A communication.)

Dated February 22, 1868.

602 W. Krutzsch, City. Improvements in machines for washing and rinsing clothes. (A communication.)

Dated February 24, 1868.

616 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in artificial breasts. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," March 3, 1868.

2946 J. Anderson. Manufacture of felts.
2953 W. Barrett and C. Martin. Tuyeres.
2957 A. H. Brandon. Articulated artificial leg.
2968 J. White. Ventilating buildings.
2976 T. Welton. Ozonized bread.
2982 A. Chambers. Machinery for manufacturing files.
2987 J. Ellison and J. Stirk. Means for economizing fuel.
2990 J. Dodge. Machinery for cutting files.
2995 A. M. Clark. Transmitting motive power. (A communication.)
2997 C. W. Harrison. Preventing incrustation in boilers.
3000 W. and D. Fisken. Construction of steam boilers.
3011 B. Cooper. Removing knots from woollen cloth.
3015 W. E. Wiley. Holders for lead.
3020 J. J. Perry. Binding books. (A communication.)
3023 W. Kendall. Locomotive engines.
3034 A. J., W. B., and S. H. Waterlow. Machines for printing from copper.
3035 J. Glover. Furnaces for steam boilers.
3037 T. Bennett. Manufacture of spoons.
3054 J. Maddocks. Securing nuts and bolts.
3059 Earl of Caithness. Cleaning boiler tubes.
3060 A. V. Newton. Ventilating buildings. (A communication.)
3063 W. Hall, J. Wren, and J. Brandwood. Casting toothed wheels.
3067 O. C. Evans. Digging machinery.
3072 A. Chaplin. Portable distilling apparatus.
3076 J. Sturgeon. Machinery employed in getting coal.
3097 W. Dickinson. Joining leather.
3113 T. Briggs and W. E. Yates. Looms for weaving.
3120 R. Palmer and H. S. Hird. Manufacture of wheaten flour.
3121 W. Geeves. Panel doors.
3123 A. V. Newton. Roller or anti-friction journal boxes. (A communication.)
3126 R. Leake and J. Beckett. Machinery for polishing cylinders.
3146 B. T. Newnham. Tables.
3179 W. Payne. Clack pieces for pumps.
3180 C. B. Hodgetts. Tuyeres.
3219 A. V. Newton. Rotary engines. (A communication.)
3222 J. Morrison. Hem folders for sewing machines.
3299 W. R. Green and J. G. Freeman. Steam engines.
3401 T. Briggs. Machinery for drying woven fabrics.
3444 F. R. Ensor. Manufacturing lace.
3453 E. Walker. Construction of breech-loading ordnance.
3570 W. Conisbee. Cylindrical typographic printing machine.
3637 J. Davison. Rigging.
3676 J. Cockshoot and H. Weatherill. Railway brakes.
3702 J. Davison. Furnaces.
48 C. D. Abel. Process for removing sulphur from iron. (A communication.)
132 J. Lang. Printing music.
182 A. Bochkoltz. Self-acting valves.
238 D. Y. Stewart. Cast-iron pipes.
274 A. Middlemist. Increasing the heat in stoves.
311 D. Law and J. Wharrie. Manufacturing cast-iron pipes.
322 J. Grimes. Machinery for manufacturing the bottoms of boots.
345 J. Livesey. Material that may be used as a substitute for glass.
387 T. W. Walker. Manufacture of bricks.
428 A. Philipp. Cigar ash and light holder.
464 F. Schafer. Testing eggs.
475 R. Young. Dressing millstones.
476 R. C. Ross. Cutting paper.
483 S. Seville. Sizeing yarns and threads.
616 W. R. Lake. Artificial breasts. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed February 28, 1868.

2461 J. Douglas	2493 P. F. Lunde
2463 J. and G. W. Dyson, and S. Martin	2506 G. T. Bousfield
2473 I. Dixon	2513 H. Carter and G. H. Edwards
2474 M. Hammerstein	2541 J. Whitham
2480 D. Nicoll	2844 T. Nelson
2489 A. Field and W. B. Nation	2977 F. J. Bugg
2492 A. E. Gelhaye	2993 H. Ritchie
	3190 W. and W. Campion

Sealed March 3, 1868.

2503 F. B. Dœring	2539 B. F. Stevens
2509 R. A. Jones and J. C. Hedges	2549 F. Tolhausen
2514 G. Cope	2554 J. Turnock
2515 J. Ford	2555 J. Medhurst
2521 H. Gardner	2593 W. F. Batho
2526 W. G. Creamer	3002 L. Stockman
2527 T. W. Helliwell	197 W. R. Lake
2534 J. B. Rogers	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

441 W. Kirrage	558 G. Lauder
483 L. A. Bigelow	577 J. Dodd
542 C. Whiting	579 A. T. Godfrey
550 T. W. Roys and G. A Lilliendahl	592 R. Johnson
556 S. S. Gray	610 L. Le C. Cottam
	708 F. A. Braendlin

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

483 L. A. Bigelow	526 G. Smith and J. Carrick
506 J. Taylor	909 J. Silvester
513 W. J. Hay	

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending February 15, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1882	0 4	2065	1 2	2088	0 10	2106	1 0	2127	0 4	2151	0 4
1968	0 8	2066	0 10	2089	0 10	2107	0 8	2128	0 4	2152	0 4
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2027	1 4	2075	0 10	2095	0 10	2113	0 8	2132	0 4	2165	0 4
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2061	0 10	2082	0 8	2105	1 8	2122	0 4	2142	0 4	2146	0 8
2062	0 8										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, MARCH 13, 1868.

THE LAWS OF VOLCANIC ACTION.

THE grand and mysterious workings of Nature, as manifested in the extraordinary phenomena which man is privileged to witness from time to time, were once the subject of wild and extravagant speculation amongst the learned few, whilst the masses wondered ignorantly on in mingled terror and admiration. In the course of time, aided by the dim light of a dawning civilization, philosophy pushed on its inquiries, and advanced its theories a little nearer to truth. Later on, the cultivation of the sciences, exact and applied, carried men forward still further in the path of research and discovery towards their goal. And the development of science still continues to present to the finite mind of man the solution of many questions which, at no great distance of time in the past, were seemingly enwrapped in hopeless darkness. Repeated observation enables us to trace the recurrence of some of the occasional and startling phenomena revealed to us, to certain well defined causes, and to assign to them precise and infallible laws. Thus, the magnificent meteoric display of November, 1866, which, at one time, would have been—perhaps was—the terror of nations, was watched and waited for, and came to us the simple, yet sublime, fulfilment of scientific prediction. Nor was this all. It likewise definitively established the existence of a new class of bodies belonging to the solar system, which were formerly thought to be mere wanderers. Their origin, their nature, their course, and their functions, were all a solemn mystery. But science has placed them in a new light, and has revealed to us the existence of numberless members of our solar system, having an extraneous or cosmical origin, and revolving in definite orbits around the sun.

So, although in a modified degree, is it with regard to the thermal forces operating within the crust of our earth. We are all more or less acquainted with the aspect and nature of a volcano; we know, too, that it is by turns active and dormant, and that whilst in the former state clouds of vapour and flame, showers of dust and ashes, and streams of lava, or molten rock-matter, are emitted from the top at intervals. We have advanced upon the olden notions of the cause of volcanic phenomena, and can, in some degree, account for the convulsions of Nature which occur from time to time. But we are, as yet, a long distance from a perfect knowledge of the laws of Nature's operations in this respect. True, we have worked out two theories of its origin—the mechanical and the chemical. The former supposes an original igneous condition of the earth, and a cooled crust over a present molten interior, whilst the latter presumes the solid crust to contain an abundance of such metallic elements as develop heat on contact with water. But here we are forced to stop, and the very fact of the existence of two theories shows that we are as yet only on the threshold of the inquiry. To the questions—What is the cause of volcanic energy or the periodicity of its discharges? what is the law which regulates the shifting of its action from point to point?—science can give no satisfactory reply. And yet, at no distant time, all these matters may be readily accounted for, and may prove to be governed by some well-known law, the non-application of which at the present time may then be a matter of wonder. Seismography, or the science of earth shocks, is but a new study, yet it is one which—combined with careful observation of volcanic eruptions and their products—may lead to a determination of the laws which regulate these operations. An admirable opportunity for prosecuting these researches offers itself in the present protracted eruption of Vesuvius, inasmuch as peculiarities are observable which never before presented themselves, or, if they did, have passed by unnoticed. In the hope then, that it may prove of some service in directing attention to the subject, we place on record the distinguishing characteristics of the present eruption.

It is now just four months since the commencement of the present eruption, and during that time it has presented three distinct phases. Scientific observers apportion to the first phase the time between the night of the 12th of November and the 15th of January. The second includes the time between the 15th of January and the 11th of February; and the third extends from the last date to the present time. In the first period the volcano was in full activity; during the second interval it exhibited great varieties with less activity, whilst the third period is marked as one of diminution. This latest phase is remarkable for its varieties and for the confirmation of certain scientific facts. On the 11th of February the flow of lava was materially diminished, and it was thought that the eruption was nearly over. On the 12th, however, there was renewed activity, which continued until the 15th; explosions were loud and frequent, chiefly in the morning and evening, and were accompanied by the ejection of stones, and followed by comparative silence. During this period the lava presented some curious features in its course. It was almost invisible on the upper part of the cone without ascending to the summit, but on arriving there it became apparent that underneath a bed of lava which had suddenly cooled in an interval of repose, a tube had been formed, and was attached almost mechanically to the crater, into which the lava overflowed, running through its entire length to near the middle of the cone. In several parts, however, the volume and its violence are stated to have broken the tube, and then, through the openings, the pure lava, without any admixture of scoriæ, might be seen wending its course downwards. During these three days or so, shocks of earthquake occurred, and the apparatus of variation was disturbed. Sublimates were collected on the summit, but not in sufficient quantities to mark the end of the eruption. On the 17th, greater activity was perceptible, and its periodicity was confirmed; twice a day Vesuvius put forth all its energies, interesting equally the scientific and curious.

At this time the guides of Vesuvius, who reside in Resina, stated that shocks were felt in that town sufficiently severe to shake the doors and windows. They also said that columns of stones were shot into the air to a height of nearly 900ft. The flow of lava, too, progressed considerably, forming at the foot of the cone five different streams, which poured over like cascades. On the 18th the great cone again commenced roaring violently, and two shocks of earthquake were recorded in Resina. On this day, too, the summit of the cone fell in, and, obstructing the way, formed three craters, which threw out large volumes of stones. The entire cone was also observed to tremble for four or five seconds as if shaken by an earthquake, and later in the day the lava forced an opening in the direction of the Piano delle Ginestre, and flowed onwards in a stream of full ten metres in width. From that time to the end of the month the mountain continued to thunder, and to throw out masses of red-hot lava, which, dividing into many streams, presented at a distance a spectacle of singular beauty. Frequent, though slight, shocks have been felt at Resina and other places in the immediate neighbourhood, and on the night of the 27th there was one unusually strong. We have now brought the eruption down to the latest recorded observations, and have noticed all the leading features and peculiarities which we have gathered from an interesting letter of the "Times" correspondent, written on the spot. There are, however, some other points added connected with this subject, and which are worthy of especial note, as being the results of careful observations made by Professor Palmieri. In fact, these are of the highest importance, as tending to throw some light upon the laws which govern volcanic eruptions. We have already alluded to the periodicity of the eruptions, and it would now appear that the volcano is subject to lunar influence. Be this as it may, observation goes to show that the periods of greatest eruption are half an hour later every day, singularly coinciding with the evolutions of the planet.

Professor Palmieri, in writing on the general subject, says:—"The eruption of Vesuvius maintains the periodic character already described by us, hence there are no novelties. All that is to be noted are the hours of return, with their duration and intensity, which are of interest to the scientific rather than to the curious observer. Hamilton was the first who marked a diurnal period in a long-continued eruption, and from his limited number of observations, he believed that the recurrences were at fixed hours. In 1855, however, we had an opportunity of studying this phenomenon better, and we observed the daily 'retard' of each increase of the lava; now we have had the opportunity of confirming what we then observed. Were there a good path, we could tell travellers and guides at what hour they should be near the summit without any risk from the projectiles or burning lava." With regard to the nature of the materials which have been thrown out during the third phase, it is to be observed that the ashes and the sublimates have been in small quantities, which, according to Palmieri's own assertions on several occasions, indicate that the eruption is not near its termination. The sublimates which have appeared, however, on the smoke holes have been chlorure of copper and of lead, while the absence of chlorure of iron has been noted as remarkable, although on the top of the cone it has been found united with "oligisto" iron. We should not omit here to refer to the precision with which the instruments of the Observatory, one of which was the ingenious invention of Professor Palmieri, mark the subterraneous movements. It is said to be such that a person, even with the windows closed and without seeing Vesuvius, can tell what are the conditions of the eruption. More, we think, could not be desired, and, if desired, not attained.

We have now gathered together all the salient points and noteworthy details of this remarkable phenomenon. We have shown how scant and bare our knowledge is of the laws which govern these convulsions of Nature. We have pointed out that by careful study and application of revealed facts, and comparison of circumstances, we may in time be enabled in this, as in other departments of science, to speak with exactitude and certainty. No good purpose could be served, nor would any beneficial results arise, were we ourselves to speculate or theorize upon the ascertained facts before us. It is a subject which can only be approached through a long chain of close reasoning, and by tedious and painstaking research and patient observation. We can only now heartily commend the matter to the earnest consideration of those whose inclination, interests, or, possibly, duty, may lead them to an investigation of the whole circumstances. It is a subject full of the deepest interest, and although it may appear mysterious and difficult to approach, it will become plain on being resolutely pursued and carefully investigated.

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Already in the present eruption we have the question of lunar influence, which was previously suspected, to a great extent confirmed, and we know not what else may be added to our knowledge before Vesuvius is again quiescent. At any rate, we have materials to work upon, and we may without presumption dive still more deeply into the secret of Nature's workings beneath our feet, since we have made ourselves so familiar with those above our head. Still, when all is done, when those secrets of Nature are mastered and the whole course of her working apparently made plain, we shall only be on the threshold of perfect knowledge. Our acquaintance with these things will doubtless only prove to us that there is much more behind. We shall end pretty nearly where we began, by confessing that "there are more things in heaven and earth than are dreamt of in our philosophy."

THE "TIMES" ON THE MINT.

IN the pages of the so-called "leading" journal of the British empire of Wednesday, the 4th inst., there appeared, with great prominence and much pretension, an article on the Mint. It bears reference to the Royal money manufactory on Tower-hill, but is so full of errors and positive mis-statements, with regard to that establishment, that it cannot be allowed to pass current without protest. From the opening paragraphs of the article in question, it might easily be inferred that the public were about to be fully instructed as to the mechanical and other processes carried on at the Mint. That idea is speedily dispelled, however, by the context, for no such information follows. The reader, on the contrary, is led, in the first instance, into an archæological maze as to the early mints of England, and in which the writer omits altogether to state that in the reign of Queen Mary all provincial mints were abolished, and one central mint was established within the Tower of London. In referring to the present Mint, the same authority states that since 1806 this "has been the sole coining centre for the British empire, where not only all the coins, from farthings to pounds, are struck, but where all medals for the army and navy, all gold medals for the Board of Trade, all Victoria Crosses, and all medal decorations of any kind awarded by the Government, are made and issued." The truth is, nevertheless, that no coins whatever were struck at the existing Mint till 1810; that copper and bronze coin has frequently been struck since that period, in very large quantities—thousands of tons—by contractors in Birmingham, and notably by James Watt and Company; that only one gold medal for the Board of Trade, and not one Victoria Cross, has ever been struck at the Royal Mint; and that many hundreds of other "medal decorations," awarded by the British Government, have been, and are now, produced outside its walls.

These are only a small sample of the many errors promulgated on this occasion with the stamp of the "Times'" authority. After making some startling assertions as to the time "when silver plate, and bars of copper, gold ornaments, and gold trinkets used to be left for coinage" at the Mint, and which certainly has not been the case within the last 200 years, the "Times" goes on to say that Mr. Peabody lately "sent £10,000 of old gold of all kinds to be made into sovereigns." This statement has not the shadow of a foundation. In fact, Mr. Peabody never did anything of the kind, and more than thirty years have elapsed since any private individual employed the Royal presses for stamping money, the last being the late Mr. Rothschild. It is further remarked that, "for the first time in the history of the Mint, not a single sovereign was struck there during the last year," and that "during nearly fifteen months not a pound sterling in gold has been added to the currency of the kingdom." Both these averments are at variance with truth. It has very frequently happened in the history of the Mint—and in its recent history, too—that a year has passed without any gold being coined. This was not so last year, however, for not less than half a million of "pounds sterling in gold" were struck at the Royal Mint and sent to the Bank of England in 1867. Similarly unfortunate for the "Times" are its remarks upon the silver coinage. It is observed of crown pieces that although "they are dying out of circulation in this country, yet that two thousand pounds' worth are annually struck at the Mint for the inhabitants of the Falkland Islands." What will the readers of the "Times" think when we tell them, on the best authority—that of official returns—that not one single crown piece has been struck at the Royal Mint since the year 1849, either for home circulation or for the Falkland Islanders. Crowns, half-crowns, and fourpenny-pieces are, indeed, rapidly becoming extinct, for not one piece of either denomination has been issued from the Mint for many years. This is a piece of information the "Times" does not give—but it is true!

After speaking of popular and unpopular coins, the first issue of florins is adduced as falling under the latter category. It is asserted that they were small in size, that the usual letters F.D. were omitted from their circumference, and that they were thence termed "graceless florins." In reality, the letters omitted in the legend on the small florin coinage were D.G., and not F.D., and the coins were known, not as "Graceless," but "Godless." Does the "Times" need to be told that F.D. is an abbreviation of Fidei Defensor, and D.G. of Dei Gratia? It would appear so. To enumerate all the mis-statements of the "Times" in its Mint article would demand more space than we can afford in our columns, for it literally bristles with them. One or two others, however, must be mentioned. It cannot be permitted to go forth uncontradicted that the Bank of England "sells its light sovereigns to jewellers, &c." It never has done, we believe, anything of the kind. Certainly, it does not do so now. Jewellers cannot "buy the cut sovereigns by the ounce or the pound." Light sovereigns withdrawn from circulation are really held by the Bank authorities until they reach a very large number, when they are re-cast into ingots. Jewellers who require sovereigns for their purposes do not need to buy them at all. They simply melt gold coins as they come to hand, whether light or heavy, and then reduce the standard of fineness of the resulting metal by the admixture of so much alloy (copper), as they find necessary. English sovereigns are, no doubt, melted down in large quantities every year, and used for trade purposes. This occurs because at the Royal Mint they are always made, with scrupulous care, of 22-carat metal, and it is easy to calculate how much of additional alloy will reduce them to any other standard. Where the "Times" obtained the knowledge of counterfeit coining which it imparts we do not know. Perhaps, its statements on this subject are exact, but in all other respects, assuredly, they are just the reverse. Had the writer of the article to which we have felt it a public duty to allude, studiously endeavoured to pervert the truth as to Mint proceedings, he could not have succeeded more effectually. It is more probable that hastily-obtained and ill-digested information is the cause of his shortcomings.

DIFFERENTIAL SATUROMETER.

A KNOWLEDGE of what is passing in the interior of a machine, and the manner in which the various parts are carrying on their respective functions, is unquestionably of paramount importance not only to the person in charge of it, but also indirectly to those whose safety, and possibly lives, may depend upon its being maintained in proper working order. To the marine engineer, one of the most essential points in connection with his duty, is to be capable of readily and accurately ascertaining the state of saturation of the water in the boiler, as both the duration of the material, and the economy of the fuel, are in a great measure dependent upon the degree to which that condition attains. The practical results attending the use of all indicators of saturation have not been very satisfactory, and reliance is chiefly placed upon the ordinary aerometers, in which the degree of saturation is obtained by allowing the water to enter a graduated gauge glass. In order to determine the effect of the temperature of the water, which is a necessary item in the investigation, a thermometer has frequently to be employed, the manipulation of which is attended with much risk and inconvenience. If the state of the water be not observed with a sufficient degree of care and frequency, it is manifest that deposits of salt will take place in the boiler. On the other hand, if the engineer, in his anxiety, be continually opening the communication, there will be a loss of heat incurred. A remedy for these contingencies would be found in an instrument which, without the necessity of any subsidiary operation, would indicate at any moment the saturation required to be ascertained. The differential saturometer, invented and patented recently by M. Coret, is calculated to afford this information, and in addition to indicating the state of the water, also records at the same time its level in the boiler, thus enabling the engineer to perceive at a glance, all that he requires to know with respect to the contents of the boiler. This instrument, moreover, registers the average saturation of the water. Its action is based upon the well-known principle of physics,—that if two liquids of different specific gravities, having the same temperature and exerting no chemical effect upon each other, be placed in two vessels or tubes communicating freely with one another, their respective heights under conditions of equilibrium will be inversely as their densities. From this it follows that if the specific gravity of one of the liquids be known, and the heights of the columns of fluid, the density of the other can be easily obtained. Putting D D^1 to represent the specific gravities and H H^1 the respective heights, we have

$$\frac{H}{H^1} = \frac{D^1}{D} \quad \text{or} \quad D^1 = \frac{II \times D}{II^1} = \text{the density required.}$$

The application of this principle is carried in the apparatus under notice as follows. In fig. 1, A B are two glass tubes placed as near one another as the vertical scale between them will admit. One of these, A, is connected with the feed water, and the other with that in the boiler. These indicators A and B are disposed in the manner usual in all marine boilers, with this difference, that in this instance one of them, A, instead of being put into communication with the water in the boiler, receives that coming directly from the feed pipe H by means of the auxiliary pipe E. A small cock r (see fig. 2) serves to regulate the flow of the water, which passes through the tube G into that of A, attains the height due to its density, and finally passes downwards into the boiler by the pipe D. The cock r permits only a small thread of water to enter at a time, sufficient to maintain the flow uniform, but not sufficient to allow of a greater amount of saturation taking place than what it possessed at its first ingress. It might be urged that a certain amount of initial velocity and disturbance is imparted to the contents of the tube A, owing to the action of the feed pumps, but this can be provided for. Moreover, even if it were neglected, the error would not amount to more than a quarter of a degree. At the lower extremity of the two pipes C and D is fixed a double cock R

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arranged so as to cut off their communication with the boiler, while at the same time it leaves them free to communicate with one another. This is effected by turning the key c, placed outside the boiler, through a quarter of a revolution, by which the two apertures shown in the section of the cock R in fig. 4 are changed in position, and no longer allow the water to flow into the tubes. All things being put "au courant," the apparatus performs its duty in the following manner. The small cock *r* is opened to such an extent as not to allow the oscillations in the tube A to exceed in height the tenth part of an inch, an amount of no practical importance. The indications are constant, and are read off at once by the scale P (see fig. 1), and no further subsidiary operations are required. During a storm, when the rolling of the vessel prevents a comparison being made between the relative levels, in consequence of the oscillations produced in the tubes, the small cock *r* is closed, and a quarter turn given to the larger one R, which cuts off their communication at once with the boiler. The oscillations are then arrested, and a comparison,

FIG. 2.

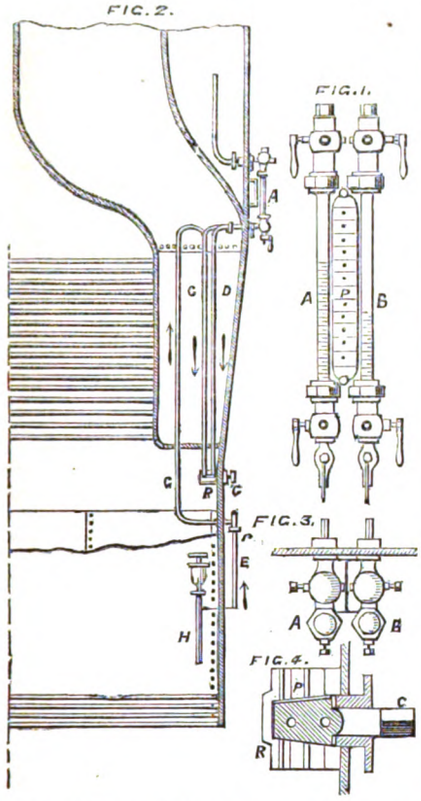

FIG. 1.

FIG. 3.

FIG. 4.

previously impossible, is made with accuracy and facility. It should also be observed that whenever the cock *r* is closed, all disturbing or vibratory action due to the working of the feed pumps is obviated, and that this cock may be maintained shut for nearly an hour, without causing any appreciable difference in the rate of saturation.

In order to effect a rigorous comparison between the two columns of liquid, when both the cocks *r* and R are opened, and the sea is tolerably calm, it is indispensable that the contents of the indicating tubes A and B should rise and fall cotemporaneously. To effect this satisfactorily, the two pipes C D should have the same internal diameter and the same number of bends, and the orifices of the indicators A and B should have identical dimensions, in order that the water should encounter an equal amount of resistance in each of the tubes, a circumstance altogether contingent upon a due observance of the above-mentioned precautions. These requisites, however, do not affect the construction of the pipe G (see fig. 1), which must be proportioned according to the dimensions and arrangement of the boiler. There is one point to be attended to respecting its position, which should be in the interior of the boiler, in order that its contents may acquire the same temperature as the water therein. Both the tubes C and D may be fixed outside the boiler, if such a disposition should be the more convenient. In fig. 1 the scale P is placed between the two indicating tubes A and B, and is graduated to degrees corresponding with those of Beaume. In every 3·28ft. in height of the column of liquid the divisions are 0·32in. apart, so that if the boiler allowed of a height of double this dimension, the scale could be read off at some distance. The principal and semi-divisions are uncovered, so that they may be seen at night, by means of a lamp placed between the scale. Owing to the sensibility and accuracy of this little apparatus the deposits of salt may be permitted to approach a convenient state of saturation, a too frequent repetition of extraction is avoided, and an economy obtained in the consumption of fuel.

VENTILATION OF PUBLIC BUILDINGS, UNDERGROUND RAILWAYS, ETC.

GENERAL MORIN'S paper on the ventilation of public buildings has just been published in the report of the annual meeting of the Institute of Mechanical Engineers, held last year in the Conservatoire des Arts et Métiers, at Paris. We quite agree with the General that the system of ventilating rooms at the top is a mistake. That admitting fresh air near or at the floor of a room, will not drive off the foul air at the top. Especially, it will not drive off the carbonic acid gas which is produced by the breathing of an assemblage of people, and the combustion of gas and other lighting material. An influx of cool fresh air near the floor, will rather tend to prevent the efflux of this gas. The specific gravity of this gas causes it to tend to the lowest parts of any room or place, and if free outlets were provided it would flow out; but as ventilation is at present provided for it cannot do so, openings at the ceiling or roof being provided for the outlet of foul air, and openings near the floor for the ingress of fresh air. Now, if all foul air were lighter than pure air, this simple arrangement would be perfectly successful, but it is not so; some is lighter than pure air and some is heavier. This being the case, what is to be expected from such an arrangement but very imperfect ventilation, which is the actual state of things in all places so ventilated.

Suppose a room, filled with people, and lighted up, and having the openings at the floor and ceiling closed till the air was thoroughly vitiated by the exhalations from the assembly and the combustion of the gas, let then the ingress and egress be opened, and what would take place? It must be remembered that the general density of the air inside the room would be less than the density of the air without, through rarefaction by the heat of the room, and it will be clearly seen that the external air will flow in, and the internal air will flow out, at both the top and bottom openings. The carbonic acid gas will tend to flow out at the bottom, and the lighter gases at the top, and the outer atmosphere will flow in at both top and bottom; therefore, ventilation can only take place by the slow mixing of the internal and external air. A current of air will not tend from the bottom opening to the top opening, which is the theory of the system. From this view of the matter it would appear that a third opening should be provided intermediately between the top and the bottom, where the pressure outward would be less than either at the top or bottom, so that a free ingress would there be afforded for the external air, and the lighter gases would pass out at the top, and the heavier at the bottom. Still there might be the objection to this intermediate opening, that it would produce a draught injurious to health. Yet we have seen churches and chapels ventilated by an oblique opening being made in the windows, so that the inflowing air passed upwards, and no draught resulted.

General Morin proposes that the ingress openings shall be at the top and the egress for the foul air at the bottom, so that the carbonic acid produced by the breathing of the people may be discharged near the source of its production. And this he considers will be best produced by suction, and to maintain this suction nothing more is required than an ordinary fireplace. We cannot exactly see that an ordinary fireplace would be very effective in producing a current sufficient to draw off the carbonic acid gas; but, at any rate, a close stove would, if it received the air to support combustion through openings in the floor from beneath the floor only. In this case the carbonic acid gas could be drawn off only by being rarefied in passing through the fire; but its presence would tend to lessen the heat: consequently, the draught. In many places a better way of producing a current would be by mechanical means—for example, by means of a fan, and this method would be especially suited to our Houses of Parliament, with the ventilation of which there has been so much trouble and expense and so little beneficial result.

Underground railways also might be so ventilated. In railway tunnels the apparatus might be made self-acting. The mechanical force of the passing trains might be used as the motive power of the fans. The fans might be directly driven by means of a weight actuating a suitable train of wheels, and this weight could be wound up by the passing trains in the following manner:—At each station let a machine for driving a fan be erected, with a lever extending under the rails. The rails might be made elastic, and to allow of a depression, which need not be of more than an inch—it might be less; half an inch would be sufficient, even if the weight on a pair of wheels of a carriage were only a ton. The weight which actuated the fan need not be more than 5cwt.; therefore, the small depression of the rails could be multiplied by the lever four times, that is, for half an inch depression it would draw the weight up two inches; so that a train of six carriages and engine would draw the weight up at least thirty inches. This would be quite sufficient to keep the fan continually going where the traffic is equal to that on the Metropolitan Railway. Of course, the amount of draw would have to be regulated by the amount of traffic, and provision would have to be made to prevent breakage in case of overwinding; but these are mere details. General Morin's method of ventilation is certainly an efficient one as to buildings, and we offer this mechanical application of it to underground railways as a simple and cheap mode of clearing their tunnels of poisonous gases.

LANDSCAPE PHOTOGRAPHY.

THE present tide of photographic opinion, in favour of small plates and light apparatus for outdoor work, will evidently result in the supply meeting the demand, for already notice has been given that new "opera-glass" and other small cameras will shortly be introduced by the inventors to the notice of some of the photographic societies. Little pictures so obtained may be readily reproduced on collodion, and of any size, by means of enlarging apparatus. The convenience to the tourist of being able to carry all his apparatus and prepared plates in a little satchel by his side, and the walking-stick legs of his camera in his hand, is too obvious to require proof. Unburdened by bulky apparatus, landscape photography will become a pleasure rather than a task, and will lead to the practice of photography by many who have not sufficient love for the art

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science to encounter the present difficulties in the way of getting good outdoor views.

A very considerable amount of photographic knowledge and skill is necessary to enable anybody to get uniformly good pictures with certainty by means of dry plates. Ordinary wet-plate photography is out of the question in the field, unless the operator increase the weight and bulk of his apparatus, and the time of taking each picture. When dry plates are used, rapidity of action is necessary to secure natural clouds and the other atmospheric effects, which give life and brilliancy to scenery. Almost the only dry plates which give great rapidity are those prepared by Russell's bromized collodion tannin process, and Sutton's gum process. As Mr. Sutton recommends the former in preference to his own, perhaps because the gum process is somewhat uncertain, the tannin process is the best dry one which can be adopted by photographic adepts. There are other very rapid dry plates on sale in the market, but their method of preparation is kept secret for trade purposes.

There is, however, a very easy process, which we have worked successfully for years, whereby plates can be made to keep in good photographic order for six or twelve hours after preparation; and the manipulations, as a whole, are even simpler than by the ordinary wet method. This is the glycerine process, and it is the wettest method of any, for the plates will not dry for six months or more; they may look dry to the eye after keeping, but the touch will prove they are still damp. As a tourist can easily extemporize a dark room at his place of temporary residence, by blocking up a window with blankets and working by the light of a candle, he has then nothing to do but prepare his plates, wander out for several hours, and take his views, then develope his plates on his return, thus getting pictures having all the delicacy and brilliancy incidental to wet processes, and without trouble.

Here, then, are the formulæ which give the best results as yet attained by this process:—Clean the plate by any of the numerous methods for obtaining a chemically pure surface, then coat it with any good bromo-iodized collodion of commerce, and sensitize in a bath containing 35gr. of pure recrystallized nitrate of silver to the ounce of distilled water. Each 10oz. of this bath should have two drops of acetic acid added, and 1½gr. acetate of soda; it should then be occasionally stirred for a quarter of an hour and filtered, when it will be ready for use. The foregoing treatment is necessary to secure freedom from nitric acid, which would decompose the glycerine preservative. More than the above quantity of acetate of soda should not be added; for, although a small quantity is an improvement, too much spoils the pictures.

The manipulations thus far, it will be noticed, are the same as in the wet process, but the plate has next to be dipped in the preservative bath, directly it is taken from the nitrate bath, and as this is done in an instant, it gives no trouble.

The preservative is mixed as follows:—	
Distilled water	7 oz.
Pure glycerine	2 ,,
Pure honey	1 ,,
Above bath solution (new) . . .	3 ,,
Kaolin	¼ ,,

Bad glycerine sometimes contains lead, and adulterated honey often contains flour, so such samples must be rejected. The above mixture is to be well shaken up in a glass bottle, which should then be exposed to diffused daylight, not sunlight, for two days. It will rapidly blacken, then throw down a muddy deposit, and, if the quantity of kaolin added was sufficient, will leave the upper part of the solution very clear and bright. The upper portion should then be filtered into the preservative bath for use. The plate should be left in the preservative bath for three or four minutes, then it should be placed on end on clean blotting paper in a dark box, for ten or fifteen minutes, to drain. It is then ready for the dark slides.

After it has been exposed in the camera, and brought back to the dark room, it should be at once developed. If it is intended to print upon albumenized paper from the negative, a pyrogallic acid developer should be employed, and the picture will come up to full printing density at once. The intensification ordinarily employed in the wet process is not necessary with the glycerine process. The best restraining acid to use in the pyrogallic developer is the formic, with a trace of citric acid, to prevent solarization when the view taken was brightly lighted by the sun. The rule is to use formic acid alone when the light is bad, and the objects dark, but to employ more and more citric acid in proportion to the brightness of the view. As citric acid is a very powerful restrainer, it should be sparingly used, and it is remarkable what a very small trace of it will correct the tendency of formic acid to produce solarization. If, on the other hand, the negative is intended for printing upon collodion by means of the enlarging camera, iron development must be employed, because pyrogallic acid would give too much density. A highly bromized collodion will be desirable in this case, and citric acid should be used in conjunction with acetic in the developer. Very rapid exposures are necessary with iron development and short-focus lenses.

Any collodion, and any developer, will do with this process, which has the peculiarity of permitting the use of a bromized collodion, containing no iodide at all, although such collodion has long been thought inadmissible in the wet process. In fact, some time ago, Mr. Sutton tried bromized against iodized plates in the wet process, and announced that the bromized plates were utterly worthless. His great mistake was that he treated both plates in the same manner, and the fact is that they require different treatment throughout. In the first place, the bromized collodion should be very highly salted to the extent of not less than ten grains of bromide of cadmium to the ounce. In the second place, plates coated with this collodion should be sensitized for about ten minutes in a sixty grain bath (which treatment would spoil most iodized plates), and then they should be dipped in a weaker bath, to get covered with fluid not too strong for the developer. If this last bath contain also organic matter, like that of the glycerine preservative, the effects are improved. Lastly, a stronger iron developer may be used with wet bromized plates. One great advantage of these plates is the excessive power they possess of resisting solarization, and giving brightly illuminated clouds with an exposure twice as long as would be sufficient to spoil the said clouds if ordinary collodion were employed. Bromized collodion usually works best a month or two after mixing when pyrogallic acid development is intended, but it is not always so when iron development is used; with newly mixed collodion the former often gives a "woolly" picture, void of sharp definition, whilst the latter causes no such defect.

THE ATLANTIC TELEGRAPH.

ON Tuesday evening last, Mr. Cyrus W. Field entertained a select party of friends at the Palace Hotel, Buckingham-gate, to celebrate the fourteenth anniversary of the day on which the New York, Newfoundland, and London Telegraph Company was formed to carry out the grand idea (the value of which we even now do not fully realize) of placing England and America in telegraphic communication with each other. It has often been remarked that had there been no Cyrus Field there would not at the present time have been an Atlantic cable. Knowing the trials and difficulties that gentleman has had to contend with during the past fourteen years, we fully believe that statement, for never since the time of the king whose name he bears has there been a man possessed of so many qualities calculated to achieve success under such trying circumstances. We mean it as no empty compliment when we say that we never found centred in one man such a wonderful ability in managing men's tempers and gaining their affections, nor with such a vast genius and capacity for forming, with equal steadiness and prudence in executing, the work he takes in hand. We are sure that no one more sincerely congratulates Mr. Field than ourselves upon such a glorious termination to the enterprize to which he has devoted the most valuable part of his life.

During the evening telegrams were sent from an instrument placed in the room to various parts of the American continent, and with marvellous rapidity the replies were received. On their arrival each was read aloud by Mr. Field. Heart's Content replied in a few minutes, New York in about an hour, and Washington in about the same time. It may be asked, and justly, too, why it was not possible to connect through to Calcutta and our other Indian possessions, and communicate with friends there with equal rapidity. With humility, if not shame, it must be confessed that, although the Indian and the Atlantic projects were started about the same time, and the latter of these has been so successful, the promoters of the Indian line lost faith after the first failure on the main route, and have been ever since endeavouring to accomplish their object by traversing circuitous routes, through by-lanes and unknown parts. How far they have succeeded the Government blue book on the subject will best explain. But now that the perfect success of the Atlantic cable has been so thoroughly established, we do hope that those gentlemen of whom England may well be proud—who so liberally subscribed their capital for the American cable—will take the matter in hand. They may rest assured that the public will assist them in making the attempt to place England in direct communication with India—adopting what we call the direct route—that is, Falmouth to Gibraltar, Malta, Alexandria, and down the Red Sea to Bombay. The adoption of this route would place us in an independent position as regards all other European and Asiatic powers. It is proved beyond doubt that deep water affords the safest repose for telegraphic cables, and that they can now be manufactured and laid with as great certainty as an engineer would construct a railway, or accomplish any minor operation. There have been leaps in the dark in the management of submarine telegraphy, but all such are to be reckoned as things of the past, and a grave responsibility rests upon those who, to suit some caprice of their own, ignore the lessons which so much dearly-bought experience should teach.

We believe the Atlantic cables are working with greater accuracy and speed than many submarine cables; in fact, if we are rightly informed, even the overland lines are unable to compete with them when their length exceeds a few hundred miles. This is very encouraging for submarine telegraphy, and there is no reason why the time should be far distant when we shall see in the same room two instruments, from one of which a message could be sent, and after performing the circuit of the entire globe, arriving back again to show itself on the other.

FRICTIONAL ELECTRICITY.*

DURING the later years of a life devoted to science and experiment, the late Sir W. S. Harris commenced a work for which

* "A Treatise on Frictional Electricity in Theory and Practice." By SIR WILLIAM SNOW HARRIS, F.R.S. London: Virtue and Co. 1867.

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materials had been accumulating during many years; the intention was that it should comprise a perfect treatise on frictional electricity, and it was also intended that the book should contain short biographical notices of leading electricians, but before the work could be completed he was seized with his last illness, and died on the 22nd of January, 1867. Before his death he had seen and corrected a large portion of the work, and in that state it is now presented to us, with some additional chapters revised by the editor (Charles Tomlinson, F.R.S.), and by Mr. Harris, amongst which may be noticed two lectures on atmospheric electricity and protection from lightning, subjects in which the author was so essentially at home. The book is prefaced by a biographical notice of the author, full of most interesting matter, and deserving the close attention of all its readers. The following extract shows the late lamented author as a man of peculiar attainments. "He completed the allotted term of man's life: he made some important discoveries in electrical science, laboured long and successfully to introduce into the Royal Navy his system of lightning conductors; was an excellent sailor, an accomplished musician, a lively intellectual companion, a steady friend, and he died honoured and beloved." With the present book before us, and the recollection of his previous works, we cannot but add the title of "successful author" to the numerous catalogue above. We dwell for one moment on the long and hard fight he had before the value of his lightning conductors was fully appreciated, and before they were adopted by the authorities. So tardy were they in adopting a system that has made our vessels so safe at sea, that we actually find that these lightning conductors were introduced into the Russian navy before our own, and that the Emperor presented Harris with several valuables in acknowledgment of the merits of his system.

There are few who have laboured so carefully and successfully in frictional electricity as the author of this book, and to his experiments and elucidation the scientific world is indebted. But the success of his experiments was mainly due to his wonderful skill in the improvement and construction of instruments and apparatus. Of the exactitude of his experiments we cannot seek a higher compliment than that paid by the late Professor Faraday in 1834 (see "Experimental Researches"):—"I have also looked with some anxiety to the results which that indefatigable philosopher Harris has obtained in his investigation of the laws of induction, knowing that they were experimental, and having a full conviction of their exactness." The editor remarks—we make the extract as a pendant to the foregoing—"This care in the selection and improvement of apparatus might seem to an ordinary observer to be often superfluous, but it led to success and to the thorough understanding of the conditions of success, so that the failure of an experiment in Harris's hands became next to impossible." In the present work the chapters on electricity, with their elucidation and experiment, will probably be familiar to many as enlarged reproductions of his earlier works on the same subject, and containing but little that is new, though when we come to examine it we are astonished at the wonderful amount of mechanical skill shown in the construction of the instruments, and the cleverness of the man who conceived so many apparatus.

Although these experiments may be familiar to many, yet there is one chapter in the book that to an experimental electrician is invaluable: we mean that containing a description of "Articles and Processes in Electrical Manipulation." Here we see the results of his labour handed down to us, the means whereby his success was obtained, the care in the selection and use of material so that the best only could be used; even the making of "paste for attaching tinfoil to his jars was a matter of study until the best recipe had been found." The various ways of doing things, as tried by him, are here given with valuable advice. This chapter contains all the articles necessarily required by an experimenter making the whole of the apparatus himself: but at the present time, with the facility of transport and extra skill of labour, there is not that necessity for such a multiplicity of tools and materials as in the days when Harris experimented: there appears in the list nothing left out. The success of electrical experiments depends greatly upon the proper insulation of the materials used; many have, of course, to be varnished to render them insulating: into varnishes, pastes, and amalgams for machines, the author appears to have penetrated so far as to have exhausted the subject. We are presented here with as many as thirty-nine formulæ for these various preparations, some required for one purpose, some for another, but all most useful, many supplying a want hitherto felt in the laboratory of a good and proper varnish for certain purposes. For this chapter on electrical manipulation alone we would recommend this book as a necessary part of the electrician's library. What must we say, then, when there is so much valuable matter besides?

Parliamentary Notes.

THE reconstruction of the Ministry caused a temporary cessation of public business, but now that matters have been adjusted both Houses have gone to work again with a will. They commenced proceedings yesterday week, when the first topic of discussion was, of course, the Ministerial changes. After the members had congratulated and condoled with each other as occasion required, they did an unpardonably stupid thing, in throwing out the Metropolitan Tramways Bill. To Mr. H. Lewis is due the discredit of proposing the bill be read that day six months, on the ground that it was a "fishing" bill. He also urged in favour of his amendment that two bills of the same character had been thrown out in past years! So, Mr. Lewis, it follows that a third, and perhaps any unlimited number, are to be added to the list? All we can say is, we are sorry the bill has been thrown out. It ought certainly to have had a chance for life in committee. There was reason and common sense in Mr. Seely's remarks in support of the bill. He very properly observed that the tramways which were proposed to be laid down would not in any way interfere with the ordinary traffic of the streets. He could not see that the ratepayers would be injured much by breaking up the streets for the laying down of the tramways, for the reason that the company would be compelled to keep in repair 16ft. in width of the road in the case of a double tramway, and 7ft. 6in. in the case of a single line. It would be unfair in the House to refuse the second reading of this bill within twelve months of the time when they passed an Act to regulate the street traffic of the metropolis. He did not think the rails would throw down horses or carriages, for the reason that they would be only 2in. wide, and the horses' hoofs would grasp a part of the roadway as well as the rail. The advantage to the traffic would be great, inasmuch as the cars would carry twice as many passengers as could be conveyed by ordinary omnibuses. That the parish authorities did not regard the bill unfavourably was clear, from the fact that out of the whole fourteen parishes only two really opposed the proposal. Mr. Seely concluded by urging that the tramways experience in America was an argument in favour of their adoption in this country. It was all, however, of no avail, and although Mr. T. Hughes supported the bill, the amendment was ultimately agreed to without a division. We shall, however, hope to see the bill brought forward again next session, and trust the public will not rest until they obtain legislative sanction to a system which will render the locomotion of the metropolis cheaper, less dangerous, and more expeditious than it is at present.

In the House of Lords, on Friday, the Earl of Cardigan presented a petition from Henry Needham Scrope Shrapnel, late of the 3rd Dragoon Guards, praying that some national reward might be made to him in consideration of the services rendered to the country by the use of the shells invented by his late father. As a proof of the value which the Government attached to this invention he might observe that millions of the Shrapnel shells were used by them during the Crimean war. The noble and gallant earl said he would move that the petition be referred to a select committee.

This rather cool request was replied to by the Earl of Longford, who justly observed that on the part of the War Department he should object to a reference of the petition to a select committee. He could not hold out any encouragement to the petitioner. It was true that the invention of the Shrapnel shell was a most valuable invention. For many years it had been in constant use in the service. But the inventor received a special pension of £1,200 a year for twenty-eight years. He further received a royalty of more than £10,000 from the East India Company. The petitioner's claims had been frequently brought forward, but they had been rejected. Sir Cornewall Lewis, whose judgment was entitled to great respect, decided that no further claim could be admitted, and Sir John Pakington was of the same opinion, and we are of the same opinion too.

Monday evening was a busy time in both houses. In the Lords, the Duke of Somerset, in moving for a return of the number of tons of iron ballast sold from the Royal dockyards since January, 1867, the amount of money received for the iron, and paid into the Treasury, said various charges of waste and mismanagement had been made against the Admiralty which it was difficult to bring to any precise test of facts. But, last year, an hon. member of the other House of Parliament stated that iron ballast to the value of £100,000 had been employed for the paving of the dockyard, and that he could produce a person who would buy it for that sum. That offer was accepted by the Admiralty, and he (the Duke of Somerset), on moving for this return, wished to know what had been actually received for this sale of iron ballast by the Admiralty.

Although the motion was agreed to, and in due course his Grace will receive a reply, the answer was virtually given the same evening in the other House, where Mr. Baxter asked the First Lord of the Admiralty whether any part of the pig iron ballast, laid down or stored in the dockyards, and sales of which were estimated to produce £100,000 during the present financial year as a naval "extra receipt," had been sold; and, if so, how much and at what price per ton; and, how many tons were still stored or laid down in the dockyards.

Mr. Corry said the Admiralty had been unremitting in their endeavours to realize the anticipations entertained last year as to the amount to be realized by the sale of the pig iron in the dockyards, but very little had been sold. In short the Admiralty had received no offers that could be entertained except for very small quantities for experimental purposes, and the amount actually paid into the Exchequer on account of sales was £63—for ten tons of the iron!! He would reserve further explanations until a more convenient season. Mr. Seely's pigs would seem to be a drug in the market.

It is to be regretted that we are improving the health of the metropolis at the expense of the navigation of our river. Such, however, is a fact; our sewage is accumulating in the Thames, and Lord E. Cecil has had to ask the Secretary of State for the Home Department whether it was true that complaints had been made to the Home Office by the Thames Conservators of the navigation of the river having become obstructed by the accumulation of sewage at Barking and Crossness; and, if so, what course he proposed to take in the matter.

Mr. Hardy said it was true complaints had been made by the Thames Conservators, and, in consequence, he saw the chairman of the Board of Works, and all he could do was to make a suggestion that an arbitrator should be appointed to decide upon the matter. It appeared, however, that the Metropolitan Board of Works were advised by their counsel that arbitration was not the proper course to adopt, and therefore he (Mr. Hardy) feared that the matter must be decided by a court of law. This is rather an unpleasant state of affairs for all parties.

We have before now called the attention of our readers to the alleged instability of our new fortifications. This matter came on in the form of question and answer, Colonel Sykes leading off

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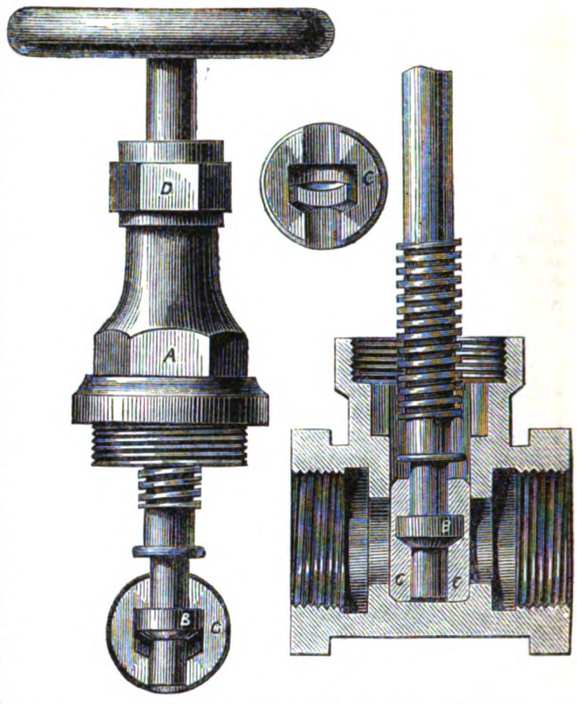
by asking the Secretary of State for War what truth there was in a recent statement in the public prints, that one of the projected fortifications at Chatham had sunk into the mud, or that the foundations had given way, and that some of the new fortifications elsewhere had shown signs of instability. And whether, considering the opinion expressed by the distinguished civil engineer, Mr. Thomas Hawksley, on August 26, 1866, that "many endeavours have been made, and much money (reckoned by millions) has been expended, I will not say wastefully or unworthily, but certainly uselessly, in endeavours to secure our coasts against the attacks of a foreign enemy;" and whether, considering the statement, under the head "Naval and Military Intelligence," in the "Times" of November 3, 1866, that we "have certainly, as a rule, been unfortunate in our military engineering, and especially in carrying out the plans for the defence of our coast line; that some forts have been built on swampy land, so unstable and treacherous that keep and magazine have cracked through, and their earthen ramparts have slid from their base;" before a further application for money was made to the House, the Secretary of State for War would lay upon the table a report in detail of the present condition of the fortifications enumerated in the Parliamentary Return, No. 157, of March, 1867; and in default of such report whether he would advise her Majesty to appoint a commission of military and civil engineers and members of the House to examine and report on the present condition of the fortifications, and whether any of them could be dispensed with.

From the reply it would seem that much more has been made of the matter than circumstances justify. Sir J. Pakington said that two of the forts near Chatham, having been built on marshy ground, had in some degree subsided, but nothing would prevent the forts being satisfactorily completed. As to whether some of the new forts had shown signs of instability, he might say that at a fort at Warrington, in consequence of a change in the soil, part of the retaining wall had shown some signs of weakness, but nothing would prevent it being repaired satisfactorily. The remainder of the question appeared to be rather in the nature of an argument than an inquiry. He thought there was some degree of inconvenience in the practice of introducing long recitals into questions containing very severe attacks upon the public departments, proceeding from persons who had expressed their views without the responsibility proceeding from authority. He had great respect for Mr. Hawksley, but he could not consent to accept his authority as conclusive, compared with that of naval and military men of the highest standing, upon whose advice the Government of Lord Palmerston determined to carry on the fortifications. With regard to the extract from the "Times," the statements contained in it were far beyond the facts. As he considered the questions of the hon. and gallant member, coupled with the extracts he had given, were calculated to create anxiety, he had no objection to furnish a report upon the present condition of the fortifications. This course will doubtless give satisfaction to all, and will set the question at rest. No—not all perhaps—for the "Times" correspondent yesterday uttered a vehement protest against the reply given by the Secretary of State for War, which, he says, is opposed to the truth. The correspondent does not like his veracity impugned, and depicts a very lamentable state of things. While the promised report is in course of preparation, we will endeavour to go and look for ourselves.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

THE ordinary monthly meeting of members took place on Saturday, the 7th inst., Mr. Joseph Newton in the chair. After the election of several new members, and the nomination of others, Mr. David Walker read a paper on the shrinkage of iron castings. The subject was treated in a thoroughly practical and scientific manner, and was made highly interesting to the associated foremen. We trust that at a future time we may have an opportunity of imparting some of the information contained in the paper to our readers. At present, it can only be said that much research and careful observation of foundry practice, on the part of its author, was made abundantly apparent by its contents. In the discussion which followed, Messrs. Hedley, Keyte, Muir, Vinicombe, Clark, Briggs, and the chairman, took a prominent part. The proceedings terminated with a vote of thanks to Mr. Walker.

PEET'S PATENT VALVE.



THE accompanying illustration represents a valve patented by Mr. S. J. Peet, of New York, which appears to have been giving great satisfaction, both on account of the simplicity of its construction, and the ease with which it may be repaired. From the engraving, representing the valve in section, it will be seen that the two discs serving to close the valve are raised or depressed by means of the hand wheel and upright stem B. These discs are suspended on the stem by its collar engaging with the semi-circular recesses on their inner faces, and prevented from separating from the stem by the walls of the passage in which they move. The lower face of the collar B, and the lower portion of the recesses in the discs are made slightly conical, so that after the discs have reached the bottom, any further pressure on them by the screw of the stem forces them apart and firmly against the walls of the valve, thoroughly closing the apertures of the pipe. The conical collar, therefore, acts as a wedge aided by the pressure of the screw. It will be seen that both sides of the pipe are closed by this means, making this a back pressure valve, as well as a direct acting gate. When the discs are raised, a free passage, without change of direction, is made through the valve for the steam, water, or gas, of the full size of the pipe. The stem is packed in the usual manner by the screw gland D.

MEE'S HOSE COUPLING.

THE intention of the inventor in this device is to make a tight coupling without the aid of a washer, or of the loose setting-up ring, or of any device for forcing the two parts of the coupling together in the line of their axes, in order to form a water-tight joint. This coupling does not depend upon the mechanical force exerted to close the joint, but the pressure of the water itself makes the joint tight.

Fig. 1 represents one end of the coupling, formed where the leather or rubber is attached precisely like any other, but otherwise differing. It has a projecting ring, A, around the barrel part, a portion of which ring is cut away to receive the hooks or

FIG. 1.

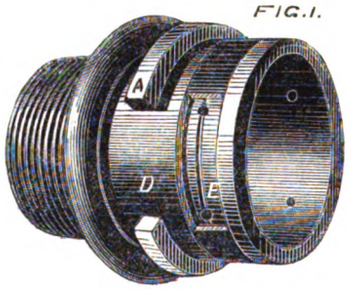
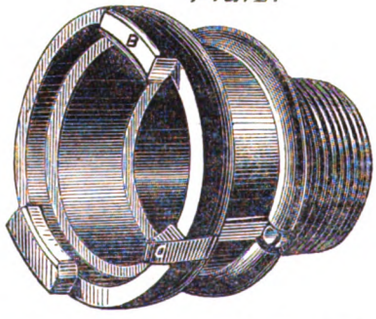


FIG. 2.



snugs B, fig. 2, which pass by the ring A, and, by a slight turn of one or the other part, securely lock the two lengths of hose or the two parts of the couplings together. This partial turning is, of itself, a sufficient lock to the parts, but to render assurance doubly sure, a spring catch C is introduced which springs into the space D, fig. 1, between the parts of the ring A, and prevents the parts from unlocking, unless force is used to raise it from its seat. Near the end of fig. 1 is turned an annular groove in which is seated a rubber ring, or a ring of some elastic substance to act as a packing. It will be noticed that a row of small holes is bored through from this annular recess to the inside of the coupling, the holes communicating on the outside with one another by a channel E. Through these holes the water inside the hose or coupling finds its way, and its pressure forces out the elastic ring against the inner surface of the section shown in fig. 2, making a perfectly water-tight joint. The "Scientific American," from which paper we gather particulars, states that this coupling was patented in the States by Mr. B. Mee, and is now being largely made by Messrs. Mee and Jackson, of Troy, N.Y.

LITHOLOGY OF THE BRITISH ISLES.

M. DELESSE has just laid before the Academy of Sciences a large map of the various beds of rocks constituting the bottom of the British seas. This bottom chiefly consists of sand, slime, more or less mixed with the latter, and different stones. The latter, already consolidated, are anterior to the present period, and do not receive deposits. They stretch far into the sea from the north-west coasts of Scotland, the Orkneys, and the Hebrides; they also exist at the mouth of the Shannon and the north-west coast of Ireland. In the British Channel they mark the junction of Cornwall with Brittany; they also mark those of the Isle of Wight and Portland with the Continent. To the east of England these stony formations are hardly to be met with elsewhere than at the mouth of the Tees and in the direction of Cape Flamborough. They generally form the bottom of the straits and friths that are washed by rapid currents. Shifting deposits are large in proportion to the rapidity of the waters that have borne them. The most important consist of sand, which occupies immense space on the Atlantic coast, the British Channel, and the German Sea. Gravel deposits, which are not extensive, are to be found on the western coasts, in the Bristol Channel, between the Land's End and the Scilly Islands, and south of Cork. Flint shingle borders the white cliffs of England, but it is also met with in the German Sea in the latitude of the Orkneys. Slimy deposits are peculiar to the mouth of the Thames, Southampton Water, Torbay, and the Irish Coast of St. George's Channel. At various points of the coasts there are marine deposits of molluscs and shell-fish. They are somewhat rare on the eastern coast of England and the southern one of Ireland, but very frequent in the Irish Sea, and all round Scotland, especially in the Minsh, and between the Orkneys and Moray Frith.

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SOIREE OF THE ROYAL SOCIETY.

ON Saturday evening last, General Sabine, R.A., as President of the Royal Society, gave the first of this year's soirees. These soirées are usually looked forward to with great interest, by reason of the novelty of many of the things exhibited; but the chief interest appeared to be called forth by the advent of the Prince of Wales, who honoured the President by his company. The Prince was conducted by the President through the various rooms, and appeared to be greatly interested by all the various exhibits that were explained to him. From none did he appear to receive greater gratification than from the explanation, by Professor Tyndall, of Faraday's beautiful experiment of the magnotization of light. This experiment was considerably heightened in interest by reason of the electromagnet and other parts being those actually used by Faraday. A polarized ray passing through an opening in the poles of a very powerful electromagnet, was, by the action of the magnet, when excited, thrown upon a screen, and other experiments were made with the view of showing the action of magnetism on light, the effect being shown immediately the magnet was excited, ceasing so soon as the current ceased.

The semaphore proposed for exhibiting telegraphic intelligence of storms, shown by the committee of the Meteorological Office, excited a great deal of attention. A map is shown dividing the country into eight districts, which are lettered and represented on a circle fixed at the upper part of a post. Moving from the centre of this circle are two arms—one red, pointing to the letters representing the direction of the wind; and the other shorter and painted green, to mark the district where the wind is blowing. On the post itself is shown a number representing the force of the wind which is indicated. A black ball shows whether the wind is within the circle marked on the map. Our space at present precludes us from going further into this interesting subject. The Meteorological Committee also exhibited three interesting instruments, termed the anemograph, thermograph, and barograph, to be used at the observing stations—the first to indicate the force and direction of the wind, consisted of a series of hemispherical cups, rotating horizontally on the top of a post. These, in connection with a train of wheels so acted on a spiral metallic pencil, recorded the force on a cylinder properly prepared, and kept moving by a series of clockwork, the direction being indicated in a similar manner, the motion being communicated by a small windmill, kept in the same direction as the wind by means of an arrow. The thermograph and barograph were instruments for keeping a constant record of the state of the thermometer and barometer photographically, so that the curve shown by the different variations of temperature, and of the pressure of the air, should be periodically and faithfully recorded.

Mr. Ladd showed his improved form of dynamo-magnetic machine, which differed from that exhibited at the soirée of last year, in having the two armatures working on one axle. This is a decided improvement, allowing similar results to be produced with less mechanical force. Some vacuum tubes were shown by the electricity obtained from this machine.

Mr. Latimer Clark's potentimeter, for subdividing the tension of a single cell into 10,000 equal parts, met with a great deal of attention, as did also Sir William Thomson's rotatory induction machine for statical electricity. Mr. Knight, of the South-Eastern, exhibited a design for a cab lamp, showing whether the cab is engaged or on call; also his plan of adopting railway signals for the protection of street crossings. It appears to us that the sudden raising and lowering of semaphore arms in a crowded thoroughfare would, by frightening high-spirited horses, tend to do harm. Mr. C. V. Walker exhibited his system of passenger communication, as used on the South-Eastern. We must not forget to mention the pneumatic telegraph signals, exhibited by Mr. Weir, for ships, mines, railways, &c. They were shown as being in operation on board ship, and appeared to work with the greatest ease and regularity. He also exhibited an apparatus for firing guns from aloft or from any position.

Amongst other articles which we have no space to describe we noticed the extraction of occluded hydrogen from palladium, and dialytic separation of hydrogen from coal gas, by the Master of the Mint; patent gas economizer, smokeless fuel for steam boilers, and Benson's patent breech-loader, by Mr. F. N. Gisborne; electrical apparatus and chains, by Mr. Pulvermacher; models of Jerusalem, by Colonel James.

A working model was also shown by Captain John Moody of a floating battery. There were other objects of interest, as works of art, &c., which, with other things we cannot find space to mention, met with a great deal of attention. The rooms were crowded throughout the evening, and the soirée, although not possessing any one great distinguishing feature, was as successful as these delightful reunions deserve to be.

IMPROVED BAR-TESTING MACHINE, AND CALLIPERS.*

By MR. JOHN PAGE.

THIS simple and ingenious machine—designed by my friend Mr. H. J. King, who represents here the contractors of the Calcutta Waterworks—for testing the strength of cast-iron bars, has been made by Messrs. D. Y. Stewart and Company, of this city, and used by them for subjecting the iron used to the tests now always required by engineers of waterworks.

A simple and cheap testing machine, that will give, to a pound, the breaking weight of a cast-iron bar an inch square, is much called for now in Glasgow, on account of the pretty general use of pig iron from Middlesborough; and we hope, ere long, to see one in every pipe foundry in town. Messrs. Edington and Son have a powerful testing machine, but it is too expensive for the ordinary use of a pipe foundry. No specifications are now issued by engineers of waterworks, without a clause binding the manufacturers to use iron of such a quality or strength that, when cast into a bar of certain dimensions, and placed on supports certain distances apart, it shall be capable of bearing a given weight, applied at the centre, before fracture; and, whatever difference of opinion may exist as to the test the iron used on different classes of work should be subjected to, it is certain the majority of engineers agree that this test is a valuable one. Although, from the great variations often found to exist in two bars cast from the same ladle, in the same box, and under apparently precisely similar circumstances, it seems ridiculous to reject a whole day's work from such a result, yet, when a series of experiments are made, and an average taken of the whole, daily fluctuations are obliterated, and a fair opinion may be formed of a certain mixture.

Fig. 1 is an elevation, and fig. 2 is a section of the testing machine. On the main spindle S, on which weight T is keyed, there are two threads cut; one near the centre, on which the hand-wheel M runs, has six threads to the inch, and the other, near the top of the spindle, has five threads to the inch,; on this thread the disc C works for registering the deflection. It will be noticed that the face of the disc C is shown in contact with that of the brass bush B, through which the top of the spindle passes, and that the hand wheel M is against the face on which it works when the large weight is being lowered on the bar.

It will now be readily understood that in the position shown, if the hand wheel M is turned round one revolution from left to right (it being a right hand thread), the spindle will be lowered one-sixth of an inch, and, in the meantime, if the disc C had no motion communicated to it, there would now be one-sixth of an inch of space between the face of the disc and the face of the bush; but if the hand wheel and the disc C are connected together in such a manner that when the one turns the other moves as well, but with freedom to slip if an obstacle present itself, to stop such a motion, the disc will always be kept against the face of the bush; for, while the spindle is sinking one-sixth of an inch by one turn of the wheel, the tendency of the disc is to rise one-fifth of an inch, which it would do were it not prevented by coming against the face of the bush. This connection is practically made by the tube J, the lower portion of which fits into the hand wheel, and on the upper, above the collar H, a short brass tube E is fitted, having a slit cut a part of the way down, which, when sprung over the smaller portion of the disc, forms a spring clip possessing sufficient friction to move it round, but at the same time allowing it to slip easily when it comes in contact with the face of the bush; this, then, will always give the deflection correctly proportioned to the fall of the spindle, and it will be perfectly independent of the position of the hand wheel with regard to the face N, which is variable, as will be seen afterwards, in lifting the upper weight. The amount of deflection is read off on the circumference of the disc C, which is formed of a sliding brass ring, graduated into two equal parts of 100 divisions each, every division representing a fall in the spindle, or a deflection in the bar of 1-1000th of an inch, and at each semi-revolution of the ring a stud in it turns the small ratchet wheel above it round a tooth which completes the registration of the deflection to three decimal places.

After the bar, which is to be tested, has been placed in its proper position, and the V-piece in the centre of the spindle just brought into contact with it, the disc C is brought up by hand against the face of the bush B, and the graduated ring turned round till it is brought up to the zero point, the hand wheel is then turned round, and the whole of the lower weight is allowed to come on the bar T. This weight, including spindle wheel and all other connections, weighs 700lb. (but can easily be made up to any dead-weight required), is allowed to come upon the bar. The 700lb. will seldom be found sufficient to cause fracture, and it then becomes necessary to bring additional weight into action. This is done by continuing to turn the hand wheel M till the three little steel rollers, which work in slots in the loose ring L, come into contact with the under side of the weight K, which, it will be observed, is supported by two spiral springs fastened to the angle irons D D at the side of the frame, and if this motion be continued, and the bar be strong enough, the whole of the weight previously borne by the springs will be transmitted to the bar, giving a total testing weight of 950lb., as the small weight K weighs 250lb. this range being found sufficient, with very few exceptions, for all tests required.

The proportion of the upper weight which is brought into service in breaking the bar is read off upon the scale G by the pointer F, the deflection of a spring is always proportional to the amount of weight it has to bear. The actions of the springs and graduations of the scale were verified by having two pulleys fitted into the frame A, and two ropes attached to the weight by the pins I I passed over them, and dead-weights O O hung on the other side, which, with a knowledge of the friction of the pulleys and the rope, easily determined beforehand, gives the best possible check to the scale; and it is very satisfactory to find that when this test is applied it accords exactly with previous anticipation. It is only necessary, then, to determine with accuracy the two extremes of the scale, at the one end by bringing the rollers just up to the weight as it hangs suspended by the springs, and at the other by slackening back the lock nuts under the angle irons, and screwing up the weight till it is seen there is no weight on the springs. If we now suppose the bar to break at any point, the spindle with all its connections will fall on the india-rubber washer V on the top of the bottom bush, and the deflections with which the bar broke at will remain recorded on the deflection disc, while the weight will be given by the pointer on the scale, so that both weight and deflection can be read at leisure after the bar is broken.

The short end of the pointer F is provided with a slot into which is fitted a pin, which, resting on the collar on the top of the tube, moves up with the weight. This provision being made to allow of an adjustment to suit any variations in the strengths of the springs, which will, no doubt, become weaker in time, although there is very little wear upon them in consequence of their being relieved of all strain except when the bars are being broken.

It might be suggested that small lead weights picked up one after the other by the hand wheel as it rose would act with more certainty than springs, but a little consideration will show that an error may be introduced in the breaking weight equal to the amount of one of these dead weights. For instance, when an additional weight of 250lb. is required, this could be made up with ten 25lb. weights, which would be quite as many as could be used with convenience; but here you might introduce an error of 25lb., for it might possibly be the last lb. of a weight which broke the bar, but it would not get credit for the 24lb. which it stood without breaking if the weights are not counted until they are clear of all support, and if this condition is complied with, it is easy to see that the weight which really breaks the bar is never lifted at all. Whereas, on the contrary, if the record is taken as soon as the surfaces of the two weights come into contact, the bars will be represented on the average as standing 12½lb. higher

* Read before the Institute of Engineers in Scotland.

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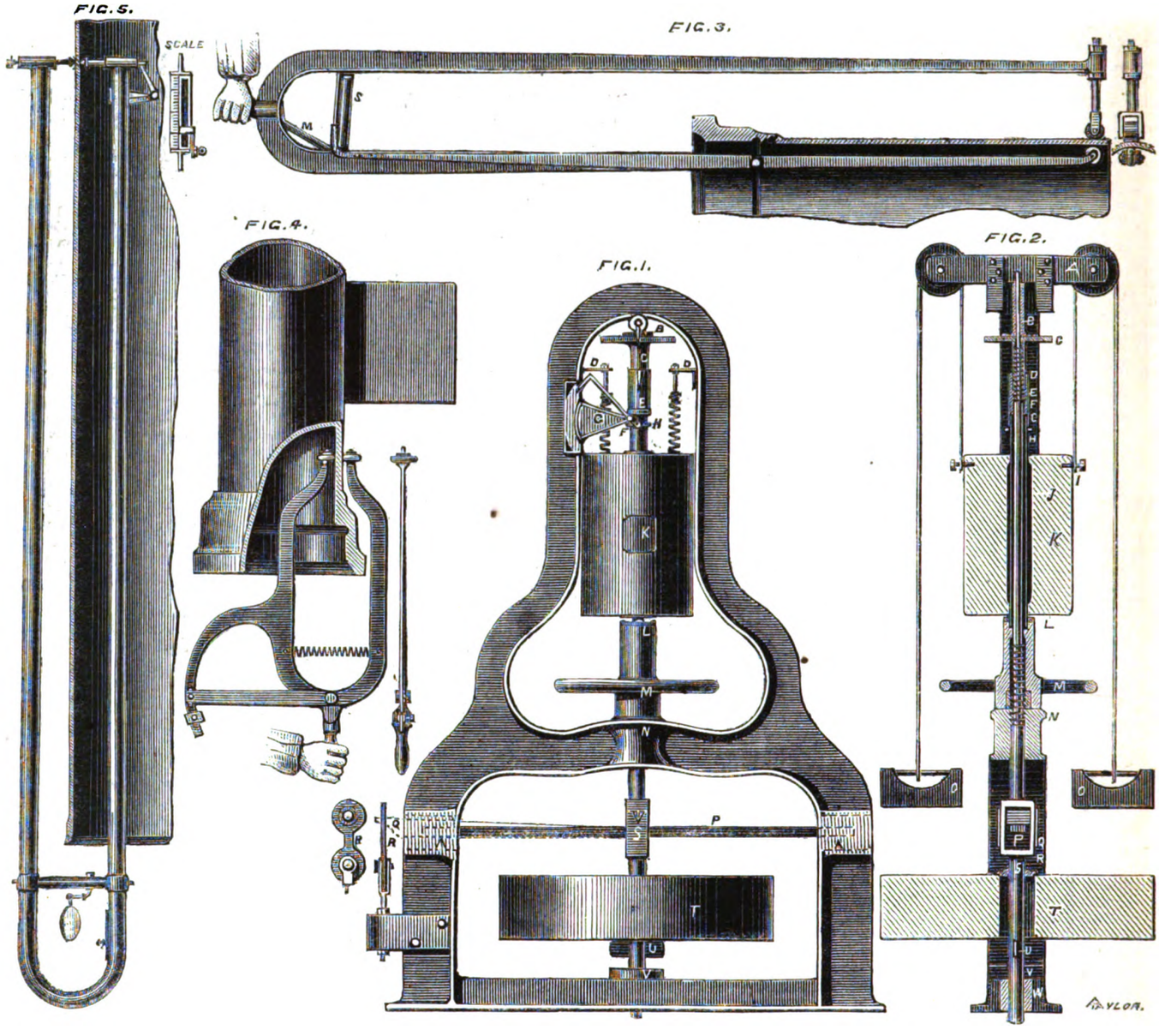
BAR TESTING MACHINE AND CALLIPERS.

BY MR. H. J. KING.



than they really did. This difference of reading with the same weights and the same machine, making the average of bars read the one way higher than the other by the amount of the least weight used; but, independently of this, the gradual application of the weight, such as is given by the relief of the springs, must be preferable.

The application of two spiral springs which might be put into tension by the hand wheel as it rose would perhaps be a simpler arrangement than the present one, but the objection to springs used in this way is, that they become weaker in time and there is no way of discovering an error, whereas a dead weight suspended forms an unerring check which detects any variation at once, and enables a correction to be made. It may be mentioned that the little downward thrust produced by the pressure of the deflection disc against the brass bush, but which is very light, is considered to counterbalance the little friction which must exist in the spindle working in the top and bottom bushes.

The machine can also be used for testing the tensile strength of metals, by placing a steel lever on the V-piece and making it the fulcrum; the short end of the lever passing through the frame, and the long one coming under the knife edge in the centre of the spindle. The link to be tested is fastened at the lower end by the pin slipped through the joint connected with the frame, and the other is slipped over the end of the lever. This arrangement being completed sufficient weight is applied in the ordinary way to break it. With the present lever in use the minimum weight that can be applied is 2,100lb., and the maximum 5,700lb. This variation being effected by shifting the centre of the lever on the fulcrum, making the ratio of the long and short ends 3ft. and 6ft. to 1 respectively.

The callipers have been expressly designed for testing the thickness of pipes. The long one, fig. 3, is adapted to measure the thickness of pipe 4ft. 6in. in from the end, and the shorter one, fig. 4, gives the maximum and the minimum thickness at the spigot ends. Upon the upper leg of the long callipers, fig. 3, and at the extreme end, a stud or pin is fitted, carrying a roller, which runs upon the top of the pipe; and on this stud a thread is cut, to allow of adjustment, by means of the nuts at the top and bottom of the boss through which it passes. Upon the lower leg, which is about two-thirds the length of the upper one, a lever works upon a stud at the end. The shorter end of the lever is provided with a small roller, which is kept against the inside of the pipe by means of the longer end, by being of greater weight; and this end records the thickness of the pipe upon the vertical scale S which is fitted between the two sides of the instrument, and likewise performs the office of a stay. In order to read this scale horizontally—which, in practice, is found necessary, to avoid stooping, when testing small pipes, a plate-glass mirror M is fastened to the frame, at an angle of about 45deg., which, reflecting the vertical scale, enables it to be easily read by anybody standing above it.

It is hardly necessary to state that these callipers can only be used for trying the thickness at the top of the pipe; but, practically, there is little advantage in this; as the light side always comes to the top, if a pipe is rolled on a level surface, and it can easily be turned round and tested again, if desired. The reason why the callipers give the thickness of the pipe only on the top is, that there is an error occasioned by its springing, which can only be corrected when held vertically. As long as it is held so, the error is constant. It can be taken into account, and the instrument adjusted accordingly; and if the person using it holds the handle at the extreme end, resting the large roller on the top of the pipe, and allowing the roller at the end of the lever to come against the inside of the pipe, it may be relied upon as giving an uniform result. The scale is divided by passing the rollers over a carefully-prepared iron scale, which is held horizontally in a vice; and the adjustment is easily done at the stud, on comparing the reading on the scale of the callipers with that on the iron scale, as the roller passes over the latter.

The other long pair of callipers—fig. 5—is a modification of the callipers first made by Mr. King. It is made of a wrought-iron tube, in

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which is carried the rod connecting the bell-crank with the scale, that records the thickness of the pipe. The connecting-rod is thus protected from injury, instead of being exposed, as in the first callipers made by Mr. King; and as the callipers are round, no handles are required, as in fig. 3—a magnifying glass is used to read the scale.

The small pair of callipers, fig. 4, are found to be useful in giving, at a glance, the minimum thickness at the end of a pipe—to try which they are opened by hand and slipped in it, the two small steel rollers being kept up by the spiral spring against the inside and outside surfaces. They are then run completely round the pipe, and, previous to being taken off, an examination is made of the slide on the scale, which is connected with one leg of the callipers, and which is pushed back by the arm on the other, as the surfaces of the two wheels, kept up by the spiral spring, come nearer together, until the minimum thickness is reached, the slide then remaining till it is read off. When put on another pipe, the slide is pushed up by hand to the arm, and the process repeated as before. The ordinary mode of testing a pipe for thickness is to try it with the long callipers at the centre and spigot end, and afterwards run the small pair round the socket end, which shows the minimum thickness there; and, if a pipe stand these tests, it may be considered uniform throughout.

SECURING WOOD TO IRON IN COMPOSITE SHIPS.

WHEN ordinary screw bolts and nuts are used to fasten a wooden planking to an iron frame it is difficult to obtain sound and secure work, because the holes punched in the iron frame are taper, and therefore the bolt touches the frame only on a line of inappreciable width, even assuming that the hole is punched exactly of the proper size; hence the rigidity of the structure depends mainly on the nip of the nut against the frame. This question has been practically dealt with in the patent before us by Mr. James Laing, of Deptford-yard, Sunderland. He uses nuts having a thin and somewhat taper ferrule formed on them on the under side, and this, as the nut is screwed on, enters the upper end of the taper hole, and when the nut is screwed home becomes jammed and ground into it so as effectually to fill the taper hole around the bolt. Such bolts and nuts are applicable in most cases in which it is desired to make an attachment to a metal frame having holes punched in it to receive bolts.

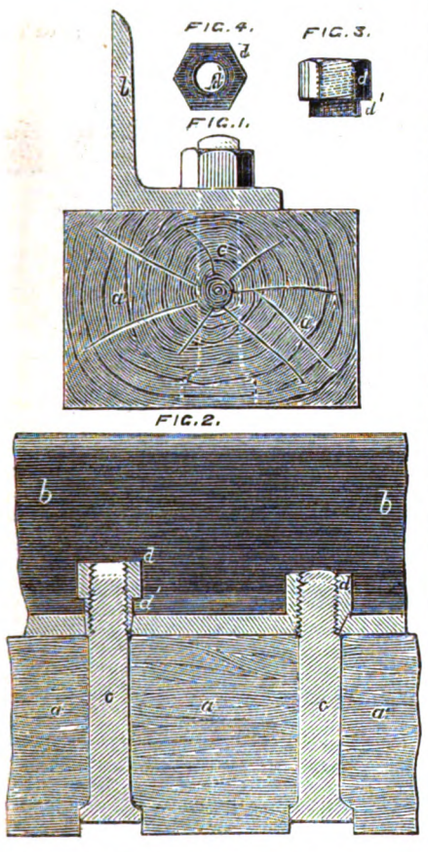
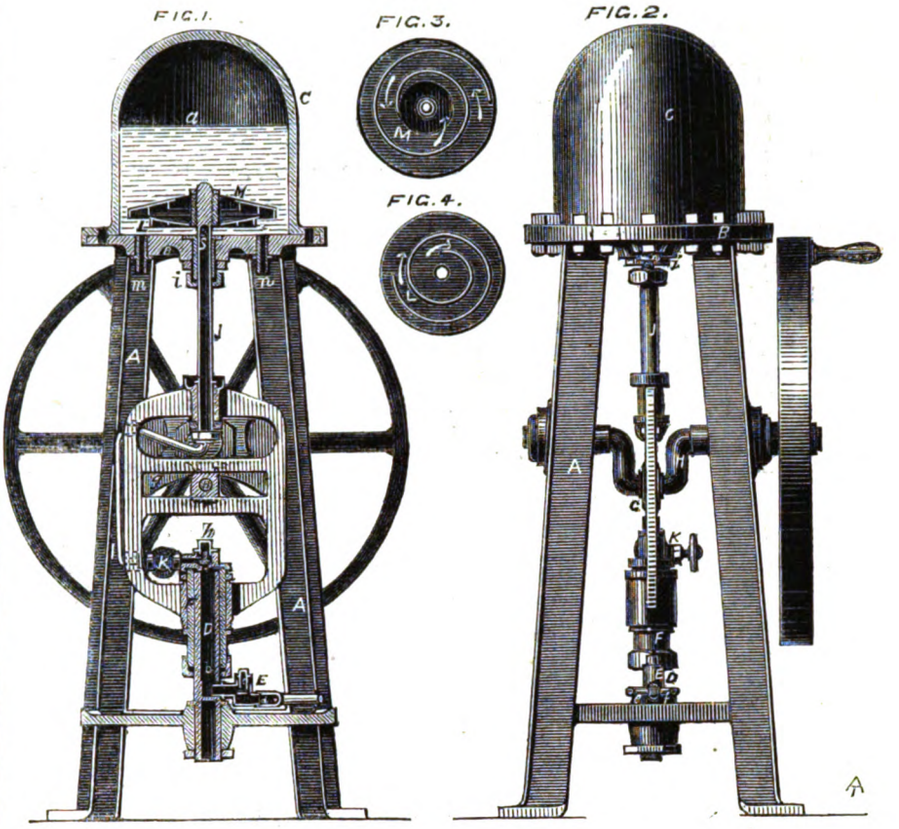


Fig. 1 of our engraving is a transverse section of a wooden plank secured to an iron frame by bolts and nuts, the nuts having ferrules upon them to fill the taper holes punched in the frames; fig. 2 is a longitudinal section; *a* is the wooden plank; *b*, the iron frame; *c c*, the screw bolts; and *d d*, the nuts which the bolts receive upon them. A side view of one of the nuts is shown at fig. 3, and an under side view at fig. 4. *d*¹ is the ferrule formed on the nut; its length should be nearly equal to the thickness of the frame *b*, but less rather than greater; it should be slightly taper, and of a size just to enter the mouth of the taper-punched hole in the frame, as is shown at the left-hand side of fig. 2; then as the nut is screwed home the ferrule *d*¹ becomes ground to fit and fill the hole in the frame, as is shown at the right-hand side of fig. 2, and in this way the working of the bolt in the bolt hole is effectually prevented. We are not yet able to record the practical application of Mr. Laing's system to any vessel, as the invention is a very recent one. It has, however, been highly and deservedly approved of by Lloyd's Committee for Shipping and their surveyors, and the invention is one of such manifest utility that we may safely predict its speedy and general adoption.

MACHINE FOR MANUFACTURING ÆRATED WATERS.

BY MR. J. MATTHEWS.



MACHINE FOR MANUFACTURING ÆRATED WATERS.

IN the above engraving we show a machine for manufacturing soda water and other aerated liquids, which possesses simplicity, and is steady in work. It has lately been patented in England by Mr. J. Matthews, of New York. In this apparatus the pump feed and agitator to the condenser are connected together without the application of joints to the latter above the average water level. The feed and agitator are operated through the base of the condenser, and the discharge or feed pipe passes from the pump into the condenser and imparts to it a reciprocating action by or with the pump. Thus the pressure of gas or liquid in the condenser is made to assist the pump in its discharging or feeding stroke to the condenser by acting upon the exposed end of the discharge pipe. In combination with the reservoir or condenser there is a pump for charging and keeping up the supply to the latter. The constituent parts of this pump are a stationary hollow plunger and a reciprocating cylinder with suitable inlet and delivery valves, and an upper reciprocating discharge or feed pipe. By this arrangement great simplicity of working parts is effected and a steady guiding action secured to the pump. On the end of the discharge pipe which projects into the condenser from below, one or more volutes, or their equivalents are placed so as (in the reciprocating action of the pump) to catch and distribute the gas in the water, and to agitate the latter within the condenser for the purpose of effecting a thorough mixing of the gas and water.

Fig. 1 represents a sectional elevation of this apparatus as applied to the manufacture of soda water; fig. 2 is an outside elevation of the same seen at right angles to fig. 1, and figs. 3 and 4 are inverted plans of the reciprocating volutes used for mixing the gas and water in the reservoir or condenser. A A are portions of the frame which carry a table B at their top, on which is secured the condenser or reservoir C for holding the carbonic acid gas and water. This reservoir is free from all joints below its water line, the average level of the latter being indicated by the line *a* in fig. 1. Inserted through the table B are tubes *m n* for attachment of the usual bottling nipple and pressure gauge or safety valve. Connected with the frame near its base is a stationary hollow plunger D communicating below by a branch *b* with a valve box E, the valve *c* of which is arranged to open upwards and control the suction by a passage *d* through branches *c f*, one of which serves as the induction pipe for the water, and the other for the carbonic acid gas. F is the working cylinder which plays up and down outside the stationary plunger D, and is connected so as to be operated by a reciprocating yoke G driven through a crank H having play in an oblong slot *g* of the yoke. This cylinder F is provided at its upper end with a delivery valve *h* which in the descent of the cylinder allows of the gas and water entering in the up-stroke of the cylinder through the valve *c*, the plunger D to be forcibly expelled through a branch pipe I and vertical pipe J by perforations *s* into the reservoir C.

The plunger D and cylinder F act as a guide below this reciprocating arrangement, while the pipe J working through a stuffing box *i* in the table B or base of the reservoir C operates as an upper guide thereto. K is a valve for shutting off communication between the pump and reservoir C when necessary while the reservoir is full or under pressure. The gas and water which are forced out through the perforations *s* during the action of the pump are admitted into the reservoir C, or gas may be admitted to water contained therein, and to effect the mixture of the gas and water any desired number of volutes L M may be adapted to the reciprocating discharge pipe J where it projects within the reservoir C the one volute L causing the gas as it rises to work spirally outwards, and passing up into or

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under the upper and larger reverse volute M to be worked in an opposite direction or spirally inwards, and finally escaping by a central orifice. In this way an effectual agitation is kept up, and thorough mixing of the gas with the water is produced by the volutes as they are worked up and down within the reservoir C.

Among the advantages which are claimed for this apparatus may be mentioned dispensing with all joints above the water level in the reservoir C, the importance of which will be readily understood when the great pressure of the gas contained in the reservoir is considered, and the great difficulty that consequently exists in making a joint above the water level tight against the escape of gas. Another advantage is that the pump is aided in its descent or discharging stroke into the reservoir C by the pressure of the gas, or gas and water contained therein acting on the head of the discharge pipe or agitator that reciprocates within the reservoir. Thus the pump is aided in producing further compression or condensation by the pressure previously effected by it, or where the pump is merely used to force in the water the same is assisted in supplying the reservoir C by the pressure of the gas separately admitted thereto. In addition to these advantages may be mentioned the great simplicity of the working parts and steadiness of action, as produced by the reciprocating cylinder F on the plunger D and discharge pipe J into and through the bottom of the reservoir, the distance apart of the guides to the pump aiding in this result, and the reciprocating action of the pipe or connection J in a longitudinal direction being preferable to a rotary one for working the agitator, as offering greater security against leakage at the stuffing box.

INSTITUTION OF CIVIL ENGINEERS.

AT a meeting of the Institution of Civil Engineers, held March 3, 1868, Charles Hutton Gregory, Esq., President, in the chair, the paper read was on the manufacture and wear of rails, by Mr. C. P. Sandberg, Assoc. Inst. C.E.

This communication was divided into three parts. First, as to the best method of manufacturing rails out of common iron, and as to the time they would last. Secondly, as to the disposal of the iron rails when they were worn out. And thirdly, as to whether iron or steel, or a combination of the two materials, was the most economical to use for rails. The mode of manufacturing iron rails for Sweden, as carried out in South Wales between the years 1856 and 1860, was described; and it was stated that, with a view of ascertaining the best method, it was decided to submit a number of sample rails, made from five different kinds of "piles," to actual practical trials. These experimental rails were laid down at the Camden Town station, by permission of the London and North-Western Railway Company; and the following table showed the number of tons passed over each description of rail before it was crushed, and also before the rails were taken up:—

Mark of Rail.	Crushed.	Worn Out.
	Tons.	Tons.
T	3,680,000	5,060,000
Y	4,140,000	5,290,000
H	3,220,000	5,060,000
E	6,900,000	8,970,000
N	3,220,000	5,520,000

A table, calculated from the above, showed how long the rails would last, supposing them to be passed over by 3,000 trains yearly, each train being composed of an engine weighing thirty tons, and of twenty waggons of ten tons each, or a gross load of 230 tons. From these tables it was ascertained, that the five different descriptions of rails were on the average crushed in six years, and worn out in nine years. The conclusion was thus arrived at, that hammering after the first welding heat, for this particular kind of iron, did not improve the endurance of the rails, but that the simplest mode of manufacture had also the material advantage of being the best. These trials at the same time established the fact, that it was not the wear or the diminished sectional area caused by abrasion, which produced the unsatisfactory results in the endurance of iron rails, but the lamination caused by imperfect welding. This explained the great difference between the wear of rails made in exactly the same way, the welding in the one case being perfect, whilst in the other it had been very imperfect.

These experiments also confirmed the rule laid down in Mr. R. Price William's paper, "On the Maintenance of Permanent Way," viz., that the endurance of rails might be measured by the product of the speed and of the passing weight. Trial rails, of the same kind of manufacture as those marked E in the previous table, but of a heavier section, laid on the Great Northern Railway, might thus be said to have borne 276,000,000 tons at a speed of one mile per hour. The endurance of the rails tried at Camden Town, under unusual conditions, where the wear was occasioned principally by the frequent use of the brakes and by continual shunting, was much less, and might be represented by 120,000,000 tons at a speed of one mile per hour. These experiments seemed to indicate that 220,000,000 tons might be carried over rails, of the section and make referred to, at a speed of one mile per hour; so that any railway company, knowing the load which yearly passed over their line and the speed, might by multiplying the one into the other, and dividing this product by 220, ascertain the life of iron rails in years.

The conclusions the author had arrived at were, that no rule could be laid down for the manufacture of rails that would apply to every manufacturing district; but that in the case of Welsh iron, to which he had more particularly referred, it had been proved that the best method of manufacturing the rail was that now most commonly practised, viz., rolling the iron into bars, piling these, and repeated rolling to the finished rail, without hammering. The author assumed that the prejudicial result from hammering was owing to the large amount of sulphur in the Welsh iron. Where the iron contained more phosphorus, and less sulphur, as, for instance, in the Cleveland, Belgian, and French iron districts, hammering had proved beneficial, and rails had been made direct from puddled bars, without the intermediate process of piling—this being, in fact, the method generally adopted in those places, and being found to answer best.

As to the disposal of the rails when worn out, and as to the possibility of re-rolling old rails with advantage by companies far removed from the seat of manufacture, such as the British Colonies, the country round the Mediterranean or the Baltic, the author thought that for railways near the seat of rail manufacture, the best way would be to continue to sell the old rails to the rail mills. For other countries, situated like Sweden, for instance, it became important to ascertain whether it would not be more advantageous to re-roll them. On this subject precise and detailed calculations were entered into, which led the author to think, that the manufacture might be carried on in that country with advantage, using Swedish Bessemer steel for the head, No. 2 iron for the foot or flange, and old iron rails for the remainder of the pile.

In the third division of the paper, as to the best and most economical material to be employed for rails, the following calculations were made:—Assuming that, under a very heavy traffic, common iron rails would last five years, steel-top rails fifteen years, and solid steel rails thirty years, and that iron rails would cost £7 per ton, steel-top rails £10 per ton, and solid steel rails £15 per ton, and that the old steel-top and iron rails were valued at £1 per ton, and the old solid steel rails at £8 per ton, then, with a rail section of 81lb. per yard, 250 tons of rails would be required for one English mile of double line, and the cost of laying the rails might be estimated at £1 per ton. On these assumptions the author has calculated the following

ANNUITY TABLE, No. 1.

Interest calculated in each case at 5 per cent,

Prices. Per ton.	When Iron Rails last.	Annuity would be for: Iron Rails.	Steel Top Rails.	Solid Steel Rails.
Iron Rails £7				
Steel Top do..... 10				
Solid Steel do. ... 15				
	Years.	£	£	£
	2	587	395	325
	3	417	307	271
Credit for Per ton.	4	332	247	245
	5	280	218	239
Old Iron Rails ... £4	10	179	163	205
„ Steel Top do. 4	15	134	148	201
„ Solid Steel do. 8	20	130	140	200

This table might be thus explained, as to iron rails lasting five years:—

	£.	s.	d.
250 tons, at £7 per ton . . .	1,750	0	0
Cost of laying down . . .	250	0	0
	£2,000	0	0
Which sum at the end of five years, at 5 per cent. compound interest, became . . .	2,552	0	0
The difference between this sum (viz., £2,552) and the value of the old rails (250 tons, at £4 per ton=£1,000) was .	1,552	0	0
The annuity required to recoup this latter sum in five years was	£280	0	0

It might be objected that the prices quoted for solid steel rails were too high. Rails of this kind had been sold in some places as low as £12 per ton, but for the best quality the present price was £15 per ton, and it was only from these that the experience had been gained, as to their enduring six times as long as iron rails. However, Table No. 2 had been calculated for the different kinds and periods at the following prices, viz., iron rails at £6, steel-top rails at £9, and solid steel rails at £12 per ton, crediting the old iron and steel-top rails at £3 per ton, and the old solid steel rails at £5 per ton.

ANNUITY TABLE No. 2.

Prices. Per ton.	When Iron Rails Last.	Annuity would be for: Iron Rails.	Steel Top Rails.	Solid Steel Rails.
Iron Rails £6				
Steel Top do..... 9				
Solid Steel do. ... 12				
	Years.	£	£	£
	2	574	382	288
Credit for Per ton.	3	404	283	233
	4	319	234	230
Old Iron Rails ... £3	5	268	206	174
„ Steel Top do. 3	10	166	149	168
„ Solid Steel do. 5	15	133	136	163
	20	117	126	150

This table showed that in all cases solid steel rail were the cheapest. The amount of traffic must, therefore, decide which material it was the most economical to use for the maintenance of the permanent way. For all railways where ordinary iron rails were worn out in five years, or in a shorter time, solid steel rails were the most economical, at the prices quoted in Table 1. Where ordinary iron rails lasted over five and up to ten years, steel-top rails would be the cheapest; iron rails in these cases being clearly proved to be the most expensive, although the cheapest where they lasted from fifteen to twenty years.

The preceding tables referred to rails of the Vignoles section. Table No. 3 had been made up for the ordinary double-headed rail, for one English mile of double line, according to the prices stated, the considerations being the same as in Table No. 2, excepting that the chairs had been taken into account. Allowance had been made for 140 tons of new chairs per mile at £5 per ton, credit being given for the value of the old chairs at £2 10s. per ton. It might be observed, that steel-headed rails were here estimated to last four times, and solid steel rails eight times, as long as ordinary iron rails,—that was making allowance for the use of both faces.

ANNUITY TABLE No. 3.

Prices. Per ton.	When Iron Rails Last.	Annuity would be for: Iron Rails.	Steel Top Rails.	Solid Steel Rails.
Iron Rails £6				
Steel Top do..... 9				
Solid Steel do. ... 12				
Chairs (140 tons per mile) 5				
	Years.	£	£	£
	2	780	379	296
Credit for Per ton.	3	751	291	249
	4	436	244	228
Old Iron Rails ... £3	5	366	223	217
„ Steel Top do. 3	10	229	177	199
„ Solid Steel do. 5	15	183	166	
„ Chairs 2/10	20	163	162	

Table No. 3 indicated that the iron rails were in no instance the cheapest; but, on the contrary, that when iron rails lasted only five years, solid steel rails had the advantage, and where iron rails had a longer duration, then that steel-headed rails where the most economical.

Another fact had still to be taken into consideration—the safety of the three different materials, in regard to high speeds, severe climate, &c. A report recently published by Professor Styffe, the Director of the Government School of Mines at Stockholm, showed the extent to which the tenacity and elongation of various materials were influenced by the amount of carbon they contained. From the tables which accompanied the report it appeared that the hardest material had the greatest absolute strength, both before and after permanent set had

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taken place, but it had the least ductility; on the other hand, a softer material had the greatest tenacity or elongation, the Bessemer material giving the same results as that prepared from the same pig iron by puddling, refining, or the cast-steel process. In a diagram illustrating these results, the per centage of carbon and of phosphorus was stated in nearly all cases. The limit for the amount of carbon seemed to be for the Bessemer material 1·2 to 1·5 per cent. With a larger amount the absolute strength, as well as the tenacity, had been found to decrease. When the amount of carbon did not exceed 0·4 per cent., and the material was not worked at too low a heat, the elongation seemed to be 16 per cent., or the same as for puddled iron from the same pig iron; and, as such Bessemer material was not only much stronger, but also more solid or homogeneous than the puddled material, it deserved a decided preference for all railway purposes. The few cases of the failure of rails by breaking might be accounted for as the result of too hard a material not perfectly manufactured, having been made at an early period of the introduction of the process. The experience which had now been gained should certainly prevent any recurrence of this.

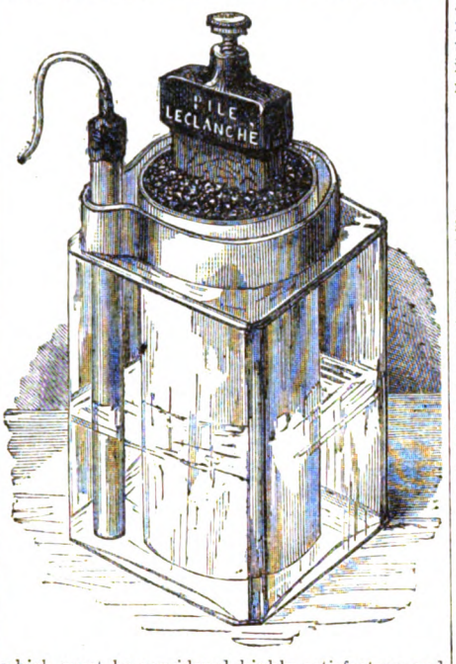
It must, however, be observed that the raw material used in both cases was charcoal pig iron, of a superior quality compared with that used in England for making Bessemer rails, which might be seen from analyses made by two eminent chemists of both countries, which were given. These analyses showed that the great difference between the two was the excess of silicon in the English, and of manganese in the Swedish pig iron; thus explaining why the one gave a better product than the other, although worked entirely without the addition of spiegeleisen. If there were only 0·6 per cent. of carbon in the solid steel, and 0·3 per cent. in the steel for the steel head, the safety ought to be the same for all the three kinds, and this would not influence the former calculations as to which was the best and most economical material for rails.

Having watched the development of the Bessemer process in England, as well as on the Continent, it seemed to the author, that by that process a good and pure raw material had the same advantage over an inferior one as in all other processes, and that a superior product could not be obtained from an inferior raw material by that process any more than by any other. In having mentioned Swedish material as an example, it must not be supposed that it was wished to advocate the use of Swedish iron in this country, but simply to draw attention to the better material; as equally good charcoal iron could be supplied from Canada and India—both English colonies. It might also be remarked, that the author's endeavour had been to arrive at the truth irrespective of prejudice, and that he had no wish to be deemed an advocate for one kind of rail more than for any other.

PEROXIDE OF MANGANESE BATTERY.

THIS battery, the invention of G. Leclanché, has excited a good deal of attention lately from its proving a constant battery, a fact that does not usually accompany single liquid batteries. It differs in many points from other batteries that have been used for electric and telegraphic purposes; as no description has up to the present time been before our readers we give now some details of its construction and working, as it evidently appears that it will come into more general use. M. Leclanché has given his attention a great deal to this subject, and seeing how unsatisfactory was the work done by most of the batteries as practically applied, he set himself to solve the following problem, "to obtain a theoretical battery in which the chemical actions being always perfectly equal to the amount of work done, necessarily leave it, without supervision, a duration equal to that work;" this solution he hopes he has found in his peroxide of manganese battery. Peroxide of manganese possessing considerable conductibility, analogous to metals, made him think that it was possible to construct a constant single liquid battery having a plate of this metal as a positive element. The chemical composition of peroxide of manganese shows that it is inoxidizable and insoluble, and that it has great affinity for decomposable bodies. As negative element he has chosen zinc, seeing that it possesses the qualifications required by theory. For the liquid solution he found it necessary to employ such as would not attack either of the two bodies, and he found that only the salts of alkaline metals would be completely inoffensive. Of the various salts tried, the salts of ammonia were found to answer best, as they allowed the depolarization and the decomposition of hydrogen to operate the most freely. With the salts of ammonia a battery was obtained which produced a current of great electro-motive force, and which allowed rapid depolarization. For practicable purposes the plate of peroxide of manganese is not used, but pounded peroxide in a porous jar, the electricity obtained from it being collected by means of a carbon plate, chlorhydrate of ammonia—the sal ammoniac of commerce—being used as the salt.

M. Leclanché says that in order to obtain good results it is necessary that care should be taken in choosing a pure peroxide of manganese and a good conductor of electricity, the manganese he recommends possessing the following external appearance—crystallized, silky, and having a marked black plumbago brilliancy, and a certain hardness. It requires to be broken into large grains and separated from the powder and mixed with an equal quantity of pounded carbon. The use of large shows a great superiority over small grains. The solution of the salt requires to be concentrated, and care has to be taken that the solution does not reach more than half-way up the porous vase, as the drier the contents of the vase are the better the conditions of working and of conductibility. From his experiments the electro-motive force appears to be considerable. Taking a sulphate of copper cell as 1·, the electro-motive force of this new battery is 1·382



which must be considered highly satisfactory, and in practice a series of forty Daniell's may, he states, be advantageously replaced by twenty-eight elements of peroxide of manganese. In proof of its excellence we may mention that up to December last, 20,000 elements of this battery were in use on different French and other railways; and in numerous stations, supplied nearly two years ago, the batteries have continued to work with a regularity conformable to the above-mentioned theory. Our illustration will explain the appearance of the battery.

The great disadvantage that almost every battery up to the present time used for purposes of practical telegraphy possesses is the amount of supervision that is always necessary; they frequently want fresh material, and do not work long before they require a thorough cleaning, and any battery that will answer for continuously working telegraphic and railway signal circuits without the looking after that the present batteries require, and will last for more than a year, will, we feel sure, be looked upon as a great boon, not only for the absence of supervision but for the decrease in expenditure that must ensue. In a large telegraph company the amount of battery power throughout their system must be enormous. What must not be the amount of saving if a battery can be adopted that works equally well with a smaller number of elements and has a lasting power more than double?

THE NAVY ESTIMATES.

THE Navy Estimates for 1868-9 were published on Tuesday last, and we here give general particulars and amounts. They present a total of £11,177,290, and the net amount, after deducting estimated extra receipts and repayments to be paid to the exchequer, is £10,733,998. The details are made up as follows:—Wages to seamen and marines, £3,036,634; victuals and clothing for ditto, £1,335,842; Admiralty Office, £182,364; Coastguard Service, Royal Naval Coast Volunteers, and Royal Naval Reserve, £263,926; Scientific Branch, £63,565; Dockyards and Naval Yards at home and abroad, £1,223,562; Victualling Yards and Transport Establishments at home and abroad, £87,179; Medical Establishments at home and abroad, £64,824; Marine Divisions, £20,709; Naval Stores, for the building, repair, and outfit of the fleet and coastguard steam machinery, and ships built by contract.—Section I. Storekeeper General of the Navy, £892,908; Section II. Controller of the Navy, £1,092,500; new works, building, machinery, and repairs, £814,237; medicines and medical stores, £78,164; martial law and law charges, £20,365; miscellaneous services, £175,800; making a total for the effective service of £9,352,579, against £9,117,758 for last year. To be added to this is half-pay, reserved half-pay, and retired pay to officers of the Navy and Royal Marines, £700,166; military and civil pensions and allowances.—Section I. Military pensions and allowances, £550,447; Section II. Civil pensions and allowances, £223,498; making a total for the naval service of £10,826,690. To this amount is added a further sum for conveyance of troops, £350,600; making a grand total of £11,177,290, against £10,976,253 for the last financial year, or a net increase of £201,037. The total number of seamen for whom provision is made is 52,070; of marines, 14,700; and of civilians, 350; making an aggregate force of 67,120.

ROYAL GEOGRAPHICAL SOCIETY.

AT the ordinary meeting of this Society, on Monday last, a paper was read on the geography and mountain passes of British Columbia, with reference to an overland route, by Mr. A. Waddington, a gentleman who has devoted many years in exploring, personally or by his agents, the different valleys and passes in order to ascertain which is the most practicable for a waggon road and railroad from the Pacific across the Rocky Mountains. In explaining the nature of the country, the author said that the two mountain ranges—the Cascade or Coast Range, having an average width of 110 miles, and the Rocky Mountains a width of 150 miles—nearly meet on the southern frontier of the colony; but diverge farther north, and leave a fertile central plain 120 miles wide. In the southern part of the country all attempts to discover practicable passes had been in vain, and no through route was possible by way of the mouth of the Frazer River. He had examined the various long inlets or fiords to the northward, and found Bute Inlet to be by far the most suitable as the Pacific terminus of the future overland route. He had discovered a river flowing into the head of the inlet, and had planned a dray-road through the narrow valley thus formed through the whole width of the Coast Range. The road that he had projected ran north-eastwardly across the plain, and struck the Upper Frazer, opposite the mouth of the Quesnelle River; the Frazer is here a navigable stream, and affords a route to the Yellow-head Pass of the Rocky Mountains, which leads to the rich level country on the eastern side of the range, extending towards the Red River Settlement. The yellow-head Pass, according to Dr. Rae, is 3,760ft. above the sea-level, the central plain is 2,500ft. in its southern part, and the Bute Inlet trail runs across it between 51deg. and 53deg. N. lat.; the pasture is excellent and the cereals (including wheat) can be grown. Mr. Waddington stated that the Canadian Government had already begun to construct the eastern end of the overland waggon-road between Lake Superior and Red River, but that no arrangement had yet been entered into with regard to the other section; and he urged the importance of the undertaking, on political and commercial grounds.

The president, Sir Roderick Murchison, bore testimony to the great geographical value of the map constructed by Mr. Waddington, on which all his various explorations were recorded. Captain G. H. Richards, R.N., Dr. Cheadle, Mr. Dallas (late Governor of the Hudson Bay Company's territory), Dr. Rae, Mr. Frederick Whymper, and others, took part in the discussion which followed.

A DESPATCH from the English consul at Zanzibar, dated 11th November, contains no positive news respecting Dr. Livingstone, but states that a white man is said to have been seen beyond the spot where Dr. Livingstone is said to have been murdered.

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EXPORTS OF MACHINERY.

NOTWITHSTANDING the outcry about the damaging effect of foreign competition upon our engineering trade, when it comes to actual figures, we find that we have not had such a bad year after all. Facts and figures are stubborn things, and what they say in a late return is, that during the past year the foreign and colonial demand for British steam engines has been tolerably good, the value of the exports in the eleven months ending November 30, being £1,829,578, as compared with £1,611,442 to the corresponding date of 1866, and £1,797,435 in the first eleven months of 1865. It is worthy of note that a decrease, instead of an increase, would have been observed in the demand for British steam engines last year, but for the very large deliveries of locomotives to the Indian railway companies. Thus, the value of the steam engines sent to British India to November 30 last year was no less than £857,627, as compared with £457,987 in the corresponding period of 1866, and £271,298 to the corresponding date of 1865. The exports of other British machinery remained about stationary last year, having attained a total of £2,781,928 to November 30, as against £2,785,908 in the first eleven months of 1866, and £3,015,249 to the corresponding date of 1865. In the ten years ending 1866 inclusive the value of the steam engines exported from the United Kingdom was as follows:—1857, £1,069,249; 1858, £1,097,278; 1859, £973,340; 1860, £1,238,333; 1861, £1,258,164; 1862, £1,624,876; 1863, £1,595,036; 1864, £1,617,117; 1865, £1,958,533; and 1866, £1,750,492. The value of the exports of other machinery during the same period is subjoined:—1857, £2,814,420; 1858, £2,502,074; 1859, £2,757,961; 1860, £2,599,488; 1861, £2,955,506; 1862, £2,467,797; 1863, £2,772,976; 1864, £3,231,475; 1865, £3,264,100; and 1866, £2,998,692.

TIMBER SUPPLY FOR INDIA.

AS the more useful woods hitherto used in India are becoming more scarce, it may be important to know that the forests of Johore contain a variety of timber trees well adapted for use in that country. Upwards of two hundred different kinds of trees exist in the Johore forests, many of them not of much value, but there are some species that for strength and durability cannot be surpassed. Amongst these may be mentioned Baloo, called Johore teak by the Europeans at New Johore. It appears to be a species between saul and teak. This timber has been sent in some quantity to Calcutta and Bombay. Sir Macdonald Stephenson, who visited these forests a few years ago, was the first to introduce it to the notice of the great railway companies. It is worth mentioning that Sir Stamford Raffles in the year 1823 got the Sultan and Tumungong "to forego all right and claim to this wood within Singapore and the islets immediately adjacent." Since then all on the island has been disposed of, most of it going to China, where it is much esteemed and is still in demand.

A grave mistake has been committed in sending some young timber into the market; this timber invariably splits more or less. Attention has been drawn to the prevention of this by Mr. Kruger, who recommends that the trees should not be felled until they are perfectly full grown, and that a year previous to felling they should be "ringed." Subjoined are some experiments of various woods, which we find in the last number of the Calcutta "Engineers' Journal;" it will be seen that the Johore kinds stand the tests well. It may be mentioned, says the above paper, that, owing to the exorbitant duty levied on timber from Johore, comparatively little business has been done in it here. There is no duty whatever on timber imported into Great Britain. As timber goes to improve a country, and as the lower classes in India cannot afford to take much of it in consequence of its price, the abolition of the impost would be highly desirable. The Maharajah of Johore levies no duties whatever on British goods and in justice ought to enjoy reciprocity. A tax of ten per cent. is levied on the export of timber by the Johore Government. There are extensive steam saw mills, at New Johore in full operation. The harbour is capacious and safe; vessels of any draught can load alongside the saw-mills wharf. The Maharajah, a K.C.S.I., is an enlightened ruler, and since his return from England last year, he has begun to make roads, build houses, open up new plantations of gambier and pepper, and otherwise improve his country. He maintains an English school, and is anxious to do all the good he can. His family has always been on the best of terms with the British; it was from his grandfather that the now flourishing settlement of Singapore was originally obtained.

REPORT of TESTS OF SPECIMENS OF TIMBER made for the Inspector-General of Ordnance, Bombay, by LIEUT.-COL. J. B. HATCH, Agent, Gun Carriage Factory, Bombay, in April, 1866.

Description of Timber.	No. of Specimen.	Weight of ditto.	Dimension of Specimen.			Weight at which broke.			Nature of Fracture.	Deflection previous to Breaking. Inches.	Test for direct cohesion, each piece turned down to 1-diameter. Weight at which Broke.			Remarks by J. MELDRUM, Manager Johore Steam Saw Mills Company, near Singapore.
		oz.	in.	in.	in.	cwt.	qr.	lb.			cwt.	qr.	lb.	
Johore Teak	1	9½	18	1	1	6	0	22	Sprung only		8	3	5	Almost indestructible. Chief of the very few woods that will really stand the climate of India. Admitted by Lloyds for "all parts in ships of the highest grade."
	2	10¼	...	...	...	7	1	19	Long		7	2	5	
	3	11	...	...	...	7	2	26	Long		5	2	5	
Malacca Teak or Maraboo	1	10½	18	1	1	5	3	22	Long		9	0	5	Used for gun carriages; not liable to dry rot, or to be attacked by white ants; does not split.
	2	10¼	...	...	...	6	2	19	Long		4	0	5	
	3	10¼	...	...	...	7	0	15	Long		9	0	5	
Maulmein Teak	1	9½	18	1	1	4	3	22	Long		2	2	5	Used for every purpose.
	2	9¼	...	...	...	4	1	22	Long		3	0	5	
	3	9¼	...	...	...	4	3	22	Long		2	3	5	

Tests of Woods; Pieces one inch square, suspended two feet clear. Weight hung in the centre from an iron hook, ¾in. round. By A. M'Kenzie, Esq. Bombay.

Name.	Country.	Breaking Weight. cwt.	qr.	lb.	Deflection.
Teak	Maulmein	2	3	6	15-16″
Teak	Deccan	3	0	5	15-16
Pine	Quebec	1	3	27	1¼
Pine	Swedish	2	1	15	¾
Kaurie Pine	New Zealand	3	0	2	1
Teak	Johore	5	1	2	1½
Cedar	Johore	3	0	3	1 1-16
Oak	Johore	3	1	21	1⅝
Daroo	Johore	4	2	9	1¼
Tampinis	Johore	4	1	27	13-16
Rosewood	Johore	4	0	24	⅞
Babool	Scinde	3	2	0	2
Mencubang Penang	Borneo	2	1	7	¾
Kapoor	Borneo	2	1	5	1¾
Eyne	Malabar coast	4	1	22½	1⅜
Jarrah	Geograph bay	3	0	25	1
Stringy Bark	Melbourne	2	0	22	1⅝

THE MONT CENIS TUNNEL.

THE Mont Cenis Tunnel entered upon a new phase at the commencement of the present year when the works were handed over to a new company to carry out. This company has at its head the engineers Sommeiller and Grattoni, two of the first projectors of the great undertaking, and whose names have throughout been honourably associated with it. The company undertakes to finish the tunnel in four years, ending the 31st of December, 1871, and to pay a stipulated forfeit for every month beyond that time during which it shall not have been completed. If it ends the work before that time the same sum is to be paid to it for every month gained. The "Savoy Journal" says the tunnel is pretty sure to be finished early in 1871, but that this will hardly be the case with the two pieces of railroad which are to connect St. Michel and Susa, the present termini of the railway north and south of the Alps, with the extremities of the tunnel. Ground has been broken on this side, but upon the other it will not be begun until the end of the winter. The work will be carried on with the utmost activity. It is estimated that if 6,000 to 7,000 workmen be employed on the North-Alpine section—and it is said that the configuration of the ground and the limited resources of the country will not admit of a larger number—the line can hardly be opened in less than four and a-half to five years, which is also about the time that will be needed to complete the section from Bardonneche to Susa. The work on those two pieces of line will be of great magnitude and extremely costly. It is estimated at from 1,700 to 1,800 thousand francs (£68,000 to £72,000) per kilometre. The average price in France is only from £10,000 to £12,000. The cost of the tunnel itself is estimated at from four to five millions of francs per kilometre. It seems that Mr. Fell, if he soon begins running his trains, is likely to have a good five years' traffic over the summit of Cenis. The summit railway line and the covered ways were ready two months ago, but some parts of the engines, which were made in Paris, would not stand the tests applied to them, and it was found necessary to replace those parts by corresponding ones of greater strength. One of the experimental engines has been working in a most satisfactory way all along, and carrying materials for the covered ways.

UTILIZING WASTE COAL.

A SERIES of carefully-conducted experiments have been made by a Board of Engineers, appointed by the United States' Navy Department to examine into the various methods of employing anthracite and bituminous coals as fuel, at the works of Messrs. Whelpley and Storer, East Boston, Mass. A furnace for burning pulverized coal was there erected, which the owners have used for several years in their ingenious process for the reduction of metallic ores. No official report of the combustion trials made with this furnace has yet appeared, but the results are thus briefly stated in the "New York Tribune." A series of experiments, each lasting forty-eight hours, showed the relative heating power of bituminous coal in lumps of four inches cube, burned on a grate with a forced blast under an ordinary tubular boiler, and the same kind of coal, one-third in lumps burned on a grate, and two-thirds slack pulverized, and driven in above the fire with a forced blast. Under conditions as nearly alike as practicable it was found that an average of 1lb. of lump coal evaporated 8½lb. of water from a temperature of 140deg. Fahrenheit, while one-third of a pound of lump coal and two-thirds of a pound of pulverized coal evaporated 9½lb. of water from the same temperature. The combustion was so perfect that in neither case were the residual ashes more than 8 per cent. of the coal used. In the latter part of the experiment the increased useful effect of pulverized coal over lump coal rose from 12 to 30 per cent., owing to the acquired skill of the firemen in increasing and regulating the heat. Assuming that the heat generated by pulverized coal is barely equal to that of lump coal, these experiments solved most satisfactorily the question what is to be done with the vast quantities of fine fuel which now lies at the mouths of coal mines in this country and in Europe. Statistics show that while the mines of Great Britain yield more than 100,000,000 tons of marketable coal per annum, about 30,000,000 tons more of waste coal are left at the mines. The percentage of waste coal at the anthracite mines of this country is somewhat less than at the bituminous coal mines, yet it has been estimated at about twenty-five per cent. of the whole weight brought to the surface. The utilization of this waste coal would virtually add one-third more to the value of the annual product of American mines, and eventually cause a corresponding diminution of the prices paid by the consumer; therefore, it may be safely averred that no improvement has been lately proposed which compares in general importance with that which would make available the waste product of coal mines. The inventors of this process of utilizing fine coal are about applying their apparatus to locomotives. Previous experiments have demonstrated that at least one-third of the air required for combustion should be admitted above the fire in the locomotive, and the remaining two-thirds under the grate bars. Still the waste resulting from rapid and imperfect combustion required in the locomotive is very large. It is claimed that by pulverizing coal and admitting it in combination with air above the ordinary coal fire, the rapid generation of heat is successfully accomplished; and what is still more important in the locomotive, that there is an almost entire absence of smoke and particles of unconsumed coal, which in spite of spark-arresters have been thus far the disagreeable and dangerous resultants of accelerated combustion. The trials to which we have referred relate only to bituminous coal. It would be interesting to know whether the same advantages can be gained by pulverizing anthracite, which requires a much higher degree of heat for its ignition.

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Correspondence.

SQUARING THE CIRCLE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

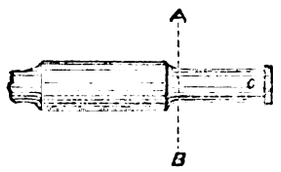
SIR,—To the Rev. Dr. Maskelyne, Astronomer Royal in 1767, navigators are indebted for the "Nautical Almanack." The moon's theory, based upon Kepler's laws of planetary motions, was then so perfected as to enable the Doctor to supply the angular distances of the moon from the sun, and certain fixed stars, at every six and three hours, so as to enable the navigator to determine his longitude by lunar observation. The lunar distances are computed by spherical trigonometry; they are computed for one, two, three, or more years in advance; and as the computed distances agree exactly with the observed distances, the accuracy of the value of trigonometrical lines may be safely accepted. But we need not go beyond our planet for a verification of the accuracy of our present trigonometrical tables; we may reasonably rely upon the trigonometrical survey of England.—I am, sir, yours, &c.,

March 9. COMMANDER, R.N.

FRACTURE OF AXLES AND BOILER PLATES.

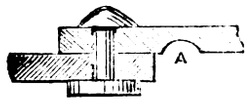
SIR,—Amongst the numerous discussions and descriptions of experiments upon iron and steel which have lately taken place, there is one important element that does not appear, and which enters apparently unheeded into the construction of all our metallic works. I would, therefore, ask those who are so disposed to answer the following questions which will bring forth the element referred to.

First. Taking a railway axle: why should it crystallize, and why on the line A B, leaving the part C almost sound?



Second. If two equal spans of a bridge be built, one on the plan of the Charing Cross bridge, and the other on the plan of the London, Chatham, and Dover Railway, across the river, each span to be of equal strength when erected, and having the same amount of traffic passing over them, why, by construction alone, should one bridge last considerably longer than the other, and which one will give way first?

Third. In the case of steam boilers which I have noticed, why should the plates at their lap be eaten out above the water line, as at the point A?



I have put this in the form of queries, to see how far the element referred to has been considered; and if not satisfactorily answered will, at a future day, with your permission, reply in your columns.—I am, Sir, yours, &c.,

C. and M. E. and ELECTRICIAN.

SPEED OF THE "WATERWITCH."

SIR,—I am much interested in Mr. Ruthven's mode of propelling steam vessels, and observe from the account given in your Magazine of February 28, that in the recent trials the "Waterwitch" attained a speed of about nine knots an hour.

You propose that some experiments should be made on the blades of the turbine, to try if by this means the speed could be improved. I understand that the water which supplies the turbine is drawn from the bottom of the vessel, which has a tendency to pull her down. I would, therefore, further suggest that the pipes for supplying the turbine should be carried forward towards the bow of the vessel. The pressure being taken off the orifices of the pipes in that position would have a tendency to move the vessel forward, instead of pulling it downward as at present, and thus you would have the drawing force forwards to add to the propelling force behind, which, with the same expenditure of power, would produce a considerable increase in the speed of the vessel.—I am, Sir, yours, &c., WM. FREW.

6, Mill-street, Perth, March 10.

MESSRS. CARRETT AND MARSHALL'S PUMPING ENGINES.

SIR,—In your journal of the 21st February, 1868, wherein you give a large cut of our combined engines and pumps for waterworks and other purposes, for forcing any distance or height in one continuous stream, you state 35,000, which should be 350,000 gallons, two and a-half miles and 470ft. high in twenty-four hours.

CARRETT, MARSHALL, AND CO.

Sun Foundry, Leeds, March 10.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of 21s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—T. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—J. M.—T. C.—J. P. C.—G. J. C.—M. B.—T. F. C.—J. H. W.—W. N.—R. E. J.—T. M.—H. S.—T. B.—R. F.—F. W. P.—G. E. P.—J. W. M.—T. H.—R. I.—C. B.—W. F.—G. W. H.—J. L. N.—H. C.—J. L.—A. W.—J. N.—W. F.—W. H. H.—Messrs. E. and D.—R. G. S.—R. T.—W. L. W.—Messrs. K. and B.—J. C.—M. L.—Messrs. C. and M.—T. S.

Meetings for the Week.

MON.—Royal United Service Institution.—Captain J. B. O'Hea, late of the 25th Regiment, on "Cartridges for Breech-loading Small Arms, and the Best Form of Projectile," at 8.30 p.m.

Society of Engineers.—Mr. F. C. Danvers on "Engineering in India," at 7.30 p.m.

TUES.—Royal Institution.—Mr. George Scharf on "Historical Portraiture," at 3 p.m.

The Institution of Civil Engineers.—Continued discussion upon Mr. Sandberg's paper on "The Manufacture and Wear of Rails," at 8 p.m.

WED.—Society of Arts.—Mr. Robert F. Fairlie on "Railways and their Management," at 8 p.m.

THURS.—Royal Institution.—Mr. George Scharf, on "Historical Portraiture," at 3 p.m.

FRI.—Royal Institution.—Professor Matthiessen on "Alloys," at 8 p.m.

SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

Naval, Military, and Gunnery Items.

DURING 1867 the cost of the army in India was £12,889,898, showing a net increase of £351,273, arising from the increased pay to private soldiers.

A NEW code of storm signals is to be used at Calcutta, and the meteorological department in charge of them is to give timely notice of impending storms. Four jetties are to be erected along the Hoogly.

THE steam tug boat "Enterprize," blew up at Calcutta on January 31, killing five natives, mortally injuring seven others, and injuring two Europeans and some natives. The chief engineer, Mr. T. Newton, had a very narrow escape.

OFFICIAL information is given by the United States' Lighthouse Board of the re-establishment, on February 20 last, of the light at the southern extremity of Half-Moon Reef, in Matagorda Bay, Texas. The structure is of wood, painted white, upon an iron-pile foundation painted black. The illuminating apparatus is a lens of the sixth order, showing a fixed red light. The light is thirty-five feet above the sea level, and should be seen in clear weather at a distance of six miles.

THE "Eclipse," 6, screw sloop, 1,273 tons, 350-horse power, nominal, having been fitted with surface condenser engines, which were manufactured by Messrs. John Penn and Sons, of Greenwich, and exhibited at the late Paris Exhibition, recently got up steam at her moorings in the basin, and the engines were worked for five hours with very great success, there being an entire absence of hot bearings and priming. The revolutions were 84 a minute. She will shortly be taken on a trial at the measured mile.

WE, "Pall Mall Gazette," have reason to believe that the proposed scheme of army administrative reform, which has been for some time under consideration, will shortly be experimentally tried in action. It is understood that the scene of the first trial will be Ireland, where recent military experience has practically proved the necessity of a change of system, and where Lord Strathnairn, the president of the committee on this subject, will be enabled to superintend the experiment, and overcome any difficulties that may arise in person.

OFFICIAL information is also given by the same Board that, on and after February 22, 1868, there will be shown from a lighthouse recently erected on the east end of Combahee Banks, a fixed white light of the fifth order, illuminating the entire horizon, and should be seen in clear weather at a distance of eleven miles. The substructure is of iron screw-piles painted red. The superstructure is of wood, painted white, surmounted by a lantern painted black. A fog-bell is attached to this station, which will be sounded every ten seconds in foggy weather.

LORD STANLEY, having heard that a balloon had been employed in the course of the war in Paraguay by the allies, wrote out for any information which could be obtained respecting it. It appears that the balloon has been of service, but as it could not be used with long ropes held by soldiers it was difficult to turn it to good account. General Mitre wrote of it:—"My opinion on this subject is that the balloon may be often employed with advantage in war, and that if the one we have has not been of much service it is owing to our not having known how to make proper use of it." An engineer, who had gained experience in the United States, had made observations from the balloon.

THE trial of Major Palliser's 9-inch gun, which was exhibited last year at the Paris Exhibition, has just been concluded at Woolwich. Its test was as follows:—420 rounds of 43lb. of powder, 87 of 45lb., and 4 of 55lb. of powder, with 250lb. shot throughout; in all, 511 rounds. The vent remained serviceable to the end. The great mass of this gun is composed of cast iron, which is lined with two barrels of coiled wrought iron, one inside the other. A crack appeared at the muzzle portion of the inner barrel shortly after firing 200 rounds. This, however, produced no ill effect whatever. It was caused by the vibration of the barrel, which was accidentally loose in the muzzle. The gun was manufactured by the Elswick Ordnance Company, and remains practically uninjured. The successful result of this trial proves the soundness of the advice of the Ordnance Select Committee in having recommended Government to incur the expenditure upon it.

WHILE many have amused themselves with speculations about the cause of the late earthquakes and violent elemental disturbances in the West Indies, we are all likely to be made aware before long of some of their apparent results. Since these occurrences, says the "New York Times," the current of the Gulf Stream has been observed to have nearly doubled its velocity, not only increasing the dangers of navigation among the islands and off the Florida Keys, even for steam vessels, but awakening apprehensions of still greater and more important general changes. The climatic effect of this huge hot water stream along the North European and American coasts is rarely realized. But the fact that the British Isles are in the same latitude with icy Labrador, will show what it does for our cousins, and suggest what terrible changes might be brought about by a shift in the direction of its current—which might as easily take place as increase of its velocity.

Miscellanea.

THE number of visitors at the Patent Office, South Kensington, for the week ending March 7, was 3,291; total number since the opening of the museum, free daily (May 12, 1858), 1,256,889.

THE number of Cornish pumping-engines reported for January last is twenty-three. They have consumed 1,665 tons of coal, and lifted 130 million tons of water 10fms. high. The average duty of the whole is, therefore, 53,200,000lb., lifted one foot high, by the consumption of 112lb. of coal.

LAST week, in a field near Mold, in Flintshire, forty-four teams met to compete for the honours of the day. Among the competitors was Messrs. Ransomes' champion ploughman from Ipswich; the Welshmen, however, beat this formidable opponent, and carried off the first six prizes with the ordinary ploughs of the district.

THE building-up of the Universal Exhibition was peculiarly exempt from accident; its pulling down has been less auspicious. The other day part of one of the external walls fell, crushing beneath its ruins two workmen. Their comrades lost no time in digging out their bodies. One was quite dead, but there are hopes for his unfortunate companion.

ACCORDING to the last accounts from America, new gold fields have been discovered at a locality on the Rocky Mountains, at Sweetwater, in Dacota, fifty miles from Omaha, within 100 miles of the route to be traversed by the Union Pacific Railroad, which in extent and richness, and facilities for working, are likely to surpass any yet opened up.

THE "German Petersburg Gazette" announces that a large railway company has accepted the Government terms for the sale of the Nicolai line, under reserve of the consent of a general meeting of shareholders about to be called. The contract entered into by the Government with an American firm for the supply of working material is to remain in force.

THE Duke of Sutherland attended on Thursday week, with Captain Shaw, and several members of the Board of Works, at the Thames Embankment, at the bottom of Norfolk-street, Strand, to witness the grand inspection of engines and firemen of the Metropolitan Brigade. The two floating steamers and four land steamers, with several manual engines, were tried, and two fire escapes. The whole of the machinery was pronounced perfect, and the officers and men were highly complimented for the efficient manner in which they directed the water from the engines.

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THE visitors to the South Kensington Museum during the week ending March 7, were:—On Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 9,376; on Wednesday, Thursday, and Friday (admission, 6d.), from 10 a.m. till 5 p.m., 1,460—total, 10,836. Average of corresponding week in former years, 10,344. Total from the opening of the museum, 7,230,864.

THE "Hanover Gazette" announces the establishment, on the railways of North Germany, of fourth-class carriages. These, which will serve to carry ordinary travellers, are at the same time organized so as to transport wounded soldiers. For this purpose hammocks will be suspended in each carriage, in which the sufferers will be laid full length and protected against all shocks.

A MARBLE statue of Charles II. is now placed in Westminster Hall, which completes the number of statues intended to be placed there for the present, viz., Charles I., Charles II., James I., William III., George IV., and William IV. The first of a series of cartoons is now placed between the statues, representing the death of Richard III., and the crowning of the Duke of Richmond.

ACCOUNTS from Alexandria make mention of two smart shocks of an earthquake having been felt there on the 19th of February at midnight. No damage was done. It was blowing hard at the time. The Peninsular and Oriental Company's steamer "Ripon" was detained for two days outside, being unable to enter on account of the weather. Some persons in Malta say they felt a slight shock on the same night.

AT the last meeting of the Royal Geological Society, the following gentlemen were elected fellows:—Chisholm Anstey, Esq.; George Bentley, Esq.; William Bull, Esq., F.L.S.; W. H. Cole, Esq; Frederick Dutton, Esq.; R. G. E. Dalrymple, Esq.; Major Goldsworthy; Hugh Jamieson, Esq.; the Right Hon. Earl of Kellie; W. W. Lane, Esq., B.A.; Major G. D. Pritchard, R.E.; W. B. Watson, Esq.; and W. C. Wentworth, Esq.

THE "Indian Daily News" describes a tea leaf rolling machine, which consists of one or more discs rotated horizontally over a surface on which the leaves are placed. This surface, which represents regular lineal indentations, is covered over with fine matting, and its relative distance from the revolving disc is under control. The latter is bound with a loose rim, which adjusts itself to the space between the disc and the lower surface, and thus imprisons the leaves whilst being rolled.

AT the fifth general meeting of the eleventh session of the Institution of Engineers in Scotland, Mr. Jas. M. Gale, C.E., President, in the chair, the following candidates for admission to the Institution were elected:—As members, Mr. D. G. Morrison, engineer, Elliot Works, Glasgow; Mr. Alexander Morton, engineer, Albert Works, Glasgow; Mr. Edward M. Bell, manager, Tinplate Works, Coatbridge; Mr. James Thomson, jun., mechanical engineer, 13, Royal-crescent; Mr. Jas. Hall, mechanical engineer, Clutha Ironworks, Glasgow.

A CONSIDERABLE quantity of foreign gold coins of the sixteenth century has just been found in the neighbourhood of Napoleon-Vendee, the value being estimated at 30,000f. The larger part of them bear the name of Phillip II. of Spain and other Spanish monarchs, and are not difficult to obtain. There are, however, two which are comparatively rare—a gold crown of Charles III. of Savoy, called the Good, struck in 1543 during the siege of Nice, and another of Cardinal Charles de Bourbon, then Legate of Pius V. at Avignon. From the fact that none of the pieces is of later date than 1571, and that all come from Catholic countries, the deposit is supposed to have had its origin in a Spanish subsidy furnished during the wars of religion.

FOUR companies share the work of cleaning the streets of Paris, the contracts for it being obtained on sealed tender. The persons employed are divided into street-sweepers of the first and second classes, with auxiliaries, men and women. The total number in the service is about 6,000. This little army of labourers is paid, not by the day, but by the hour. The sweepers of the first class receive 38 centimes, and those of the second 29; the male auxiliaries, 25; and the female, 20. As the work is ten hours daily, summer as well as winter, the wages of the men amount to 2f. 50c., and the women to 2f. Nearly all these labourers, of both sexes, come from Alsace, Rhenish Prussia, the Grand Duchy of Baden, and Luxemburg, but chiefly from the latter.

THE North-Eastern Railway Company have set resolutely about the replacement of the whole of their numerous wooden viaducts with stone and iron, and in some places with solid embankments. Upwards of £67,000 have been spent in this way during the past five years, and it is estimated that the work yet to be done will cost £110,000 more in the next six years. The Hutton, Malton, and Whitby viaducts have been completed, the Ripon is in progress, and the Norton is being filled up. The Ouseburn viaduct will be next taken, after which the remaining works of magnitude will be the Esk Valley viaducts (two), and the Scotswood, Willington, Cassop, and Bradbury viaducts. The whole of the wooden bridges, however, cannot be finished till six years hence, and it is proposed to expend yearly a sum of about £20,000 until completion.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—2268, 2294, 2312, 2313, 2324
BUILDINGS AND BUILDING MATERIALS—None.
CHEMISTRY AND PHOTOGRAPHY—2270, 2305, 2314
CULTIVATION OF THE SOIL, including agricultural implements and machines—2272, 2291, 2215
ELECTRICAL APPARATUS—2307
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2269, 2281, 2299, 2302, 2306, 2323, 2325, 2333, 2336
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—2319, 2329
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—2298, 2311, 2338, 2342
GENERAL MACHINERY—2275, 2278, 2283, 2288, 2289, 2290, 2296, 2310, 2316, 2332, 2334
LIGHTING, HEATING, AND VENTILATING—2320
METALS, including apparatus for their manufacture—2282, 2285, 2292, 2308, 2337
MISCELLANEOUS—2271, 2273, 2274, 2276, 2280, 2286, 2293, 2295, 2297, 2301, 2303, 2304, 2309, 2317, 2321, 2326, 2327, 2330, 2331, 2339, 2340
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2341
SHIPS AND BOATS, including their fittings—2287
STEAM ENGINES—2284, 2300
WARFARE—2277, 2318, 2328, 2335, 2343

2266 J. LOCKWOOD. *Improvements in steam boiler and other furnaces.* Dated August 5, 1867.

This invention consists in the application of a partition longitudinally of the furnace, constructed of fire-clay, common clay, &c., and either with or without openings through it, thus dividing the furnace into compartments longitudinally, which may be fired or fed with fuel alternately, so that while the smoke or unconsumed products of combustion are issuing from one compartment, the heat from the incandescent fuel of the other part will ignite the same.—Patent abandoned.

2267 T. WHITTAKER and M. ROURKE. *Certain improvements in the preparation of waterproof paper.* Dated August 6, 1867.

This invention consists in submitting long or continuous lengths of paper to a process of oiling, pitching, tarring, or waterproofing liquid, whereby both sides become covered simultaneously with the waterproofing material, instead of and in contra distinction to treating paper in small pieces, and on one side only, as hitherto. In the process of oiling or waterproofing, the roll of paper is mounted in bearings and as it unrolls it passes beneath a guide roller submerged in a receptacle containing boiled oil, or similar liquid, by which means both sides are covered and the paper becomes saturated; it then passes between squeezing rollers, or between blades called "doctors," and on to hot cylinders, or into a heated chamber, or is otherwise dried.—Patent completed.

2268 J. BOLLAND. *Improvements in furnaces for steam boilers and other purposes.* Dated August 6, 1867.

In performing this invention the inventor makes the dead plate hollow, or with an air chamber below, into which air is conveyed from two pipes passing under the fire-grate; the air becomes heated in passing through these pipes, and in the air chamber, and then it enters an arched air chamber with perforations on the inside, and towards the fire-grate surrounding the fire-door; there are sliding dampers or other equivalents between the dead plate and the arched air chamber to shut off the communication between them when required. The firing door is hollow, and the inner partition is perforated to allow the air entering from the air chamber in the dead plate to pass over the fire-grate, and these perforations in the firing door can be opened or closed by a sliding plate, the spindle of which passes through the front of the firing door. The grate bars are made as usual, but the fire-grate is divided into two parts by a midfeather made of a perforated bent plate reaching from the bridge to within about twelve inches from the dead plate. There is a swivel damper near the bridge to open and close the orifices to the main flue alternately, and there is another damper in the main flue which is connected by levers and rod to the firing door, so that when the door is opened for admitting fuel, this damper is closed to prevent the cold air passing into the flues. The two portions of the fire-grate are fired alternately, and when fresh fuel is applied to one side of the grate, the swivel damper of that side is closed, and the smoke is then conveyed around the front end of the midfeather to the other portion of the fire grate, which is then at a red heat, and when fuel is put on the fire that had been red, the position of the swivel damper is reversed, and the smoke is carried over the other fire which has then burnt bright.—Patent abandoned.

2269 A. M. CLARK. *Improvements in reeds for weaving.* (A communication.) Dated August 6, 1867.

According to these improvements all the requisite strength and regularity is retained in the reed, while, at the same time, each tooth possesses such flexibility and elasticity as to permit of the passage of threads of varying thickness, or otherwise imperfect, after which they immediately resume their original position. The teeth of this reed are united at one end by the ordinary process of tying and soldering, while at the other end they are simply received in a grooved sheath without soldering, and without tying, if needed, the space between each tooth being obtained by means of plates threaded on a uniting rod.—Patent abandoned.

2270 T. LUTHRINGER. *A new colouring matter called Geranosine.* Dated August 6, 1867.

The patentee claims, first, the production of this new colouring matter by re-acting on the fuchsine dissolved in water or diluted alcohol by oxygen contained in bi-oxide of hydrogen, or oxygenated water, in co-operation with the mineral or vegetable acids and the action of heat. Second, the above described process for the manufacture and preparations of this colouring matter. Third, its application, industry, and more especially to the colouring, by dyeing or printing of textile fabrics, such as silk, wool, cotton, and thread, and also of paper, feathers, skins, and other materials.—Patent completed.

2271 E. J. W. PARNACOTT. *An improved construction of trenail.* Dated August 6, 1867.

The patentee claims forming trenails with a cutting edge, and capable of receiving a lateral expansion, in the manner and for the purpose described.—Patent completed.

2272 H. H. MURDOCH. *Improvements in means or apparatus for sorting, screening, and classifying corn, seeds, flour, or other substances which it may be desirable to classify.* (A communication.) Dated August 6, 1867.

This invention consists in arranging and combining a series of concentric cylindrical sieves or screens of different diameters one within the other, each sieve or screen having apertures, holes, or meshes of a different size, those of the inner screen being largest, and those of the outer screen smallest, so that the corn, &c., being fed into the inner screen, and rotary motion being communicated to the series of screens, the meshes or apertures in the inner screen will arrest the largest grains or pieces, and the remainder of the corn, &c., will fall through to the second screen, where, again, the largest grains or pieces will be arrested, the remainder passing through to the third screen.—Patent abandoned.

2273 F. RYLAND. *Improvements in pulleys for suspending window frames, and for other like purposes.* Dated August 6, 1867.

This invention consists of improvements in that part of pulleys for suspending window frames, &c., called the mortice plate. The patentee makes the mortice plate with semicircular ends, and he makes in the centres of the semicircular ends the holes through which the screws are passed to secure the mortice plate in the mortice of the window-frame or other article. He also makes the opening in the mortice plate in which the bowl or wheel of the pulley works with semicircular ends.—Patent completed.

2274 M. JONES. *Improvements in kitchen ranges.* Dated August 6, 1867.

The patentee claims constructing and arranging the flues of the top and bottom ovens of kitchen ranges, and combining the said flues with independent vertical back flues, substantially as described, whereby one or other or both of the ovens may be heated at pleasure, and the quantity of heated air circulating about them regulated.—Patent completed.

2275 E. CORNELY. *Improvements in sewing machines* Dated August 7, 1867.

The patentee claims, first, the combination with the revolving looper of the "Willcox and Gibbs" machine of an auxiliary looper under the arrangement described, whereby a "Willcox and Gibbs" machine, without changing its functions as a single thread machine, may be used as a double thread machine, substantially as described. Second, operating the reciprocating auxiliary looper by a circular excentric, substantially as set forth. Third, the combination of the oscillating lever which drives the reciprocating looper with the pitman and its extension, substantially as described. Fourth, the combination of the driving mechanism of the reciprocating looper with the driving mechanism of the rotary looper, and of the needle, by a reciprocating lever receiving its movement by an oblique pin on the connecting rod of the excentric of the main shaft, substantially as described. Fifth, in combination with the lever for driving the reciprocating looper the coupling and uncoupling device, substantially as set forth.—Patent completed.

2276 C. M'DERMOTT. *An eyelet and paper fastener combined.* (A communication.) Dated August 7, 1867.

This invention consists in forming a paper fastener with an eyelet by means of which a hole will be secured through such masses of paper as it is desired to bind together, and through which eyelet or hole tape may be passed for further securing the papers and affording means for the application of seals, legal or other. Also for the threading many separate packages of paper together.—Patent completed.

2277 A. J. PATERSON. *Improvements in cartridges and fire-arms.* Dated August 7, 1867.

The specification of this invention is too elaborate to be quoted here at sufficient length for an intelligible abstract. The invention will probably be described and illustrated in a future number of this journal.—Patent completed.

2278 F. C. MARSHALL and H. STEWART. *Improvements in machinery or apparatus for raising or forcing water or other fluids, and for the transmission of the motive power of water, steam, or other fluid or gases.* Dated August 7, 1867.

This invention is not described apart from the drawings.—Patent completed.

2279 R. H. MICHELL. *Improvements in dredging machinery, and apparatus or appliances for the stowage and discharge of substances dredged up, the said apparatus or appliances being applicable to lighters, barges, or vessels used for other purposes.* Dated August 7, 1867.

This invention consists in the following arrangements:—The patentee makes the upper tumbler or roller over which the buckets pass, and by which the bucket chain is driven, capable of being raised or lowered, so that dredging may be effected in deeper water, and higher barges may be loaded than without such an arrangement. Also he makes the upper tumbler with the ladder frame capable of being lowered to the deck when the vessel is going to sea, so that top weight may be done away with. We cannot here devote space to the details of this invention.—Patent completed.

2280 M. HAMER. *Improvements in machinery for india-rubber thread cutting.* Dated August 7, 1867.

This invention relates to those machines in which the india-rubber is caused to revolve while a cutting tool advances, retreats, and is traversed so as to sever successive strips of the material, and consists, first, in causing

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the said cutter to advance at an accelerated speed. Second, in an arrangement of self-acting apparatus for causing the cutter to traverse for successive cuts. Third, in a method of adapting the cutter for different thicknesses of material. The invention cannot be described in detail without reference to the drawings.—Patent completed.

2281 T. S. CRESSEY and J. WEBB. *Improvements in apparatus for shrinking cloth.* Dated August 7, 1867.

The apparatus here employed consists of a rectangular trough of tinned iron, &c., and of a wooden box of the same length and breadth, and having a grated bottom and a close-fitting lid. The bottom of the box is fitted into the top of the metal trough, and they are fixed together. The cloth is wound tightly on a roller; it is laid upon the grated bottom of the box, and the cover is put on. The water is then boiled by a gas burner, or a small fire-grate erected under the trough, and the process is continued until the moisture has saturated the roll; or steam from a separate steam boiler may be led into the trough. The cloth, being tightly rolled up is compelled to contract uniformly as it shrinks under the influence of the moisture and heat.—Patent completed.

2282 E. T. HORSLEY. *Improvements in treating cast iron.* Dated August 7, 1867.

The object the patentee wishes to attain is, by fluxing and purifying the cast iron whilst in a state of fusion, either as it runs from the blast furnace or from other smelting furnaces, to convert it into a clear and hard substance for the casting of steam and other cylinders, and for bearings, retorts, and other articles, and to produce iron more convertible into steel, and for making steel. He attains these ends by the use of borates of the fixed alkalies (or alkaline earths), or mixtures of the same, with the alkalies, alkaline earths, or other carbonates, or mixtures of boracic acid with the alkalies, alkaline earths, or such of their salts as when heated with boracic acid yield fusible borates. He works with or without a current of electricity from a battery.—Patent completed.

2283 J. P. BINNS. *Improvements in machinery for the manufacture of paper bags.* Dated August 7, 1867.

This invention has reference to a former patent, dated August 18, 1866 (No. 2129), and the specification is too elaborate to be quoted here sufficiently in detail for an intelligible abstract.—Patent abandoned.

2284 G. HOLCROFT and W. N. DACK. *Certain improvements in steam engines.* Dated August 8, 1867.

The first part of this invention relates to an improved expansion gear for cutting off the steam in proportion to the load. The second part consists in placing a circular or segmental expansion valve within the steam valve; and the third relates to the governor by which the variations in the speed of the engine are made to act on the expansion gear above referred to, or on the steam or throttle valve. The expansion valve is moved to and fro, on and by the slide valve, and the traverse of the expansion valve is regulated by bushes through which the spindle or coupling rod of the expansion valve passes. One of these bushes has a right and the other has a left-hand thread; these bushes are screwed into the boss of a pinion, into which a rack moved to and fro by the governor gears; by this arrangement any variation in the speed of the engine causes the bushes to approach or recede from each other; consequently, the bushes act sooner or later on shoulders on the expansion valve spindle or coupling rod, and thus vary the cut-off of the steam in the proportion required. The improvement in governors consists in the combination of a weight to counterbalance the centrifugal force of the balls with arms crossing each other, and suspended to centres above the point of intersection of the arms.—Patent abandoned.

2285 A. M. CLARK. *An improved metallic alloy, and in the application of the same.* (A communication.) Dated August 8, 1867.

The patentee claims the composition of the improved alloys, to which he gives the name "minargent," the chief features being, first, the introduction of pure tungsten and pure aluminium in the alloys, as described. Second, alloying the considerable proportion of nickel, notwithstanding its known anti-affinity to aluminium. He does not confine himself to the exact proportions of each of the component parts of the alloys.—Patent completed.

2286 C. BENSON and J. BARKER. *Improvements in apparatus for preparing moulds for the casting of pipes, culinders, pillars, rollers, and other forms.* Dated August 8, 1867.

Here the model of the intended pipe, &c., is supported horizontally upon movable and adjustable bearings, by which it may be moved up so as to bear on the opposite surfaces of the mould, leaving only so much of it above the table as may be required for the time to be moulded. The parts of this table are capable of sliding horizontally on guides, and they are moved to and fro by hand, or by screws or racks and pinions, or by other suitable means, so that they may be adjustable for receiving between them models of different sizes. The parts of the table are provided with recesses or openings through which may rise guides, operated by racks and pinions, or otherwise, to retain the mould boxes in position; or such or other recesses or openings may serve to receive parts of the mould boxes. The guides may be held in position when raised by pins or studs. When the desired model has been placed in position between the parts of the table, the parts of the table are slidden close up to it; the mould box is then placed in position on the table, and the sand is rammed in the ordinary way. When this has been done to the extent desired, the model is allowed to drop from the sand by actuating excentric or other motion to the bearing of it. The box may then be turned over, when it will have the mould of the part of the model which projected above the surface of the table formed in it.—Patent completed.

2287 H. W. WITHERS. *Improvements in the construction of boats.* Dated August 8, 1867.

This invention consists in forming externally in each side of the boat a longitudinal recess of curved form, and in fitting in each recess a hollow cylindrical structure, or a corresponding solid structure, of cork or other sufficiently buoyant material. When the boat is stowed away, these structures fit into the recesses, and then form part of the ordinary contour of the boat; but when the boat is required for use, and lowered into the water, and more carrying power is required, they are turned upon their centres, so as to extend out from the sides of the boat, and thus give additional bearing or surface, whereby the buoyancy and lateral stability of the boat are greatly increased. The structures are narrowed towards their ends, so as not to interfere with the way of the boat.—Patent completed.

2288 F. WIRTH. *An improved machine for stamping letters.* (A communication.) Dated August 8, 1867.

This machine has a roller for the letters to rest on, and the roller has pins or claws arranged to project through its surface, and take hold of each of the letters lying thereon. These claws bring the letters into the proper position for another roller with gutta-percha guide wheels to seize and press them against the first roller, while the stamps which are carried by the second roller are printed distinctly on the said letters. This is done, however, without stopping the downward movement of the letters, which are guided by conducting bands into a box, where they arrange themselves in the order in which they enter the machine. In proportion as this box is filled with the letters it is moved on rails by means of an excentric pusher, and a rack, so that the box is emptied as fast as it is filled.—Patent completed.

2289 J. E. F. LUDEKE. *Improvements in apparatus for obtaining motive power, and for raising and forcing water and fluids.* Dated August 8, 1867.

Here the inventor constructs an apparatus consisting of two cones, each mounted on an axis turning in suitable bearings, and so arranged that the cones are in contact apex to apex, and along a straight line connecting the apex and base of each cone. These cones are combined with a close casing so that their bases form portions of two opposite sides of the casing, and the interior of the casing is divided into two chambers; the division on one side is formed by the line of contact between the cones, and on the other by a plane surface or wing fixed to the side of one of the cones in a radial position. The edge of this plane enters a groove cut to receive it in the face of the other cone. The two chambers into which the casing is thus divided are filled with water or liquid, and by suitable passages put in communication with the two ends of a cylinder, also filled with liquid, and having a piston working within it. Then, if motion be imparted to the axes of the cones first in one direction and then in the other, causing them to work through a small arc, a movement will be imparted to the piston and piston rod up and down, and after the first impulse is withdrawn, these motions will continue for an indefinite time, and if the piston rod be suitably connected with machinery it will drive it continuously.—Patent abandoned.

2290 W. R. LAKE. *Improvements in printing presses.* (A communication.) Dated August 8, 1867.

This invention relates to a printing press with a rotating or vibrating impression cylinder or platten, and a similarly operating type-cylinder or bed, with a straight "forme," and the improvements consist, partly, in the peculiar construction of the impression surface of the platten, and in the mode of gearing the same in connection with the type-cylinder, in order to cause the platten and cylinder to operate together to produce the required impressions upon the sheets of paper or other material introduced between them. The details of the invention are voluminous.—Patent abandoned.

2291 T. J. BAKER. *Improvements in the manufacture of wheat and other grain into flour, and in machinery connected therewith.* Dated August 9, 1867.

The patentee claims, first, the use of the fan described and shown, by which air is thrown into the millstone case, and kept at a pressure, and is also caused to partake of the rotation of the stone for cooling the stones, and keeping the metal and millstone case relatively dry. Second, the apparatus described and shown by which the material injected into the millstone case, both by the stones and fan, is divided into two separate streams issuing from the millstone case by two separate ducts, one above the line of the flotation of the dust and meal, and entirely free therefrom, the other mingled with the meal and the products of the grinding through the meal escape, and the apparatus by which such division is effected and adjusted. Third, the recess described and shown into which the air and products of the grinding are thrown, and in which a final separation is effected between the meal and dust and the air, and other gaseous matter, the latter being permitted a free escape upwards, whilst the meal and dust are detained by brushes and contractions so far as to prevent the escape of air downwards. He also claims the throwing of the upper current into the recess at a point at which it can aid in preventing the upward escape of dust or meal, as described and shown. Fourth, he claims the mode of balancing the running stone described and shown, and any modification of the same.—Patent completed.

2292 W. R. DAWSON. *Improvements in smelting titaniferous iron sands.* Dated August 9, 1867.

The patentee claims the use of sawdust or wood in small pieces or particles, either with or without small coal, in, or about in, the proportions stated, for preparing titaniferous iron sands for smelting, as described.—Patent completed.

2293 F. J. SEYMOUR. *An improved case or box for holding twine or cord.* Dated August 9, 1867.

The patentee claims a case or box for holding twine or cord constructed to be suspended from any suitable support, and provided with a brake to prevent the running out or unwinding of the twine or cord by its own weight, as described.—Patent completed.

2294 H. A. AVERY and G. PENABERT. *The application of a certain vegetable powder for removing and preventing incrustations in boilers.* Dated August 9, 1867.

This invention consists in applying a vegetable powder, found chiefly in Central America, and formed of the debris of a ligneous plant. It decomposes the calcareous parts of the water before they take effect, and thereby prevents incrustation.—Patent completed.

2295 W. J. MILLER. *Improvements in table knives and forks.* (Partly a communication.) Dated August 9, 1867.

This invention consists, first, in attaching the blades of table knives to their handles by means of a bolster formed of two parallel plates, between which the end of the ivory or other handle is inserted, the bolster being secured to the handle by rivets passing through the handle from one plate of the bolster to the other. Second, in making the bolsters of table knives of German silver, or some other hard metal or alloy other than iron or steel, and attaching the bolsters to the steel blades by brazing or hard soldering. Third, in improvements in the manufacture of metallic handles for table knives and forks.—Patent abandoned.

2296 R. HEATHFIELD. *Improvements in machinery for the manufacture of cut nails.* (A communication.) Dated August 9, 1867.

This invention relates to the "feeder," which consists of a tube slightly inclined, the end nearest the cutter being lower than the other end. Through this tube the strip of metal from which the nails are to be cut is passed, and to the tube an alternating motion of partial rotation is given in the ordinary way. To the end of the tube, and on one side thereof, an arm is fixed, parallel to the axis of the tube. The extreme or free end of this arm is bent at right angles, and has a slot or opening made in it, through which slot or opening the strip of metal passes. The outer end of the tube, or the end most distant from the cutter, is supported in a bearing which allows the tube a slight motion in a vertical plane. The inner end of the tube is pressed upon by a spring, the end of the spring being formed into a clip or bearing. The action of the feeder is as follows:—The strip of metal fed through the tube and slot, or opening in the arm, is urged forward towards the cutter in the usual manner; after one nail has been cut from the strip, the tube performs a semi-rotation, the end of the arm bearing on the bed of the machine, and constituting an oscillating centre about which the rotary motion is performed. The inner end of the tube, together with the arm and strip, consequently rise and fall in a vertical plane during the semi-rotation of the tube, the tube and arm being pressed down to the bed plate, and lateral motion in them prevented by the spring described. The action of the feeder is, after each nail has been cut from the end of the strip, to turn the strip at the same time, slightly raising it, and bringing it down again in the same position upon the bed plate, the motions being very similar to those effected by the human hand in hand-fed nail cutting machines.—Patent completed.

2297 C. HOHGREFE. *Improvements in apparatus to be applied to chimney tops.* Dated August 9, 1867.

Here the patentee employs a series of funnel-shaped rings having an inner diameter corresponding with the width of the chimney. These rings are fixed horizontally, and one above the other, with their mouths downwards, and with spaces between them. Their surfaces are curved so that the wind blowing against them horizontally becomes deflected upwards in a vertical direction, and the ascending current of air so obtained tends to draw the smoke out of the chimney.—Patent completed.

2298 H. A. BONNEVILLE. *Improvements in stringed instruments having sound boards.* (A communication.) Dated August 10, 1867.

This invention relates to the just equipoising of the resistance with the power in stringed instruments having sound boards, and more particularly in pianos, by using the same metal, so that the expansion and contraction is the same, from which results the more perfect maintenance in tune of the instrument, and a greater sonority, and consists in connecting the board which carries the pegs of the strings, which are made of wire, with that to which the said strings are fixed by forged iron bars bound together by iron connecting rods to prevent their going apart.—Patent abandoned.

2299 H. B. BARLOW. *Improvements in doubling and winding machines.* (A communication.) Dated August 10, 1867.

The patentee claims all the particular and general arrangements of the machine, and especially the use of a single instrument which, bearing both bobbin and stop motion, places them at the same time out of the reach of the moving power when a thread breaks. Also the means of stopping the bobbin instantly, and allowing the bobbin to be moved round at liberty on its axis when this motion is at the end of its course. Also the self-acting arrangement of parts described, or any equivalent system, of lifting the bobbins and disengaging the balanced catches to place them more within the reach of the attendant. Also the particular arrangement of a piece serving at once as bracket, the various parts as a stop-piece for the bobbin, and stop-piece for the counter weight of the self-acting lifter, and as inclined plane to isolate the bobbin at the end of the motion, which causes its rotation to stop.—Patent completed.

2300 J. DAVENPORT and J. KITSON. *Improvements in, or applicable to, slide valves for admitting the flow or passage of steam, water, or other fluids and gases when pressed.* Dated August 10, 1867.

This invention consists in so constructing and arranging slide valves that an equal amount of pressure will be applied to the face as to the back part of the valve; consequently, it will be in equilibrium at all times when in action, thus removing or preventing friction on the sliding surfaces. For this purpose a frame or back plate is applied to the back of the valve, which is kept in position by projections passing through an opening or openings in the ordinary cover of the valve box to about flush with its outer surface, and a flexible plate is placed over the same which overlaps the projections; also an additional cover is applied having recesses formed therein of greater areas than the areas of the steam and exhaust ports, with communicating passages through the said projections of the back plate, where other recesses are formed of equal areas to the areas of the steam and exhaust ports; and passages are also formed through the valve, so that the steam, water, or other pressed media will exert equal pressure on all sides of these parts, while the flexible plate allows for variations of expansion and contraction of the metal.—Patent completed.

2301 E. NEWBY. *Improvements in shackles or joining links.* Dated August 10, 1867.

Here the inventor so forms the iron or metal of which the joining link is made that either one of its two segments will exactly coincide and be identical in its form with the other. He employs a through pin or key which is capable of being riveted at each of its ends, thus securing them firmly together, and preventing them moving in a lateral direction or opening.—Patent abandoned.

2302 G. HODGSON. *Improvements in looms for weaving, and in apparatus for the manufacture of parts of such looms.* Dated August 10, 1867.

The first part of these improvements relates to means for effecting variation in the order of picking, particularly adapted to the use of rotary shuttle boxes. According to one arrangement the picking tappets, whilst they are controlled to revolve in the motion of the loom, are yet capable of sliding endwise on their shaft, so that either may be in position to act on its bowl or wiper arm from a picking shaft, or be out of the way to miss them, whereby several successive picks may be effected from either end of the loom, or the picks may follow each other alternately from one and then the opposite end of the loom. The improvements relate, second, to when successive picks of weft are capable of being effected from the same

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side of the loom, or what is called "pick and pick," to means by which successive wefts may be lifted out of the way of the fork or feeler just before the throwing in of weft from the opposite side or selvage of the loom.—Patent completed.

2303 A. M. CLARK. *Improvements in refrigerating apparatus applicable for the manufacture of ice and for other refrigerating purposes.* (A communication.) Dated August 10, 1867.

This invention is not described apart from the drawings. —Patent completed.

2304 G. WARSOP. *Improvements in apparatus for cleaning windows.* Dated August 10, 1867.

The main object here is to enable persons to clean the outside of a window from the interior of the room. The patentee employs a frame which clamps on to the window sill or ledge, and on this frame he mounts a horizontal axis perpendicular to the plane of the window. This axis carries a stud on one side, on which a lever is mounted; it has a handle on its inner end, and at its outer end a socket is carried on spindles parallel to the stud on which this lever turns. Into this socket there is fitted a long rod, having at its upper end a brush and rubber for cleaning the window. By means of a spring this rod is drawn inwards, so as to cause the brush or rubber at its end to press against the outer surface of the window. Then, by working the handle up and down whilst the horizontal axis is caused to rock, the brush or rubber may be moved over every part of the surface of the window. The horizontal axis may be controlled either by a handle upon it, or by grasping and guiding the cleaning rod on the outside of the window. Any convenient form of brush may be fitted to the upper end of the cleaning rod; it is made removable at pleasure, and the rubber he employs consists of a palm or flat surface of rectangular form, with a projection at the back, which is jointed to the upper end of the rod, and the joint is so formed as to allow sufficient freedom to the palm or surface to turn every way, so that it may at all times rest flat against the glass, and also that its angles may be able to enter the corners of the window panes; where the surface of the window glass is curved the palm should be curved to correspond.—Patent completed.

2305 R. GIRDWOOD. *An improved composition to be applied to sheep and other animals for the purposes of destroying vermin and parasitical life thereon and for protecting them therefrom.* Dated August 10, 1867.

The patentee claims the compounding or mixing together of an oil or oils obtained from tar or resin, and an alkaline lye to form a dip or composition to be applied to sheep and other animals, as described.—Patent completed.

2306 R. EDMONDSON. *Improvements in the construction and manufacture, and in tools for the manufacture, of pickers used in looms for weaving.* Dated August 10, 1867.

The patentee claims, first, the construction of the entire frame of the picker of malleable cast iron in one piece, having the barrel part filled with bushes of buffalo hide, &c., to work upon the spindle, and with a receptacle for buffalo hide, &c., to act against the tip of the shuttle, substantially as described. Second, the mode of securing bushes of buffalo hide or similar suitable material into the barrel part of metal pickers by screw threads, or by expanding each end of a tube of buffalo hide, substantially as described. Third, the mode of folding, applying, and securing a piece of buffalo hide into a receptacle in a metal picker frame to act upon the tip of the shuttle, substantially as described. Fourth, the mechanism for screw tapping metal pickers, the method and tools for forming screwed bushes of buffalo hide, and the tools and system or method of swelling or spreading over the ends of a piece of buffalo hide which acts against the tip of the shuttle to secure it in the receptacle in the picker frame. —Patent completed.

2307 F. H. HOLMES. *Improvements in apparatus for the production of the electric light.* Dated August 10, 1867.

This invention has for its object the production of electric light by the aid of an electro-magnetic machine, so constructed and arranged that a lower speed of rotation to that hitherto required will suffice to produce the desired intensity of light.—Patent completed.

2308 C. D. ABEL. *An improved method or process for removing sulphur, phosphorus, and other impurities, from iron, steel, and other metals.* (A communication.) Dated August 12, 1867.

This invention consists in removing the sulphur, phosphorous, and other impurities from iron and steel during their manufacture by what is known as the "Bessemer" or pneumatic process, by introducing into the converting vessel carbonic acid gas either subsequent to the introduction of the air blast, or in combination therewith.— Patent completed.

2309 E. MOUNIER. *Improvements in penholders.* Dated August 12, 1867.

This invention relates to pen and ink holding penholders. The handle is in two parts, screwed together, the upper one serving as a reservoir, the lower part bearing the pen being furnished with a spring, the bottom of which terminates in a small flat plate for closing or opening the bottom of the holder, and allowing or intercepting the passage of ink. There are various details given in the specification which we cannot with advantage produce here.—Patent abandoned.

2310 E. COURTIS. *Improvements in the construction of machines for splitting, or for splitting and cutting, sarsaparilla, and other woody or vegetable fibrous substances.* (A communication.) Dated August 12, 1867.

This invention consists, first, in the application to machines for splitting or for splitting and cutting sarsaparilla, and other woody or vegetable fibrous substances, of a pair of elastic rollers of peculiar construction, whereby pieces of various size of the substance to be split may be introduced between the said rollers at the same time, and by them be presented to the splitting knife placed behind them, in such manner that, notwithstanding the variety of sizes in the pieces of the substance, the said knife shall operate to split them more nearly into two equal parts than has heretofore been possible by the use of ordinary rollers. Second, in the application to such machines of a pair of drawing rollers placed behind the above-mentioned elastic rollers, and between the splitting knife and transverse cutting apparatus where such is employed. The object of the drawing rollers is to assist the before-mentioned elastic rollers in pressing the substance against the edge of the splitting knife by gripping between them that portion thereof which has already been split, and by their revolution to draw it over the knife blade in conjunction with the pushing action of the elastic rollers, at the same time presenting the split portions to the action of a rotary or other cutter by which they are cut to the desired length. —Patent completed.

2311 A. TURNER and W. HEMSLEY. *Improvements in the manufactory of gloves, underhirts, drawers, socks, stockings, and other articles of clothing which are usually made from knitted or looped fabrics.* Dated August 12, 1867.

The object of this invention is to adapt and apply a woven fabric for manufacturing the articles of clothing above mentioned. The patentee claims, first, producing the above-named articles from woven fabrics in the manner set forth, instead of from knitted or looped fabrics, as has heretofore been the case. They claim, particularly, producing the said articles with the required degree of elasticity by cutting up a woven fabric diagonally, or (if from a tubular fabric), helically, so as to cause the warp and weft thread to run in diagonal directions across the article, as in fabrics made in braiding machinery. They also claim the application to the purposes above mentioned of a woven fabric produced by introducing the weft at an angle of 45deg., or nearly so, to the warp. Last, they claim manufacturing lined articles of clothing suitable for winter wear, by the use of a double or compound fabric produced by dividing the warp into two sheds, into one of which a light weft to form a face is introduced, while into the other a thicker weft to form the plush surface or lining is introduced, as set forth.— —Patent completed..

2312 J. H. EVERS. *Improved apparatus for generating steam.* Dated August 12, 1867.

This invention relates to that class of steam generators in which the water is regularly supplied in small quantities to a steam generator which is heated by a naked fire in such a manner as to flash the water into steam immediately upon its introduction into the steam generator. The improved apparatus is formed of a coil or coils of pipe wound round and arranged in any desired shape, so as to form a fireplace. This arrangement of pipes is placed in a sand mould of corresponding shape, and round it is cast molten iron, so as to enclose the coil or coils of pipe in solid metal.—Patent abandoned.

2313 E. B. WILSON. *Improvements in furnaces.* Dated August 12, 1867.

This invention (which has reference to a former patent dated December 2, 1865, No. 3090), has for its object the further facilitating of the descent of the fuel, and the clearing of the furnace as well as the obtainment of more perfect combustion. The invention consists, partly, in imparting a rocking motion to the inclined cast-iron plate which carries the fuel. In furnaces constructed as described in the specification of the former patent the inventor rocks this plate by a lever, whereby the fuel is agitated and assisted to descend, thus giving a continual stream of gas into the working chamber, and improving the combustion. The grid may be rocked in the same manner, and an iron plate may be continued above the grid (if such be used), if not above the opening, and likewise rocked so as to assist the descent of the fuel. He also makes the bottom of the fuel chamber in one or more pieces, which are lowered and raised by a lever; but before lowering the bottom, plates should be inserted in order to keep up the fuel; or this may be sometimes done by lifting the lower part of the bottom plates, so as to retain the fuel in its position. By this arrangement the furnace is easily cleaned out. He introduces water into the upper hot-air chamber by a pipe, or in a trough, to be evaporated by the incandescent fuel; and he introduces water into the bottom of the fuel chamber, dishing it so as to cause it to retain the same. The steam or vapour of water passes into the furnace, and is burnt with the fuel, the quantity being under regulation by a tap, &c.—Patent abandoned.

2314 A. MCDOUGALL. *Improvements in the extraction of the sulphur contained in products resulting from the alternate exposure of certain metallic oxides to gases containing sulphuretted hydrogen, and to oxygen.* Dated August 12, 1867.

The document relating to this invention are with the law officers "under objection," and cannot at present be seen.—Patent completed.

2315 J. SHANKS and J. CARGILL. *Improvements in lawn mowing machines.* Dated August 12, 1867.

This invention consists in constructing the sole plates or bottom blades for lawn-mowing machines so as to be reversible—that is to say, the sole plates or bottom blades are made with two edges, so that when one edge is worn, the plate can be unscrewed and reversed or turned round, when the new edge will be brought into contact with the cutter.—Patent completed.

2316 J. J. RAWLINGS and H. WILKERSON. *Improvements in machinery or apparatus for washing coprolites.* Dated August 12, 1867.

According to this invention it is proposed to combine with the ordinary revolving perforated cylinder and water trough an internal rotatory agitator, working inside the outer cylinder, but at a higher speed of revolution, such agitation serving not only to stir or agitate the coprolites while in the water, and so effect their more thorough cleansing, but also serves to facilitate their delivery or passage through or along such outer cylinder, whereby the process is considerably expedited.—Patent abandoned.

2317 W. SWENSON and J. E. HEILMANN. *An improved appliance to be used for carrying and holding railway tickets and labels.* Dated August 12, 1867.

This appliance consists, first, of a metallic frame formed with grooved sides, the shape and dimensions of such grooves being suitable to admit the ticket or label. The frame is attached to a piece of chain, and a spring or other catch, or a ring, by which it may be attached to a button of the waistcoat or elsewhere, and thus, if desired, be worn or carried out of sight, still always at hand in a certain fixed place when required to be exhibited by the traveller. Under the second modification the appliance for holding the ticket consists of a wire bent into the form of a loop, and formed with a point or barb at one end, while on the opposite end a hole or eye is formed. Over the body of the loop a ring slides, so that in using it for holding a ticket or label the point is pressed through the ticket or label, entering the hole in the opposite end of the loop, so that when the ring is pulled over the loop to its lower end the ticket or label is effectually retained. —Patent abandoned.

2318 W. T. ELEY. *Improvements in the means employed for rendering cartridges or cartridge cases for firearms waterproof.* Dated August 12, 1867.

This invention consists in coating cartridges when made up (or in coating the paper cartridge cases previous to being filled or charged) with wax, stearine, paraffin, &c., dissolved in coal tar or other suitable spirit or solvent in such proportions as to remain fluid or semi-fluid when cold. The cartridges or their paper cases are dipped or immersed in a cold solution of the above-named compound or materials, from which they are taken and allowed to dry, and when the spirit or solvent has evaporated, the paper cases or cartridges will be coated with a thin coating of the wax, stearine, &c., contained in the solution employed.—Patent completed.

2319 G. DAVIES. *An improvement in centrifugal apparatus for washing sugar.* (A communication.) Dated August 13, 1867.

This invention consists in providing the ordinary centrifugal tubs with an apparatus by which a wall of dry sugar of uniform thickness, concentric with the wall of the centrifugal tub, may be formed within the same, for receiving the application of jets of water for washing or purifying the sugar, and also in the mode of operating such apparatus.—Patent abandoned.

2320 H. T. EVERIST. *Improvements in apparatus used in the manufacture of gas.* Dated August 13, 1867.

This invention relates to the construction of exhauster governors or regulators, whereby a more uniform pressure may be maintained in the retorts when manufacturing gas, whatever quantity is being produced, than by the use of the exhauster without the interposition of such apparatus. It consists of a circular metal tank or covered case having an orifice in the centre of the bottom plate, through which rises to somewhat less than half its height a pipe which is connected to the outlet of the exhauster. In the top plate of the case an orifice is also cast, and over this is affixed a pipe in connection with the inlet of the exhauster. Within the case, and over the pipe first mentioned, a metallic bell or gasholder-shaped vessel is suspended by a rod working through a stuffing box in the cover, and attached to a chain which passes over a wheel on the outside of the case. The chain terminates in a rod whereon counterbalance weights are hung. In the sides of the bell two, three, or more graduated angular apertures are formed. These openings may be made either in the plain sides of the bell or in recesses constructed in it specially for the more easy passage of the gas. The bell is also provided with guide rollers to preserve it in proper position when in use.—Patent completed.

2321 E. SCORE. *Improvements in quoins or wedges for fixing type or blocks in their chases, and in appliances used therefor.* Dated August 13, 1867.

This invention consists, essentially, in forming quoins or wedges for fixing type or blocks in their chases of metal instead of wood, as heretofore.—Patent abandoned.

2322 J. J. BRIGHT. *Improved gear for actuating screw and other like propellers of navigable vessels by manual, animal, or motive power engine, and for elevating, lowering, connecting, or disconnecting such propellers.* Dated August 13, 1867.

This invention consists of a peculiar arrangement of apparatus (comprising various shafts and cog wheels) for actuating screw and other like propellers of navigable vessels, which is more particularly applicable when the vessel is not provided with steam power, and is chiefly intended for use in calms, or when entering bar harbours —Patent completed.

2323 G. and J. PILLING and F. JENNINGS. *Improvements in machinery for sewing or covering the lists or edges of fabrics.* Dated August 13, 1867.

This invention relates to machinery or apparatus for placing and securing a web of closely woven material over each list or edge of fabrics to be dyed along with the fabric, and technically known as "sewing." The improvements consist in certain mechanical parts for folding the said lists either into rolls, or upon cords, and placing the web or webs in position, and sewing it thereon; also drawing or propelling the fabric forward intermittently. An ordinary frame or table is employed, on which is supported a rotary shaft, which may receive motion by hand or other power. A groove is formed across the table, and a folding instrument is attached, which is constructed of two tongues or strips of metal twisted spirally, leaving a space betwixt them for the list to pass through. A series of guides or curved plates is also attached to guide the web and cord (when used) into proper position, and a pair of fluted rollers is employed to draw or propel the fabric forward under operation, which receives intermittent motion by ratchet wheel and pawl from either a cam, excentric, or crank fixed on the rotary shaft. The patentees employ a circular or curved needle mounted on a spindle, to which oscillatory rotary motion is given by an excentric, cam, or crank on the rotary shaft, and a rod operating a toothed segment wheel in gear with a pinion on the said spindle; also a looper or instrument for taking into the loop of a thread formed by the needle after its passage through the fabric is hinged so as to be operated by a lever and rod attached to an excentric, cam, groove, or crank fixed on the rotary shaft, which, taking into the thread, forms a loop, and transfers it to a suitable position for the needle to pass through on its next insertion.—Patent completed.

2324 B. F. STURTEVANT. *Having reference to blowers for furnaces, &c.* Dated August 13, 1867.

This invention is not described apart from the drawings. —Patent completed.

2325 H. M. MELLOR. *Improvements in circular knitting frames.* Dated August 13, 1867.

Here, in place of a wheel with radial slides, the patentee makes a wheel carrying levers, each capable of rocking on its fulcrum to and from the centre of the wheel. Each lever has a sinking nib at one end, and near its other end it rides upon its fulcrum. The sinking levers are fitted into radial slots in the periphery of a cylindrical boss which carries them, and the whole is carried round by means of a driver wheel in connection with it working on to the stems of the needles, and as each lever comes round to the point where it is to sink the yarn, a cam within the circle of the wheel act on the lever and progresses forward the end on which the nib is formed. The lever is afterwards brought back by another cam surface. Another part of the invention consists, when constructing a circular knitting frame, in using needles with spring beards able to slide in a direction parallel with the axis about which they rotate, as already mentioned, in connection with a sinking wheel having movable sinking

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blades arranged either to slide radially, or as levers to rock on a fulcrum, as above set forth. Another part of the invention relates to the arranging circular knitting frames to produce work with a trick rib or seam down it from end to end, so that the work may more nearly resemble that produced on a flat frame.—Patent completed.

2326 S. R. WYBRANTS. *Improvements in utilizing certain waste materials, and in manufacturing packing therefrom.* Dated August 13, 1867.

This invention consists in using waste pieces of belting made of cotton, and other textile materials, for manufacturing packing for piston and pump rods or plungers, or other movable parts of machinery, which is effected in the following manner:—The waste pieces are washed and cleansed, after which they may be mangled, calendered, or otherwise treated; they are then laid over and caused to adhere to a thin web or sheet of textile material, such as coarse canvas, a solution of gutta-percha, india-rubber, being used to effect the adhesion.—Patent abandoned.

2327 A. SWAN. *Improvements in apparatus for evaporating or recovering lees.* Dated August 13, 1867.

This invention chiefly consists in employing or utilizing the flame and heat produced from burning lees in the ordinary pan or roaster. For this purpose the inventor places the bottom of a vertical tubular or other boiler upon, or partially upon the pan which contains the thick lees to be burnt or roasted; the flame and heat from the burning lees thus assist in raising steam in the boiler, and he employs the heat from this boiler for evaporating thin lees preferably, as described in the specification of his patent of October 16, 1866 (No. 2671). The pan or roaster is heated by furnaces in the ordinary manner.—Patent abandoned.

2328 M. F. HALLIDAY. *Improvements in breech-loading firearms.* Dated August 13, 1867.

This invention consists, first, in the particular conformation of the rear face of the barrel, the front and rear faces of a movable piece carrying the exploding pin or striker, and the front face of a fixed piece behind the movable piece, as described. Second, in an improved arrangement of extractor. Third, in the formation of an aperture below the movable piece to allow of the escape of the empty cartridge case; and, fourth, in the combination of the parts of breech-loading firearms, all as described. We cannot here give space to the details of this invention.—Patent abandoned.

2329 J. BADGER. *Improvements in kitchen or cooking ranges.* Dated August 13, 1867.

The patentee claims, first, constructing and arranging or combining the parts of the fire-grates of kitchen or cooking ranges so that the fire-grate may be raised or lowered in the fire-place, and fixed or supported at the required height, in order to increase or diminish at pleasure the depth or fire space of the grate. Second, opening and closing the chimney hole of the range, and forming a draught plate or box at the said chimney hole when the grate is an open one, by means of a door constructed and used substantially in the manner described.—Patent completed.

2330 C. E. FLOWER. *Improvements in cooling brewers' worts and beer.* Dated August 13, 1867.

The patentee claims the improvements in cooling brewers' worts and beer described—that is to say, by the use of brine or other dense solution which has been artificially reduced to a low temperature.—Patent completed.

2331 J. FAWCETT. *Improved apparatus for extracting oil from oleaginous seeds and nuts, and making oil cake for compound cake for cattle feeding.* Dated August 13, 1867.

The patentee claims the use of loose open boxes and plates, arranged and worked as set forth, for oil extracting and cake making, as distinguished from the presses now in use, and whereby the use of woollen bags, hairs, or metal substitutes may be dispensed with—Patent completed.

2332 T. WALKER. *Improvements in machinery for cutting grooves in knotchboards of stairs, ladder strings, and in other articles requiring such grooves.* Dated August 13, 1867.

Here the patentee employs arms mounted so as to be capable of being turned to any required angle, and connected together by suitable rods, which are carried by sliding pieces mounted on the arms. The material to be grooved is placed upon the rods, and is moved against a revolving cutter situate above, and is traversed along rollers or other guides for succe sive cuts. The distances apart of the grooves are regulated by a gauge piece which is mounted so as to be capable of being turned upward and downward upon a centre, and is placed in one groove to determine the position of that which is to succeed it. The gauge piece is also capable of being moved horizontally.—Patent completed.

2333 W. TURNEY and J. ACKROYD. *Improvements in jacquard machinery or apparatus used in the production of figured lace and other fabrics.* Dated August 13, 1867.

This invention consists in the employment of two driving shafts and two sets of driving cams, which communicate motion to the several parts of the Jacquard machinery or apparatus. By the employment of two shafts and two sets of cams constructed according to this invention the inventors are enabled to give a greater range to the throw of the bars.—Patent abandoned.

2334 W. B. LEACHMAN and J. HOLROYD. *Improved apparatus for pumping fluids.* Dated August 14, 1867.

The object here is to pump fluids, whether in a liquid or gaseous state, and for this purpose, within a suitable chamber furnished with orifices at the bottom and the top for injection and ejection, the patentees place a cylinder capable of revolving upon a shaft which passes transversely through and is secured to the chamber, such cylinder being provided with bearings on the outsides of the chamber through which it passes. The cylinder is so arranged as closely to fit the chamber (which is of a cylindrical formation in its side elevation) in one portion, whilst it is a considerable distance from it on the opposite side. Upon the shaft, and within the cylinder, they key a grooved excentric or cam, in which, at equal distances apart, friction rollers are placed connected with vanes or floats free to slide within grooves cut in the periphery of the cylinder, such vanes or floats always being in close contact with the inner surface of the chamber.—Patent completed.

2335 A. M. CLARK. *Improvements in fastenings for securing bayonets on firearms.* (A communication.) Dated August 14, 1867.

This invention consists in having the socket or tube of a bayonet formed with a longitudinal slot in which a spring having a shoulder or projection at its inner side is fitted, the lower end of the spring being secured by a screw, rivet, or otherwise to the lower end of the bayonet socket or tube. The exterior of the barrel of the firearm near its muzzle is provided with a projection over which the projection or shoulder at the inner side of the spring catches when the socket or tube of the bayonet is fitted on the end of the barrel, and firmly secures the former on the latter.—Patent completed.

2336 C. HOLLIDAY. *Improvements in means or apparatus for printing woven and other fabric or material.* Dated August 14, 1867.

This invention relates to printing spots and other forms or figures on the surface of fabric or material, particularly when using for the purpose paint, japan varnishes, or other matter of a semi-fluid or glutinous nature, the fluidity of which is increased by heat, so as to facilitate its application, and of which comparatively large quantities are required to be unpressed at a time, and the improvements consist in adaptations or combinations of means for applying the heat required, and by which several different colours may be so applied at the same time.—Patent completed.

2337 J. A. JONES, R. HOWSON, and J. GJERS. *Improvements in puddling and other furnaces employed for melting, boiling, or heating iron.* Dated August 14, 1867.

This invention consists in a mode of utilizing the waste heat of puddling and other similar furnaces by causing it to heat a mixture of air and steam, which mixture so heated is employed for the combustion of fuel, thereby economizing the consumption thereof and preventing smoke.—Patent completed.

2338 C. F. BOWER. *An improved combined bed, couch, and chair, for the use of invalids.* Dated August 14, 1867.

This invention consists, according to one arrangement, in providing a strong rectangular frame supported on four legs with castors, to one end of which frame there is coupled, by a hook or otherwise, a carriage supporting an invalid's chair, such carriage having the usual pair of hand-propelling wheels in front, and a swivel wheel behind.—Patent abandoned.

2339 W. BETTS. *Improvements in metallic capsules for bottles and other like receptacles.* Dated August 14, 1867.

Here the patentee produces the name of the firm with or without a special trade mark or ornamentation upon one or more parts of the body or outside of the cylindrical or conical part of the capsule itself. This may be accomplished by taking type or a printing block made the reverse to ordinary type, and applying gold size, or other suitable adhesive preparation, to such printing surface. He then presses thereon a sheet of foil, and from this sheet he transfers the impression to the side of the capsule by rubbing or pressing the foil, the flexibility or pliability of the foil facilitating the transferring of the edge to the side or curved surface of the capsule. Gold or other metallic leaf or powder or powdered pigment is then to be applied to the capsule, when the name or device will appear clearly thereon. These names and trade marks may be produced, if desired, in two or more colours by successive printings, whereby the effect of multicoloured trade marks will be obtained.—Patent completed.

2340 W. BETTS. *Improvements in metallic capsules for bottles and other like receptacles.* Dated August 14, 1867.

Here the patentee produces the trade mark in intaglio, or sunk upon the capsule, and in the interior, or upon the body, of such trade mark he produces the name of the manufacturer or firm employing the same, or other words or devices in relief. The die required for producing this trade mark should, of course, have the trade mark engraved in relief thereon, and the name of the manufacturer or firm using the capsule engraved in intaglio, or sunk upon the raised device. By adopting the method described in the specification of his patent, dated April 15, 1864 (No. 953), he is enabled to obtain a multicoloured effect, the trade mark being in one colour whilst the name or names of the manufacturer or firm using the capsule, or any other words or symbols raised within such trade mark, are of a different colour.—Patent completed.

2341 G. BUXTON and S. BANN. *Improvements applicable to axles of engines and carriages for railways and other roads.* Dated August 14, 1867.

This invention consists in mounting axles of engines and carriages of railways and other roads so that the blocks which carry them shall, independently of their usual vertical motion, be capable of swivelling upon centres, so that, if one side of the engine or carriage become more elevated than the other, the axle, by turning upon centres of motion, will accommodate itself to such position without a strain being put thereon.—Patent completed.

2343 H. BESSEMER. *Improvements in ordnance and machinery to be used in throwing projectiles, part of which machinery is applicable for other purposes.* Dated August 14, 1867.

The patentee claims, first, in the construction of ordnance, the formation of cells around the bore of the gun adapted to contain elastic meriform matter to operate by its expansion on the shot. Second, in the construction of ordnance, the employment of longitudinal flanged bars surrounded by cylinders or hoops. Third, casting ordnance with air cells around the bore, as described. Fourth, the construction of ordnance by building up flanged hoops or rings by turning such rings or hoops, and riveting the same together. Fifth, in the construction of ordnance, the employment of a tube and jacket having a space between them for the storing of compressed air, as described. Sixth, forcing the projectile into the gun by means of hydraulic apparatus, as described. Seventh, in the construction and working of ordnance, causing the projectile to form the valve closing the main air passages by which air is admitted to the rear of it for it propulsion. Eighth, the employment of studs in rifled projectiles arranged to alter their position to suit the differential pitch of the rifling, as described. Ninth, the employment of a disc or cover to the muzzle of guns, using compressed air for the propulsion of the projectile, and forming a partial vacuum in such guns, as described. Tenth, constructing ordnance in such manner that the projectile may be forced into a contracted part of the bore, and so retained until when the discharge is required it is started by the admission of air to its rear by a small valve or cock. Lastly, in ordnance constructed to throw projectiles by compressed air, the employment of a cock or valve to prevent the premature accumulation of air at the rear of the projectile, as described.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated October 24, 1867.

2988 W. E. Gedge, Wellington-street, Strand. A novo kind of nail or tack for upholstery and cabinet work. (A communication.)

Dated October 28, 1867.

3028 J. de Silva, Liverpool, painter and paint manufacturer. Improved compositions for coating the bottoms of iron, steel, and wooden ships, and other navigable vessels and marine works generally.

Dated January 10, 1868.

93 J. H. Glow, Howland-street, Fitzroy-square. Improvements in the manufacture of boots, shoes, and gaiters.

Dated January 28, 1868.

302 J. D. Brunton, Leighton-crescent, Kentish Town, engineer. Improvements in machinery or apparatus for cutting, dressing, planing, turning, and shaping stone.

Dated February 6, 1868.

410 C. Brakell, Windsor-road, Oldham, Lancashire, engineer. Improvements in apparatus for measuring fluids.

Dated February 11, 1868.

456 T. Smith, Walnut Tree-walk, Lambeth, modeller and machinist. Improvements in steam engine counters or registering machines.

Dated February 12, 1868.

471 H. S. Barron, Alexander-terrace, Barking-road, West Ham, mechanical draughtsman. Improvements in double-action reciprocating pumps, by which the usual suction and delivery valves are dispensed with, and their functions performed by means of a sliding action of the barrel.

472 J. Smith, Cheetham, Manchester, bleacher, dyer, and finisher. Improvements in apparatus for boiling animal and vegetable substances, and for evaporating the solutions obtained in such processes.

473 A. F. Bayford, Hamilton-terrace, St. John's Wood, N.W. Improved apparatus for facilitating the watering of plants in pots, in conservatories, greenhouses, and other similar structures.

Dated February 14, 1868.

495 D. Elland, High Ousegate, York. Improved apparatus for signalling in railway carriages between drivers and guard.

502 G. A. F. Eichbaum, Southampton-buildings, Chancery-lane. Improvements in means or apparatus for indicating the amount of money received by omnibus conductors and other persons.

Dated February 15, 1868.

507 R. H. Rimes, Bradford, boot and shoe manufacturer. Improvements in boots and shoes.

513 A. M. Clark, Chancery-lane. An improved material applicable for the manufacture of felted and other fabrics. (A communication.)

516 J. Leetch, Birmingham. An improved apparatus for transmitting signals by pneumatic pressure.

Dated February 18, 1868.

527 J. Cronier, Hyde-road, Middlesex, boot and shoe maker. An improved universal rotary heel for boots and shoes.

528 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in kilns and apparatus employed in the manufacture of bricks. (A communication.)

530 R. Butterworth, Patricroft, Lancashire. Certain improvements in looms employed in the manufacture of smallware goods.

531 R. Baguley, Blackburn, shuttle maker. Improvements in shuttles for looms for weaving.

532 J. and J. Hinks, Birmingham, manufacturers. Improvements in portable stoves.

533 A. M. Clark, Chancery-lane. An improved vegetable extract for culinary purposes. (A communication.)

534 C. E. Brooman, Fleet-street, City, patent agent. Improvements in breech-loading firearms. (A communication.)

535 W. Perkins, Russell-place, Fitzroy-square, chemist, and G. G. Tandy, Anerly-road, Penge, Surrey. An improved preparation or compound applicable for insulating electric conductors, and for such purposes as india-rubber and other vulcanizible gums are applicable.

536 W. E. Newton, Chancery-lane. An improved material for the base of artificial teeth and for other purposes, and also an improved construction of mould for forming dental plates. (A communication.)

537 J. Thompson, Manor House, Camberwell-road, and J. Thompson, Camberwell Green, Surrey. Improvements in fastening railway rails.

539 W. Weild, Manchester, engineer. Improvements in the process of treating sewing threads to prepare, starch, dress, polish, and wind the same, and in some of the machinery to be employed therein.

540 W. Betts, Wharf-road, City-road, capsule manufacturer. Improvements in the production of trade marks or other designs upon metallic caps ules for bottles and other like receptacles, and in the apparatus or means employed therein.

541 H. Chamberlain, St. John's Wakefield, Yorkshire, civil engineer. Improvements in the manufacture of compressed bricks, and in the machinery or apparatus employed therein.

Dated February 19, 1868.

542 J. Higginbotham and L. Moore, Manchester, mechanics. Improvements in machinery for turning, grinding, and polishing rollers or cylinders composed of metal or other material.

543 T. Beeley, Hyde, Chester. Improvements in keirs.

544 R. Blezard, Liverpool, millwright. Improvements in machines for cleaning wheat and other grain.

545 J. Kirkland, Liverpool, engineer. Improvements in the construction of pumps.

546 E. Wright, Bradford, engineer and millwright. Improvements in self-acting means or apparatus applicable to steam boiler and other furnaces for the consumption or prevention of smoke.

547 W. and J. Cooke, Tinsley, Yorkshire, iron and steel manufacturers. Improvements in the manufacture of finished irons.

549 J. J. King, Glasgow, warehouseman. Improvements in sewing machines.

550 W. H. Steel, Park-road, Clapham. Improvements in hand saws for cutting dovetails, and for other purposes.

551 W. Edwards, Wolverhampton, manufacturer. Improvements in roughening the shoes of horses and other beasts of draught and burden.

552 R. P. Faucheux, Caversham-road, Kentish Town.

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Improvements in reels or bobbins, and in means or apparatus to be applied thereto.

554 G. P. Dodge, Upper Thames-street, City, india-rubber manufacturer. Improvements in the manufacture of india-rubber valves, valve seats, and other similar articles.

555 G. P. Dodge, Upper Thames-street, City, india-rubber manufacturer. Improvements in packing for the stuffing boxes of steam engines, and for other like purposes.

556 F. H. Renault, Rue de la Chaussee d'Antin, Paris. An improved combined umbrella and walking stick.

557 J. G. Jones, Blaina Ironworks, near Newport, Monmouthshire. Improvements in machinery for exhausting air, suitable to be used for ventilating mines, and for other similar purposes.

558 W. S. Guinness, Cheapside, City. Improvements in sewing machines.

559 J. Lord, Oadby, Leicestershire, manufacturer. Improvements in apparatus for coupling and uncoupling railway carriages and vehicles.

560 L. B. Joseph, Upper Norwood, Surrey. Improvemens in carriage and other wheels and tyres.

562 W. Myers, Birmingham, jewellers' factor. Improvements in lockets, miniature bracelets, and miniature brooches.

Dated February 20, 1868.

563 P. Bauer, J. Johnson, and W. Jones, Manchester. Certain improvements in apparatus to be employed for lubricating revolving shafts or axles.

566 P. N. Goux, Rue de Longchamps, Paris, agricultural proprietor. Improvements in collecting and in disinfecting human excreta, and converting the same into manure, also in the apparatus or means employed therein.

567 J. H. Johnson, Lincoln's Inn-fields. Improved means for increasing the draught in steam boiler and other furnaces or fireplaces. (A communication.)

568 J. Hullett, Purbrook, Hampshire. Improvements in aeronautical apparatus.

569 J. G. Tatters, W. Keeble, and B. Newbery, Plymouth. Improvements in the preparation of cigars.

570 T. A. L. Murray, Brompton. Improvements in rails for tramways.

572 G. Davies, Serle-street, Lincoln's Inn. Improvements in taps. (A communication.)

573 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in apparatus for shearing or clipping the wool or hair of sheep and other animals. (A communication.)

575 R. Fennelly, Wellington Chambers, London Bridge, and P. Kenny, Waterford, Ireland. An improved method and apparatus for singeing off the hairs, bristles, and other matters on pigs in order to prepare them for being converted into bacon.

Dated February 21, 1868.

576 G. Davies, Serle-street, Lincoln's Inn. Improvements in the manufacture of gas for lighting and heating. (A communication.)

577 G. A. Bridgett, Rose Bank, Fallowfield, near Manchester. Improvements in steam engine slide valves, valve gear, and governors, parts of which are applicable to other purposes.

578 L. M. Becker, Guildhall Chambers, Basinghall-street, telegraphic engineer. Improvements in the manner of indicating the position and supply of fire plugs, fire cocks, fire alarms, and for other purposes.

580 W. Thompson and T. Stather, Kingston-upon-Hull, engineers. Improvements in apparatus for washing and drying grain.

581 H. Walmsley and T. W. Taylor, Manchester. A self-acting registering apparatus to register the number of persons entering into and on omnibuses, or similar vehicles plying for hire.

582 M. A. F. Mennons, Southampton-buildings, Chancery-lane. An improvement in certain descriptions of bristle brushes. (A communication.)

583 T. Altham, J. Clark, and S. Ridehalgh, Nelson, Lancashire. Certain improvements in machinery or apparatus employed for sizeing yarn, termed tape legs, being also applicable to other similar machinery.

584 T. and J. R. Bury, Blackburn, shuttle makers. Improvements in shuttles for looms for weaving.

585 J. Wheatley, East Mousley, Surrey, builder. An improved construction of chimneypot.

586 A. V. Newton, Chancery-lane. Improvements in reaping and mowing machines. (A communication.)

587 W. Wilson, Newcastle-on-Tyne, hat manufacturer. Improvements in apparatus for lubricating the sliding valves and pistons of steam engines. (A communication.)

Dated February 22, 1868.

588 A. de Metz, Wolverhampton. Improvements in commode pots or vessels to be used as water-closets or for other purposes.

590 J. M'Call, Houndsditch, City, provision merchant. An improved mode or process of preserving meat.

591 C. J. Galloway, Manchester, engineer. Improvements in wrought-iron and steel piles, pillars, and columns.

592 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for supplying type formes in printing presses with various coloured inks for each impression. (A communication.)

593 J. Needham, Piccadilly. Improved fastenings for gloves, boots, and other articles.

594 A. V. Newton, Chancery-lane. Improvements applicable to steam boiler and other furnaces. (A communication.)

595 J. J. Aston, Middle Temple, Barrister-at-law. Improvements in machinery or propellers applicable for the propulsion of ships, boats, and other vessels on and over the water.

596 B. E. R. Newlands, F.C.S., Malvern-terrace, Charlton, Kent. Improvements in treating spent oxide of iron, or oxide of iron which has been used in gas works or otherwise, to separate sulphur from sulphuretted hydrogen, and in the purification of sulphur obtained from such oxide of iron.

597 W. H. Ryland, Birmingham, manufacturer and factor. Improvements in fastenings for articles of dress and jewellery.

598 F. Sangster, Dacre Park, Lee, Kent. Improvements in parasols and umbrellas.

599 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in electrical signal or alarm apparatus. (A communication.)

600 S. Firth, Leeds, merchant. Improvements in machinery for cutting coal, stone, or other minerals.

601 E. J. Nicoll, Oxford-street, and T. M. Ablett, High Holborn, shoemaker. Improvements in waist springs for boots and shoes.

603 R. Heathfield, Birmingham, manufacturer. Improvements in the manufacture of cut nails.

Dated February 24, 1868.

605 J. W. Watts, Norway-street, St. Luke's. Improvements in machinery for preparing vegetable fibre.

607 P. H. Hancock, Tachbrook-street, Pimlico, and J. P. French, St. Andrew's-terrace, Wandsworth-road. Improvements in printing machines.

609 J. Macintosh, North Bank, Regent's Park, and W. Boggett, Lindsey House, Chelsea. Improvements in the manufacture and application of elastic goods or fabrics.

611 W. E. Newton, Chancery-lane. Improvements in the manufacture of illuminating gas. (A communication.)

613 G. S. Dracopulo, Cardiff. A new apparatus for raising or forcing water, applicable to ships, mines, and other purposes.

615 R. and J. J. Bodmer, Newport, Monmouthshire, and L. R. Bodmer, Lansdowne-road, Notting Hill. Improvements in the manufacture of artificial stone, and in machinery to be employed therein.

Dated February 25, 1868.

617 H. Defries, Houndsditch, City, manufacturer. Improvements in the manufacture of opal or glass lamp and gas globes, chimneys and shades of every description.

621 E. T. Hughes, Chancery-lane. Improvements in the manufacture of hoop skirts. (A communication.)

623 E. Hutchinson, Darlington, Durham, iron manufacturer. Improvements in the construction of planing machines.

625 J. and W. Dobbs, Manchester, hatters. Improvements in the ventilation of hats and similar coverings for the head.

629 J. M'Leod, Renton, Dumbarton, engineer. Improvements in apparatus for washing yarns.

633 C. Pieper, Finsbury-square. Improvements in machinery for grinding or preparing wood for the manufacture of paper. (A communication.)

635 C. Pieper, Finsbury-square. Improvements in reaping machines.

637 A. M. Birchall, Preston, Lancashire, tobacco manufacturer. Improvements in the manufacture of twist tobacco, and the making of the same into rolls, and in the machinery or apparatus employed therein.

Dated February 26, 1868.

639 G. C. Mackrow, Orchard-yard, Blackwall, naval architect. Improvements in the construction of batteries for ships of war.

641 L. Pocock, Gordon-square, London. An improvement in bookbinding.

645 W. E. Gedge, Wellington-street, Strand. An improved machine intended to divide, break, or crush all substances capable of being triturated, more especially bones and horny substances of every kind, for converting them into manure. (A communication.)

647 A. V. Newton, Chancery-lane. Improvements in electro-magnetic apparatus. (A communication.)

649 F. Mittonette, Deepfields, Staffordshire, engineer. Improvements in furnace doors.

651 W. Dowell, Rhyl, Flintshire, whitesmith, and J. Dowell, Penmaenmawr, Carnarvonshire, ironmonger. Improvements in locks.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated February 27, 1868.

653 F. Wirth, Frankfort-on-Maine, Germany. Improvements in pedals and damping apparatus for pianofortes. (A communication.)

658 C. C. and W. T. Walker, Shropshire, engineers. Improvements in centre valves for gas purifiers and other apparatus.

Dated February 28, 1868.

674 J. G. Stidder, Hanover-street, Long-acre, engineer. Improvements in water-closets, lavatories, and urinals, and in regulating supplies for same by water valves.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," March 10, 1868.

2988 W. E. Gedge. Nails or tacks. (A communication.)

3014 G. and E. Dorsett and J. B. Blythe. Burning gases.

3027 W. Payne and A. B. Fraser. Ships' pumps.

3028 J. de Silva. Compositions for coating the bottoms of ships.

3029 G. Smith. Marking boards used in the game of billiards.

3030 H. A. Bonneville. Machine for manufacturing paper bags. (A communication.)

3045 E. T. Hughes. Machines for twisting lines. (A communication.)

3047 W. Bishop and B. Burningham. Preventing effluvia entering tanks.

3049 W. P. Savage. Excavating soil.

3051 G. Davies. Preventing incrustation in steam boilers. (A communication.)

3052 W. H. A. Bowhay. Constructing horse ploughs.

3056 T. E. Symonds. Construction of ships.

3057 F. Piercy. Tinting photographs.

3062 R. Clegg. Pumps.

3064 W. S. Dixon. Producing a blue dye.

3069 W. R. Lake. Exhausting the air in vessels for food-preserving purposes. (A communication.)

3070 I. Kendrick. Steam boilers.

3080 S. Parr and A. Strong. Construction of buildings.

3083 W. Darcy. Fastening gates.

3086 W. E. Gedge. Hat cover. (A communication.)

3117 C. E. Brooman. Reckoning apparatus. (A communication.)

3118 E. C. Vine. Stays.

3119 A. M. Clark. Railway brakes. (A communication.)

3122 W. E. Newton. Steam boilers. (A communication.)

3124 A. M'Dougall. Apparatus for stirring solid substances.

3137 A. M. Clark. Pianofortes. (A communication.)

3140 T. J. Baker. Manufacturing wheat into flour.

3149 J. Wheeler. Gloves.

3151 T. Clark. Permanent way of railways.

3152 T. Blackburn. Looms for weaving.

3153 C. Anderson. Regulating the position of endless travelling webs.

3159 W. Inglis. Shaft couplings. (A communication.)

3163 W. Chippendale. Coupling railway carriages.

3166 S. Hall and M. Whittingham. Locks.

3169 J. Gresham. Giffard's injector.

3171 M. Rollason. Suspended gas lamps.

3177 J. H. W. and A. W. Biggs. Joining warp ends.

3191 F. L. de Gerbeth. Treating oils.

3195 H. A. Bonneville. Lubricating boxes. (A communication.)

3223 P. de Bavay. Attenuating the effect of shocks between engines or carriages composing a railway train.

3249 R. Holliday. Cleansing wool.

3306 R. Leighton and T. Kirksham. Sewing sheets of paper forming books.

3336 R. M. Letchford. Matches.

3376 T. S. Horn. Miners' safety lamps.

3433 J. Eckersley and D. Martin. Permanent way of railways.

3449 R. M. Letchford. Circular boxes.

3488 J. Rae and G. Miller. Railway wheels.

3668 J. Lightfoot. Printing certain textile fabrics.

3685 J. Goodfellow. Metallic pistons for steam cylinders.

168 N. H. Rolfe. Machinery for cutting laths.

326 E. T. Mainwaring. Bale or metallic tie.

357 C. E. Brooman. Steam valves. (A communication.)

438 W. T. Sugg. Valves.

540 W. Betts. Producing trade marks.

602 W. Krutzsch. Machines for washing clothes. (A communication.)

647 A. V. Newton. Electro-magnetic apparatus. (A communication.)

653 F. Wirth. Pedals for pianofortes. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed March 6, 1868.

2533 S. Smith	2756 E. P. Alexander
2538 J. and T. Bayley	2761 J. L. Field
2544 E. J. C. Welch	2865 W. E. Newton
2559 J. H. Brown	2981 J. L. Norton
2564 J. Rae	3013 R. Carter
2567 J. Pottle	3305 H. James and E. Drewett
2580 W. F. Cooke	3389 C. Albisser
2584 J. Perrin	3457 W. A. Herring
2607 J. A. M'Kean	3490 J. Beatty
2653 W. E. Newton	3712 J. Novikow
2693 R. Wilson and J. Nuttall	80 T. Greenwood
2708 G. H. J. Simmons	198 W. R. Lake

Sealed March 10, 1868.

2314 A. M'Dougall	2641 W. Potts
2438 G. Haseltine	2724 J. E. H. Andrew
2583 J. Wilderspin	2728 A. M. Clark
2591 J. Reid	2750 I. Dimock
2595 J. M. Napier	2779 W. R. Lake
2596 S. Dalton	2788 G. Mellor
2597 W. Whitehead	3003 G. J. Gunther
2598 H. A. Bonneville	3092 W. Cooke and W. Francis
2602 H. A. Bordin	3207 J. D. Scally
2603 R. Canham	3302 W. G. M'Ivor
2609 G. F. Bradbury and T. Chadwick	33 W. H. Atkinson
2621 A. M. Clark	179 H. A. Bonneville
2623 W. W. Burdon	184 J. Davidson
2637 J. G. Willans	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

585 S. Chatwood	648 J. Shanks
597 D. and J. Manwell	659 W. Clark
608 H. Taylor	660 J. T. Harris
615 W. E. Newton	662 R. G. Fisher
617 A. Akeroyd	665 W. D. Allen
619 C. F. Varley	668 G. F. Ansell
636 L. Perkins	669 V. Delperdange
637 A. E. A. Aubert and G. E. M. Gerard	699 J. Atkins
	718 L. Gantert
639 W. Clark	748 B. Lawrence
642 F. Tolhausen	790 R. J. Gatlin

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

569 H. A. Silver and H. Griffin	604 J. Hirst and J. Hollingworth

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending March 7, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2515	0 6	2125	0 8	2150	0 10	2172	1 6	2188	0 4	2224	0 4
1637	0 10	2126	0 6	2153	0 10	2173	0 6	2190	0 8	2225	0 8
1860	1 4	2130	0 8	2154	0 4	2175	0 8	2191	0 6	2228	0 8
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2078	0 8	2135	1 0	2156	0 10	2177	2 4	2195	0 4	2230	0 4
2085	0 8	2137	0 8	2157	0 8	2178	0 8	2197	0 4	2231	0 4
2086	0 10	2139	0 4	2159	0 4	2179	0 6	2198	0 4	2232	0 4
2091	1 2	2140	0 10	2160	0 10	2181	0 4	2200	0 4	2233	0 4
2094	0 8	2141	0 4	2161	0 10	2182	0 10	2202	0 4	2236	0 10
2110	2 2	2144	1 4	2162	0 10	2183	0 4	2205	0 8	2237	0 4
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2115	0 10	2146	0 6	2166	0 10	2185	0 4	2213	1 0	2240	0 4
2119	1 10	2147	0 10	2169	1 8	2186	0 8	2216	0 10	2248	0 10
2123	3 10	2148	0 10	2170	0 8	2187	0 4	2221	0 4	2252	0 4
2124	0 10	2149	0 4								

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, MARCH 20, 1868.

SUBURBAN RAILWAYS.

THE growth of the suburbs of the metropolis, and the almost total emigration of everybody to those localities after the hours of business, has necessitated the construction of special lines of railway for nearly the sole purpose of carrying them backwards and forwards. Of this description of line, the Metropolitan—commonly, but not quite fairly, termed the Underground—Railway, the Metropolitan Extension, and the North London, are the most prominent examples. No two could possibly form a greater contrast, with respect to the principle adopted in their construction, than the two former. The Metropolitan proper, from Farringdon-street Station to that at Edgware-road, is wholly beneath the surface of the ground, although not arched over continuously, while the extension from Grosvenor-road Station, which is built upon the Victoria Bridge, to Ludgate-hill terminus, is carried the entire distance upon arches and intermediate bridges. Apart from the question of land, the cost of which is so variable as to vitiate all comparative estimates, the relative economy of the two systems would be an interesting subject. The cost of the permanent way would also stand as a constant in the comparison. We should thus have the cuttings, tunnels, retaining walls, and over bridges of the low-level system balanced against the embankments, viaducts, and under-bridges of the high-level line. So far as the bridges are concerned, the advantage lies upon the side of the low-level principle, as an over-bridge, from the far less weight it has to carry, can be more economically constructed than an under one, which has to bear the maximum load that any bridge is ever subjected to. The test of a string of locomotives covering the span of a bridge, which is the maximum load supposed possible to be brought upon any railway structure, entails the employment of an amount of material and a weight of iron sufficient for a couple of ordinary over-bridges. Against this comparative saving upon the side of the low-level lines must be placed the items of tunnels and retaining walls, features altogether foreign to the other system. There are additional reasons for employing retaining walls, in the cuttings of a metropolitan line, over and above those influencing their adoption in other situations. To prevent landslips, the choking up of the way, and stoppage of traffic, are the principal reasons for building retaining walls in cuttings in the open country, but while this is also the case in the example we are considering, there is a more serious result attending a slip. It might entail not merely the interruption of the traffic, but by precipitating valuable property, in the shape of houses and offices, into the gulf, cause an enormous expenditure in the shape of damages and compensation.

Besides necessitating the construction of special suburban locomotive routes, the matutinal and nocturnal journeys to and from the City by the inhabitants of the environs, have caused a very considerable increase of traffic to the main lines running through suburbs affording eligible sites for building upon. Virtually, a regular metropolitan traffic has been developed upon these lines, of which, perhaps, the London and South-Western and the South-Eastern are the best examples. As a consequence of this augmentation to the existing traffic, and, in some instances, an establishment of it where previously there was little or none, those stations in proximity to the terminus where formerly trains rarely stopped, now possess a complete service of their own. This is, however, attended with disadvantages in other respects. Let us select a place—Acton, for instance, the first station upon the Great Western line. This locality is developing rapidly, and the Company has recently put up additional accommodation there. Assuming that only five trains per diem stopped there some years ago, and that in a few years to come it will be necessary to run a dozen, how is this increased service to be effectually carried out without detriment to the rest of the traffic? One plan would manifestly be to run a greater number of trains, and the other to cause more to stop on their outward and home journeys. It would, however, be impracticable to run a large number of trains upon a main line solely for the accommodation of places scarcely ten miles out of London, especially over the same pair of rails. The Metropolitan Extension has demonstrated the absolute necessity of laying down separate tracks for different systems of traffic by providing for the main line, and the Extension proper, distinct lines of way. This obviates the difficulty, which would otherwise have to be surmounted, of stopping main line fast trains at small stations, which would not merely cause a serious delay in the time of accomplishing a long journey, but would be a great and unwarranted inconvenience to passengers bound for distant destinations.

It has been long proved that the running of two descriptions of traffic over the same metals is not an economical method of working a line. The shunting of the slower trains to make way for the faster, the danger of collisions in consequence, and the thousand and one hazardous contingencies involved, which in numerous instances have culminated in lamentable catastrophes, bear witness to the unsoundness of such an arrangement. Stephenson is stated to have remarked that the time would come when there would be a separate line of way from London to Newcastle, purposely to bring coals to the metropolis, and, but a short time ago, it was seriously mooted whether the experiment would not be worth trying. It may probably be ultimately accomplished. The remark applies with full force to the carrying on of suburban traffic. There is no question but that whenever a locality in the vicinity of a large city which was formerly but little resorted to becomes thickly populated, and is capable, with the assistance of the adjacent neighbourhood, of constituting a considerable and permanent source of passenger traffic, it ought to have its wants of intercommunication adequately supplied. To effect this, additional lines of rails should be laid down connecting it with the metropolitan terminus. In fact, it should be considered as an individual metropolitan extension, and not as a portion of some gigantic main line. The two should have a distinct line of demarcation maintained between them. Upon the present Extension this arrangement is adhered to so rigidly that passengers starting from either the Victoria or Ludgate-hill termini are not permitted to travel by a main line train to a station upon the Extension route, although the train stops at it for the purpose of taking up. The argument justly is, that there is an abundance of Extension trains running between Victoria and Ludgate, and the main line trains are essentially intended for those travelling beyond the bounds of the metropolis, and that, therefore, their seats should not be occupied by others whose journey is confined to a couple of miles, and for whom there is ample accommodation provided elsewhere. A great obstacle to any of our existing main lines adopting the plan of laying down additional rails to meet the requirements of an increase of traffic is the enormous price of land. In some instances, as upon the London and North-Western, space has been gained here and there by cutting off the toe of the slopes and building dwarf walls, the usual method of gaining additional breadth of road when wanted. There is, however, a limit to this, and even to cutting away nearly the whole slope and constructing regular retaining walls, and at the last the extra space can only be obtained by the purchase of the adjoining land.

THE COST OF OUR SHIPS OF WAR.

THE frequency and persistency of Mr. Seely's motions and speeches in the House of Commons, coupled with occasional violent articles in the press, have tended to invest the question of the cost of our ships of war with an interest it would not otherwise have possessed. The public has been told from time to time, through the two sources above named, that the waste and general mismanagement in our Royal dockyards have been so great that it would, upon all considerations, be a wise policy to entirely confine to private firms the building of ships for our Royal Navy. Indeed, some speakers and writers have gone so far as to advocate the closing of our Royal dockyards, for every purpose, both in peace and in war, and to trust solely and absolutely to the resources of private shipbuilding firms for the construction and repair of our fleet. We need scarcely add that we are not ourselves prepared to go this length. It is a question which, like all others, has two sides, and we believe we shall best discharge our duty to our readers, and render service to the State, by examining impartially into the facts of the case, and drawing those conclusions which the facts alone justify.

We have before us the blue book ordered to be printed by the House of Commons, July 22, 1867, showing the expenses incurred on her Majesty's ships building, converting, repairing, fitting, &c., during the financial year 1865-66, being the last return published. In the first place, we may state that, by the direction of the Lords of the Admiralty, Alexander Glen Finlaison, Esq., actuary of the national debt, was requested—with the view of determining the amounts which should appear in the accounts to be presented to Parliament as the current estimated annual charge for pensions of officers and workmen—to reduce to a present annual charge, if possible, in the shape of a per centage on the present amount paid as salaries and wages, the deferred charge incurred by the pensions of dockyard officers and artificers. Mr. Finlaison's report is published in the return before us; it is as lucid as can be desired. From it we find that the number of established artificers on the books of the various dockyards is (or was) 9,486, and the sum annually paid them for wages £622,358, the average wages per man being £65 12s. 1d. per annum, and the average pension per man £33 2s. 11d. per annum. There are 214 officers promoted to salary from daily pay, to whom, in the aggregate, the sum paid is £42,865, the average salary per man being, therefore, £200 6s. per annum, and the average pension per man £117 10s. 4d. The class of officers who have been on salary for the whole period of their service comprises 233 persons, to whom, in the aggregate, is paid for salaries a sum of £63,186 per annum, the average salary per officer, therefore, being £283 6s. 10d., and the average pension £253 9s. 11d. per annum. Assembling the sums paid to the three different classes of recipients under the head of wages and salaries, and the sums computed to represent the increase of charge caused by the prospect of allowances in superannuation, Mr. Finlaison obtains the following general result:—

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	Issue of wages and salaries.		Latent increase on account of superannuation allowances.
To artificers	£622,358	...	£43,565
To officers promoted from day pay.....	42,865	...	3,890
To officers on salaries whole period of service	63,186	...	5,045
TOTAL.....	£728,409	...	£52,500

It, therefore, appears that there is a latent addition to the total sum paid for wages and salaries equivalent in amount to a further charge of £52,500 per annum by reason of the prospective charge for pensions. This latent addition amounts accurately to £7 4s. 2d. per cent. (in decimals 7·2075); but owing to considerations which have to be taken into account for mortality and secession, it appears that, for ordinary purposes, the rate of enhancement given to the wages and salaries of all classes combined by the prospect of pension on retirement may be placed at 7 per cent. We have given these figures in order that our readers may know the result of a careful and elaborate examination of this subject by Mr Finlaison—the most eminent authority we have upon such matters.

We now come to the more important part of our subject. On reference to the published return before us, we find that ships built in our Royal dockyards are charged with a very large sum for "incidental expenses" and "establishment charges," a sum much larger than any that has to be borne by a contract-built ship. Of course, private shipbuilders, in estimating the amount at which they can tender for the building of a ship for the navy, have to make provision for establishment expenses, interest on plant, &c., but they have not to provide for such vast charges as are placed to the debit of ships building in our Government yards—charges amounting, in many instances, to 50 per cent. upon the actual cost of the ship. It scarcely seems possible that gentlemen possessing the least acquaintance with business generally, and accountantship in particular, should tolerate a system which charges a ship building at Sheerness, Portsmouth, or Chatham, with any portion of the cost incurred in keeping a ship in seaworthy and efficient condition at the other side of the world. It is, nevertheless, the fact that many thousands of pounds expended in our naval establishments at the Cape of Good Hope, Hong Kong, Sydney, and other ports (we have eleven naval establishments abroad) are charged to ships building, &c., in our home dockyards. We cannot see the reason or justice in making a ship building, repairing, or converting in our Royal dockyards bear a pro rata charge for the chemical branch of the service, the chapels, the schools, scholarships, Southsea Castle lighthouse, coaling and watering service at Portland breakwater, &c. At any rate, it must be evident that if such charges as these are added to the cost of our Government-built ships, any fair ground of comparison of cost between them and ships built in private yards does not exist.

We cannot within the scope of one article deal with this subject in the comprehensive manner it deserves, and we must, therefore, at present content ourselves with one or two illustrations in support of our views. From a long list of items we take the following:—"Harbour and dockyard gear—viz., cables, pendants, chains, swivels, bridles, and buoys, transporting hawsers, warps, and docking and launching rope gear." This item amounts at the home yards to £42,183; at our naval establishments abroad to £2,753, making a total charge of £44,936. Now, this amount includes expenses which in no way spring from the shipbuilding, converting, and repairing operations carried on in our dockyards. It is also evident that a ship built in a private yard bears no portion of this charge, although as soon as she is out of the hands of her builders she occupies her position in one of our harbours, and has the use of the aforesaid gear, and which has been charged to ships being either built, converted, or repaired in a Government yard. Other items include fire-engines, buckets, hose, and other gear connected therewith; also, waterworks. There are also charges for shipping of timber and stores to other yards at home and abroad; for landing, surveying, receiving, depositing, and issuing timber and stores; for the preservation of timber, boats, and other stores; for deterioration of the value of timber and stores, &c., &c. It will be seen that some of these items (and we have only mentioned a few out of many) are directly attributable to a State policy, and are no more chargeable to Government-built than to contract-built ships. The ships built in our Royal dockyards have also to bear the whole charge for experiments, the advantages resulting from which are equally available for private shipbuilders as for the Government service.

We will conclude with the following illustration of the effect of the system we complain of. The "Agincourt," built by Messrs. Laird, of Birkenhead, undocked on the 27th March, 1865, figures in the return before us as follows:—"Total expenditure to 24th March, 1866, exclusive of indirect charges," £451,596 11s. 4d.; "incidental expenses" and "establishment charges," £7,418. The "Bellerophon," built at Chatham, undocked 26th April, 1865, stands as follows:—"Total expenditure to 24th of March, 1866, exclusive of indirect charges," £353,682 16s. 4d.; "incidental expenses" and "establishment charges," £121,842: so that although the "Bellerophon" cost nearly £98,000 less than the "Agincourt," she is charged with £114,424, "incidental expenses" and "establishment charges" in excess of that ship. It is now many years since sundry red-hot reformers turned their attention to Admiralty account-keeping, but the result of their labours seems wretchedly unsatisfactory.

"ACCIDENTAL DEATH."

THE above two words comprise the almost stereotyped verdict of coroners' juries at the inquests held after fatal boiler explosions. Now, there are thousands besides ourselves who know and feel that this is, in nine cases out of ten, an insult to human understanding—in fact, a very farce. We have never lacked opportunity to point this out, and, further, to insist that fuller investigation by more competent witnesses should be enforced. We have, also, held that since there is such a lack of moral responsibility in the matter, there ought to be some steps taken to enforce a legal responsibility. A man at 15s. a week is set to drive an engine; from, what in him is excusable ignorance or carelessness, an explosion occurs, life is sacrificed, and a verdict of "accidental death" is returned. Another thickhead ties scraps of iron and brickbats to his safety-valve lever to get more work out of his boiler: a similar result follows, and a similar verdict is returned. A penny-wise and pound-foolish steam user buys up a cheap boiler: it bursts, kills someone—verdict as before. Another wiseacre never overworks his boiler, and so goes quietly on for years, brooking no interference, because he never works above a proper pressure. At last a seam gives out through corrosion, or some similar cause, down comes—or rather up goes—his roof: death follows, and verdict as before. And we could fill a page with such and many other cases of ignorance, carelessness, prejudice, and shortsightedness which pass unpunished, because of the irresponsibility attaching to the culpable parties.

Now, it is very obvious that since society cannot take care of itself, authority ought to step in and override moral obliquity. Our guns and our cables are proved; why not, then, our boilers? In other countries the Governments insist on this, and were we to do so it would be the first step towards remedying a very dangerous condition of matters. But this would not be enough. The conditions under which guns, cables, and boilers are used imply wear and tear, and of a hard and trying nature, too. Then, if the users are not competent to judge for themselves as to the soundness or unsoundness of their machines, and if a wholesale destruction of life and property is probable by their failure, surely it is time for authoritative intervention. But as there appears no disposition to take the question up in this form we must turn to another view of the case, if haply we may find some means of checking the evil in a different direction. Prevention is certainly better than cure, and there are hundreds who have the good sense to act out this adage in a practical way, by joining one of the boiler insurance associations, and having their boilers inspected periodically. But the frightful accidents which constantly occur from boilers "not under inspection," induces us to look around for a legal cure since there is no legalized system of prevention.

Working, then, in a circle, we again arrive at our starting point, coroners' inquests. And here the first thing we have to notice is the notoriously unsatisfactory evidence which is adduced on these occasions as to the cause of the sad catastrophes under investigation. We cannot help thinking that an important step towards the reduction of the number of steam boiler explosions would be accomplished if it were made compulsory on the part of coroners to call to their assistance competent scientific men. These witnesses should be experienced in the construction and working of steam boilers. They should examine the exploded boiler, and make a searching investigation into all the facts relating to the occurrence. They should prepare plans and detailed particulars, which should undergo the careful consideration of the jury. By this means the blame would be brought clearly home to the right party, and we hope the law would be found to provide a punishment proportionate to the merits of the case. It is but reasonable to infer that by the above course of proceeding we should have, in the first place, reliable evidence, and verdicts in accordance with stated facts. Were this so, boiler owners—knowing that in the event of an explosion occurring to their boilers, a searching investigation would be made—would exercise greater care and precaution in the purchase of their boilers, the selection of their attendants, and would adopt all the precautionary measures at their command in working. That we should then have greater immunity from such fatal occurrences is not a mere matter of speculation or conjecture, but an absolute certainty. One, too, proved over and over again by the returns of the boiler insurance companies, which tell the ever-constant tale of boilers saved from bursting, by timely examination on the one hand, and of the explosion of boilers not under inspection on the other.

We are very glad to be able to say that not only are we not alone in our views of the subject, but that these views are now finding expression in a quarter where they are likely to lead to a practical issue. We may write and write till we are tired, and still may fail to convince some who choose to hold a contrary opinion. But when it comes to publicly recording the unanimous opinion of such gentlemen as Mr. Fairbairn, Mr. Whitworth, Mr. McConnel, and others of the same stamp, the most supine and apathetic may be led to see that there is something of responsibility attaching to steam boiler ownership after all. In view of this, it was certainly with satisfaction that we noticed the resolution on this head, which was passed

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at the annual general meeting of the Manchester Boiler Association, held at Manchester last week, under Mr. Fairbairn's presidency. The resolution, which was supported by Mr. Webster, the eminent Queen's counsel, sets forth:—"That investigations conducted by coroners, as to the cause of steam boiler explosions, are, as a rule, unsatisfactory, the evidence unsound, and the verdicts contrary to facts, in consequence of which the public are misled, and these disastrous occurrences allowed to continue with constant loss of life. Fuller investigation would prevent this, and it is, therefore, highly desirable that coroners should at all times avail themselves of competent and independent engineering assistance in conducting inquiries having reference to steam boiler explosions, and this meeting requests the Committee of Management to take such steps as they may find necessary to ensure this becoming the established practice."

We rejoice to see such a resolution emanating from such a body of men as were assembled at its passing, and we have now some hope that the subject will assume a definite and tangible form. It was some four years since discussed by the Society of Engineers whether it was not within their province to bring the subject under the notice of the Government upon public grounds. We think it was; and if the members are still of the same opinion, it is doubtless still open to them to aid in the movement by co-operating with the authors of the resolution. This will be the more easy when it is borne in mind that Mr. Fairbairn and Mr. Whitworth are enrolled amongst their honorary members. But however this may be, and from whatever quarter the movement may receive support, it may depend upon ours. We are strongly of opinion that. having been once set on foot, the question will not rest until satisfactory provision has been made for enabling coroners' juries to arrive at more just conclusions than they generally do, and to give occasionally a verdict somewhat the opposite of "accidental death."

ELECTRICAL COMMUNICATION IN TRAINS IN MOTION.

THE vexed and long-agitated question of communication in trains in motion has received a step in advance, by the report Colonel Yolland has just sent in to the Board of Trade upon "experiments recently made on various lines of railway in which some of the trains have been run wholly or partially fitted with different systems of electrical communication between passengers and the servants of railway companies in charge of those trains." By instructions issued from the Board of Trade, certain experiments were to be carried out with the view of testing again the feasibility of the various plans of passenger communication that had already been tried; in addition to the fitted trains already running on the London and South-Western and the South-Eastern Railways, trains on a different plan were fitted on the London and North-Western, and on Mr. Preece's system (the South-Western) on the Midland Railway. In order the better to test the working of these communications, instructions were issued that the trains should be started from the stopping stations by the rear guard using the communication to the head guard and driver, careful reports being made of the daily workings of the communication. In the document now before us, Colonel Yolland gives an exhaustive report of the various workings, of which we give some details, but, as some description of the different systems is necessary, we state simply, for the information of our readers, their various peculiarities, and the manner in which each resembles or differs from the others. The plans tried were Mr. Preece's on the South-Western and Midland, Mr. Walker's on the South-Eastern, and Mr. Martin's on the North-Western. They have each a single conducting wire running throughout the train; for extra safety, two couplings, fixed at one end to the carriage, are used by Preece and Martin, whilst Walker uses one movable coupling. Each system provides a bell with battery and signalling arrangement in the guards' vans, a signalling arrangement in the carriages, on the plan that the communication once made remains so until the advent of the guard; the principle in each is identical, but different in detail. Preece and Walker have bells on the engine—on the Midland a semaphore on the weather board was used—Martin has none. Walker alone uses an external visual signal to indicate the compartment or carriage from whence the alarm was raised. The three plans are worked identically on the same electrical system, that known as "current equilibrium," and first used on the South-Western, where it is used in its integrity, requiring no adjuncts, such as the switches in the vans as used on the South-Eastern and North-Western; they are not required, and must render the working more confused by introducing further complications, which, in this case, are unnecessary.

Current equilibrium may be simply stated. If an insulated wire be continued for any length, and at various points in it similar poles of equal batteries be connected, the opposite poles being to earth, it is evident that the current will be in equilibrium, that the batteries are inactive. Let any point of the insulated wire be put to earth, the batteries immediately start into activity, and can be made to act upon any bell, indicator, or other apparatus. We can thus easily understand the electrical system in trains, the batteries in the various vans connected to the insulated wire, and each compartment being a point where a mechanical arrangement is brought into play for putting that wire to earth, and causing an action on the bells in the guards' vans. This is the system which may be said to be the only true one for working trains electrically. On the North-Western the results are reported as satisfactory; the experiments commenced on January 8, with a train of two vans and seven carriages making twenty-five double journeys of 125¾ miles, representing a mileage of 6,287 miles. Three failures are spoken of, all being in the conducting wire, which had "been unnecessarily twisted and broken by porters in the act of taking off the electrical coupling wires." On the South-Western experiments were made with the up and down Exeter expresses on the system of Mr. Preece, which has the merit of being constantly in use on this line since May, 1865—nearly three years. These trains usually consisted of the fitted engine, two vans, and five carriages, the distance being 219¾ miles. Forty-eight double journeys were made, giving a mileage of 21,096 miles. Seven failures in starting signals are reported, but these are all satisfactorily accounted for—two are due to the bell being placed on the tender—blowing off steam preventing the driver from hearing it; four occurred at Exeter station on account of the train standing on turn-tables preventing the "earth" being made good; the remaining failure is supposed to be due to the guard making the signal improperly. These seven failures cannot be looked upon as due to the system itself, and practically are not failures at all. Colonel Yolland remarks, "I travelled by this train on the 19th inst., and found the communication complete to the guard." "I think these experiments must also be regarded as satisfactory."

On the Midland, the Leeds express was fitted up with the same system, with the difference of a semaphore on the engine instead of a bell; this train did not work so satisfactorily as the above: this is not to be wondered at when we consider the changes made in the journey. The train left King's Cross with the fitted engine, two vans, and six carriages, one of which was not fitted. At Trent, the train was broken up, the two vans, two fitted and one unfitted carriage going on to Leeds. At Chesterfield, two unfitted carriages were added on. At Normanton, one unfitted van was taken off, and the train arrived at Leeds with "two fitted and two unfitted carriages, two vans, and the engine fitted." On the up-journey the reverse would take place. It is to be wondered at that the communication acted as well as it did. This train ran thirty-four double journeys of 201 miles each way, giving a mileage of 13,668 miles. A good many failures took place, but they were most of them satisfactorily accounted for. Two were due to weak batteries—a fault that could not occur if trains were well looked after; the others were principally mechanical, and are due more to the way in which the train was fitted up, which was without Mr. Preece's supervision. The substitution of a visual signal, such as the semaphore, in the engine does not appear to have been a satisfactory change; the travelling inspector, who was told off to carefully watch this train, reports "there is no dependence upon the drivers observing this signal; many of the signals given have been missed by them. The men say that looking out and watching their engines occupies their attention so much that there is no dependence to be placed upon their seeing the signal."

On the South-Eastern three down and the three up corresponding trains were fitted on Mr. Walker's plan, and ran respectively 96, 116, and 112 journeys of 88 miles each journey, giving the following mileage—8,448, 10,208, and 9,886 miles. The trials of these trains were reported as being very satisfactory, eight failures being reported, besides "six others where the train was not fitted." The failures are accounted for by weak batteries or mechanical defects. A train running so short a distance, and with so very few stoppages, place these trials upon the most favourable footing, and we are rather surprised at hearing of any failure at all. The comparative statement of mileage of these trains would be—

	Miles Daily.
Midland, one train running	401
North-Western, one train running	251½
South-Eastern, three trains running	each 176
South-Western, two trains running	„ 219¾

With the exception of the South-Western all these trains made double journeys, stopping for some hours at the terminal station, being cleaned and made up again, and returning to their original departure station same day.

These trials may be looked upon generally as a trial of one electrical system worked with slightly different mechanical arrangements. The success of any one proves the correctness of the system, whilst the success of all three places it beyond doubt. In all these trains the communication was frequently tried from the various carriages, and in all cases the mechanical arrangements were found to be equally satisfactory.

Referring more particularly to these electrical experiments, Colonel Yolland remarks, "the more simple the means of communication provided, the better it will be. Visual signals outside each compartment of a carriage or on the engine are useless, and only serve to increase the cost of the apparatus. Electric bells to ring in the guards' vans and on the engine are all that can be necessary." Colonel Yolland considers that there are some differences which should be got rid of. He only mentions one—the use of a single coupling on the South-Eastern (the position of which he objects to), and the use of two on the other lines; two couplings are used to ensure a good electrical contact, and render

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failure less likely. Another question is, should these couplings be entirely disconnected at both ends or remain a fixture at one end to the carriage. We certainly think the latter the more approved method, and prefer using two couplings to one. This is a point there should be unanimity in. The manner of coupling on every line should be the same, for then a carriage would always be able to work in connection with foreign stock. No mode of communication will, in his opinion, be considered efficient which does not provide that a signal shall be given to the driver in the event of a train breaking away, and this can, he says, be effected with the electric apparatus. Many inventions were shown to him for carrying out the required objects, but he has declined expressing an opinion upon any that have not been in practical working on a line. As regards the possibility of establishing and maintaining electric communication throughout the entire length of a railway train, he thinks it is impossible to doubt that it can be done; but in order to keep such a system in order, it will be necessary that by starting trains and frequent signalling, it should be so worked as to be always in order, for fear that from disuse, it may, when required, be found wanting.

We are glad to find that our own opinions on this subject are so fully borne out, not only as to the practicability, but also to the necessity of such a communication, of both of which Colonel Yolland is thoroughly persuaded. Colonel Yolland considers that the question for decision is, shall railway companies be compelled by legislative enactment to provide the means of communication in trains—the decision pending on the questions, "Is such communication necessary, in order to provide for the public safety? Is it practicable?" For nearly three years the system of the South-Western has been working successfully; that fact is sufficient answer to the second question. As for the first, we certainly consider that for express trains and trains for long journeys, such a communication is necessary, and we should be glad to see some law passed rendering it compulsory.

PROTECTION OF THE EYES OF METAL WORKERS.

DR. HERMANN COHN, of Breslau, an oculist of some standing in the medical world, who is particularly well known by his examination of the eyes of 10,000 school children, has recently occupied himself with statistically ascertaining the effect which the occupation of metal workers has upon their eyes. The results he obtained by examining 1,283 factory workmen of Breslau are of the utmost interest for both masters and men in this branch of industry, and are worthy of a short abstract from the original paper, published in a medical journal, the "Berliner Klinische Wochenschrift." Although his range of observation was necessarily very limited, inferences on other similar branches are easily made. Dr. Cohn examined the workmen of six engineering establishments, whom he thus classifies:—599 fitters, 386 blacksmiths, 129 turners, 35 drillers, 13 planers, 27 enginewrights, 5 screwers, 15 boilermakers, 69 foundrymen, 8 cleaners of castings—altogether, 1,283. He did not include any labourers in his examinations, because their occupation is too shifting, and, therefore, he confined himself to mechanics with a constant occupation of the same character. About 90 per cent. of these men declared that their eyes had often been struck by small chips of iron, turnings, borings, or filings, which had been removed by some of their fellow-workmen. In every workshop there is a man or two who have acquired by long practice a remarkable proficiency in removing foreign bodies from the cornea. All those minor accidents were excluded by Dr. Cohn, and all the following figures refer only to such accidents of the eyes as required medical aid, and caused, for the most part, an interruption of work. Of the 1,283 workmen examined there had been 633—that is, 49 per cent.—under medical treatment for accidents caused to their eyes by metal chips, &c., and this on an average twice over, the number of accidents to the eyes being 1,231—that is, 96 per cent. of 1,283. The cleaners of castings seem to be most exposed to such accidents—87 per cent.; then come the enginewrights, 83 per cent.; turners, 69 per cent.; drillers, 54 per cent.; boilermakers, 53 per cent.; fitters, 49 per cent.; planers, 46 per cent.; blacksmiths, 44 per cent.; foundrymen, 26 per cent.; screwers, 20 per cent. Out of the 633 wounded men, 354 were soon relieved by medical treatment; but 279 required more or less time before their eyes were cured, and they consequently had to stay from work all this time. The whole time lost in this way amounted to 4,726 working days—that is, on an average, 17 days for each wounded man. The eye wounds of drillers, cleaners of castings, and turners, were soonest healed (four to ten days); next come planers, screwers, enginewrights, fitters, and blacksmiths; foundrymen and boilermakers seem to be exposed to the most dangerous eye-wounds, requiring from 40 to 47 days for curing. Out of the 1,231 eye-wounds, 1,172 were completely cured, 38 = 3 per cent. were not completely, and 21 = 2 per cent. not at all cured. This means that of 1,000 metal workers, 28 lose part of their seeing power, and 16 the whole use of one eye in consequence of their occupation.

It would not be much to the purpose in this place to follow Dr. Cohn in the medical detail of the different wounds, and their effect on the eye; only so much may be mentioned that the wounds of blacksmiths and fitters are, as a rule, of a much more dangerous character than those of other men, and that they lose one of their eyes much oftener than these. This is no matter of surprise, since their eyes are mostly hurt by red-hot metal. Now, the question arises—Cannot this danger to the eyes of metal workers be avoided by their using protecting spectacles? Of the men examined by Dr. Cohn, only 21 used blue conservation spectacles, in consequence of previously received wounds; and 31 used ordinary convex glasses, owing to their being far-sighted. Not one used protecting glasses. When asked why they did not take more care of the most noble organ of their body, the men always replied, "Spectacles are too easily broken," "They are too heavy, and they are too dear." These objections are unquestionably valid, and caused Dr. Cohn to consider what other preventive means might be resorted to against those too frequent accidents to the eyes of metal workers. There happens to be a manufactory of objects of mica, such as lamp chimneys, &c., at Breslau, where Dr. Cohn resides, and thus mica suggested itself to him for his purpose. He caused Mr. Raphael, the proprietor of the just-mentioned establishment, to try experiments with manufacturing protecting spectacles from mica, and those experiments were crowned with perfect success. They seem to have completely solved the above-named difficulties. The mica spectacle glasses are curved somewhat in the shape of watch glasses; they not only protect the eye in front, but their brass frames fit closely on the osseous circle round the eye sockets, so that no chips can enter the eye from any part, and still the eyelashes do not touch the glasses. The frame is made of thin brass wire, which can easily be bent by hand into any shape. As hinge-joints would have caused too much expense, the side parts are soldered on to the frame. The thickness of the mica is one-half millimetre. Only the purest kind of mica being used for this purpose, these spectacles are just as transparent as real glass ones. They impart, to be sure, a slight pale grey tint to the objects, but they do not in the least weaken the optic power of the eye. For blacksmiths and foundrymen, such a grey tint is rather an improvement, and for other metal workers it is not in the least objectionable. Now, these mica spectacles, besides protecting the whole eye, have the following advantages:—First, they cannot be broken; heavy blows with a sledge-hammer only squeeze them flat, without breaking the glasses. They may be thrown to the ground with full force without being damaged in the least. Red-hot metal poured on the mica does not make any impression on it. The shower of pointed particles of iron which issues from lathes, &c., only rebounds from the perfectly elastic mica glasses. Secondly, Mica spectacles are almost twice as light as glass spectacles; a pair of French watch-glass-shaped spectacles weighs 13·9 grammes; mica spectacles only 7·5 grammes. Thirdly, mica spectacles keep the eyes of the workmen cool, mica being a very bad conductor of heat. Fourthly, mica spectacles are very much cheaper than glass spectacles, especially watch-glass spectacles, which are the only ones that protect the whole eye. The mica spectacles are sold at Breslau for about eightpence English money a-piece. They would be, of course, a few pence dearer in this country, as carriage, duty, commission, &c., would add to the expense. But, at all events, their cost would be exceedingly trifling when compared with the very serious expense, loss of time, and pain that are caused to iron workers by the frequent accidents to their eyes. No doubt, Mr. Raphael will soon establish an agency for the sale of mica spectacles in this country, and we shall then hear more about them. As it is, we strongly recommend our metal workers to look into so important a matter.

PREPARATIONS TO PHOTOGRAPH THE GREAT ECLIPSE.

IN the middle of August next there will be a total eclipse of the sun, of almost the longest possible duration, and visible in India. The Indian Government has, consequently, made preparations to obtain a photographic record of the phenomena presented during the obscuration, in order to gain still further information as to the physical constitution of the sun. Major Tennant and a party of sappers have spent some days at the observatory of Mr. Warren De La Rue, at Cranford, in order to perfect themselves in astronomical photography before they attempt the work before them next August in India. The telescope to be employed upon the occasion is now in course of construction by Mr. Browning, F.R.A.S., and it is almost an exact copy of the one used at Cranford by Mr. Warren De La Rue. The mirror, of silvered glass, is 5ft. 9in. in focus, and the image of the sun—which it will throw out at the side of the tube, because of the interposition of a plane mirror, as in the Newtonian telescope—will be a little more than 1in. in diameter. This small size of image of course gives an enormous concentration of light, but when the pictures are taken the dark body of the moon will obscure all but the prominences upon the sun, thereby reducing the overaction which might otherwise be expected. The process to be adopted is that hitherto used with so much success by Mr. De La Rue in lunar photography. The collodion will be salted with iodine of cadmium only, excited in a 30gr. or 35gr. bath, developed with pyrogallic and acetic acids, and fixed with hyposulphite of soda. The totality will last nearly five minutes, in which time it is expected that six negatives will be obtained. Each plate will be enclosed in a metallic dark slide, and rest against ledges of chemically pure silver, the latter metal giving security against stains. Great

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care has been taken by means of micrometer wires and other devices to secure the accurate "register" of each plate, and to make the pictures comparable one with the other in the matter of measurements. No attempt will be made to magnify the image of the sun by the interposition of lenses between the mirror and the photographic plate, because this plan would diminish the intensity of the light, lengthen the exposures, and interpose possible sources of imperfection in the matter of focussing.

By long experience lunar photography has been brought to a high degree of perfection, and the processes adopted are sound in principle, both theoretically and practically. Solar photography is open to a little more criticism, because every practical photographer knows that bromides are much better adapted for taking brilliantly-lighted objects than iodides. It is only within the last few months that the right method of working with bromide of cadmium only, and no iodide, has been discovered. In the early days of photography it was thought that bromides alone were useless in collodion, because they gave nothing but thin grey images, devoid of pictorial beauty, and the mistaken opinion was caused by the fact that experimentalists worked with bromides in conjunction with the same baths and solutions found so successful with iodides.

The fact of the matter is, that a bromized collodion must be treated in an altogether different manner to give the best results. The silver bath should be double the ordinary strength, that is to say, sixty or seventy grains to the ounce, and the collodion, containing ten or twelve grains of bromide of cadmium to the ounce, should be excited in it for about ten minutes. When taken out, the solution upon the plate will be much too strong for clean development: hence the plate should be dipped in a second nitrate bath, weaker than the first and very pure, after which it is ready for exposure. This second bath may with advantage consist of the ordinary preservative used in the glycerine process, as the purified organic matter contained therein has a beneficial effect on the pictorial qualities of bromized plates. The bromized collodion works best a month or two after mixing, and sometimes the addition of a minor proportion of iodized collodion is an advantage. A pyrogallic acid developer is probably the best under ordinary circumstances, though when the organic preservative is used, the pictures given by iron development are so delicate that it is doubtful whether they would show symptoms of granulation under the microscope.

In photographing the great Indian eclipse, it is quite evident that the operators must not be allowed to try novel photographic experiments, yet the views here set forth demand serious consideration. It is an established fact that bromides will photograph details in brilliantly lighted objects, which iodides are incompetent to produce, showing in place thereof a dark patchy blank. Bromized glycerine plates will secure good pictures of brilliantly-lighted fleecy clouds after an exposure long enough to utterly spoil the same clouds upon an iodized plate. Solarization may in all cases be checked by a trace of citric acid in the developer, yet this acid must be added very sparingly, because an excess of it lengthens exposure. For lunar, stellar, and planetary photography, we acknowledge, upon theoretical grounds, that the use of iodized collodion is right in principle, but in the matter of the intense light incidental to solar photography, the presumptions are very strong in favour of bromides. When a commercial photographer wishes to secure detail in a brilliantly-lighted white object, his rule is to use a "highly bromized collodion, slight over exposure, and slight under development." Till experiment shall prove the contrary, it is difficult to see why the same principles should not hold good in solar photography. At all events, no stone should be left unturned in the attempt to bring solar photography to such perfection that the plates will take impressions of every feature presented by the sun, and set at rest the dispute whether interlacings, like "willow leaves," are ever seen upon its disc, since one set of observers says they are sometimes to be seen, and other observers ascribe the alleged phenomena to imagination. Moreover, bromides are sensitive to more of the rays of the spectrum than iodides, so are calculated to include a slightly greater range of actinic phenomena. An experienced practical photographer would be a valuable addition to the Indian expedition.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

TO SEPARATE BUTYRIC ACID, AND OBTAIN PINEAPPLE ESSENCE FROM GLYCERINE—A NEW MODE OF ORNAMENTING PAPER—A PROCESS FOR SILVERING HOOKS AND EYES MADE OF IRON WIRE.—THE PHYSICAL PROPERTIES OF PETROLEUM—A DISCOVERY IN MAGNETISM—NEW CHEMICAL DISCOVERIES.

GLYCERINE separated from most fats is contaminated with butyric acid. Its pre , according to H. Perutz, may easily be recognized by distilling the glycerine with some sulphuric acid and alcohol, by which means butyric ether will be obtained and at once identified by the pine-apple odour. On the large scale, the butyric acid may be separated by filtering the glycerine through animal charcoal. The acid will be retained in combination with lime, and the butyrate of lime may afterwards be extracted by alcohol, and the solution, on distillation with sulphuric acid, will give pineapple essence in commercial quantities at a cheap rate; or the butyrate of lime may be decomposed by the addition of oxalic acid, and the butyric acid purified by distillation.

Puscher gives a simple process for ornamenting paper with silky crystals, an improvement on the method we published last year, in which sugar of lead was employed. He now recommends sulphate of magnesia to be used. He dissolves six parts by weight of Epsom salts and six parts of British gum in six parts of water, adds a small quantity of glycerine, and boils the liquid for a moment. He then strains the solution and allows it to cool a little. Before it is quite cold he spreads it with a camel's hair brush upon paper previously done over with a thin solution of glue or gelatine. As the paper so prepared dries it becomes covered with a beautiful crystalline surface. The crystals are long or small according to the strength of the solutions, and rapidity with which the paper is dried. To obtain variegated crystals, the solution may be coloured with various aniline colours, and the paper must be prepared with a mixture of equal parts of white of egg and water instead of the gelatine solution. Paper so ornamented, it is said, may be glazed by passing it between rollers or putting it under a press. In consequence of the presence of the glycerine, the paper does not completely dry, and may be printed upon by the lithographic process without being moistened. The process is recommended for ornamenting envelopes, dinner, pattern, and visiting cards, and also playing cards. One perhaps useful application remains to be noticed. A solution prepared with one-third the quantity of gum before mentioned, and with no glycerine, may be applied to a lithographic stone, and a copy of the crystallization obtained may be transferred to another stone by the usual lithographic process. A transfer may be made from this to three or four other working stones, from which many thousands of impressions of the crystals may be taken. The author recommends the impressions from these stones on yellow paper as a back ground for bank notes, for as no two exactly similar crystallizations are likely to be obtained it will be impossible to commit a forgery. The yellow paper is, of course, recommended to prevent a copy being made by photography.

A process for silvering hooks and eyes made of iron wire has been patented in Bavaria by Toderer. Such hooks and eyes are first suspended by means of zinc in a copper vessel containing dilute sulphuric acid until the iron shows a clean bright surface. They are then well rinsed with water, and afterwards placed in a bath of a mixed solution of sulphate of zinc, sulphate of copper, and cyanide of potassium. Here they remain until they receive a bright coating of brass. They are lastly transferred to a bath of nitrate of silver, cyanide of potassium, and sulphate of soda, in which they quickly receive a coating silver. This new manufacture, it is said in "Dingler's Journal," answers all requirements. To us it looks complicated, and the result improbable, but we give it in case any of our readers should like to try the experiment.

The physical properties and calorific power of American petroleum have been investigated by M. Henry Deville, who has just communicated his results to the Academy of Sciences. We shall return to the memoir for some useful facts it contains, and now only notice one important point established. M. Deville shows that Pennsylvanian petroleum increases in bulk by one hundredth of its volume for every 10deg. Centigrade of heat. This, the author points out, is a fact to be considered when storing petroleum for fuel in steam vessels, where it will necessarily be exposed to a higher temperature. Space should be left in the casks to allow of this expansion, or they may burst and give rise to an explosion. Another source of danger on board ship—and, as dealers and speculators in the article well know, a cause of great loss—is the power petroleum has of penetrating wood. The loss and the danger, however, may both be obviated by paying over the interior of the casks with a strong solution of glue or albumen. This, when dry, forms a coating impermeable to the oil. There are other solutions used for the same purpose, but nothing, we believe, answers better than glue, although M. Garnier states that he can send petroleum about safely in paper bags saturated with a preparation of his invention. M. Deville makes the recommendation quite unnecessarily we think, that the lighter oils should be distilled off when the petroleum is intended for fuel.

M. Gerard has discovered a very curious fact. If a metallic ring made of wire, the diameter of which varies regularly, so that at one side of the ring it is very thin, and at the other side relatively very thick, be suspended over an electro-magnet, it will begin to revolve. The author sees in this fact the germs of a new system of electric telegraphy, for the details of which we wait.

The indefatigable Dr. Hofmann announces the discovery of a new acid which bears the same relation to napthaline that acetic acid bears to marsh gas. A few weeks ago the same eminent chemist communicated to the Royal Society the discovery of "the mustard oil of the ethyl series."

HAVRE INTERNATIONAL MARITIME EXHIBITION.

THIS exhibition, which is to open on the 1st June, proposes features of special attraction for the shipbuilders and engineers from the opportunity it affords of bringing prominently before a large public at a great shipping port all new inventions and improvements calculated to be useful in navigation. The classes embrace everything relating to the construction, fitting, preservation, and navigation of ships and steam vessels. Models of lighthouses, port and harbour constructions, signals, diving and salvage apparatus, appliances for loading and unloading vessels. Indeed, no matter that can add to the completeness and comfort of a ship, whether for the purposes of war, common passenger trade, or fishing operation, seem to have been omitted in the programme published by the committee. The promises of support and contributions from the principal maritime nations of Europe and America, holds out the prospect of its being, indeed, an international display. There can be little doubt that special exhibitions are more likely to be generally beneficial than those great 'omnium gatherums where exhibits are swamped from the multiplicity of objects shown, rendering it impossible to form a just appreciation of merit. English exhibitors who have not already secured space have little time to lose, and should send in their applications forthwith to the concessionaries for the United Kingdom, Messrs. J. M. Johnson and Sons, of Castle-street, Holborn.

THE tolls received on the Chelsea-bridge in the financial year 1866-67 amounted to £6,014. The year's expenses were £2,398. The result was that the balance in the hands of the Paymaster-General was raised to £10,892.

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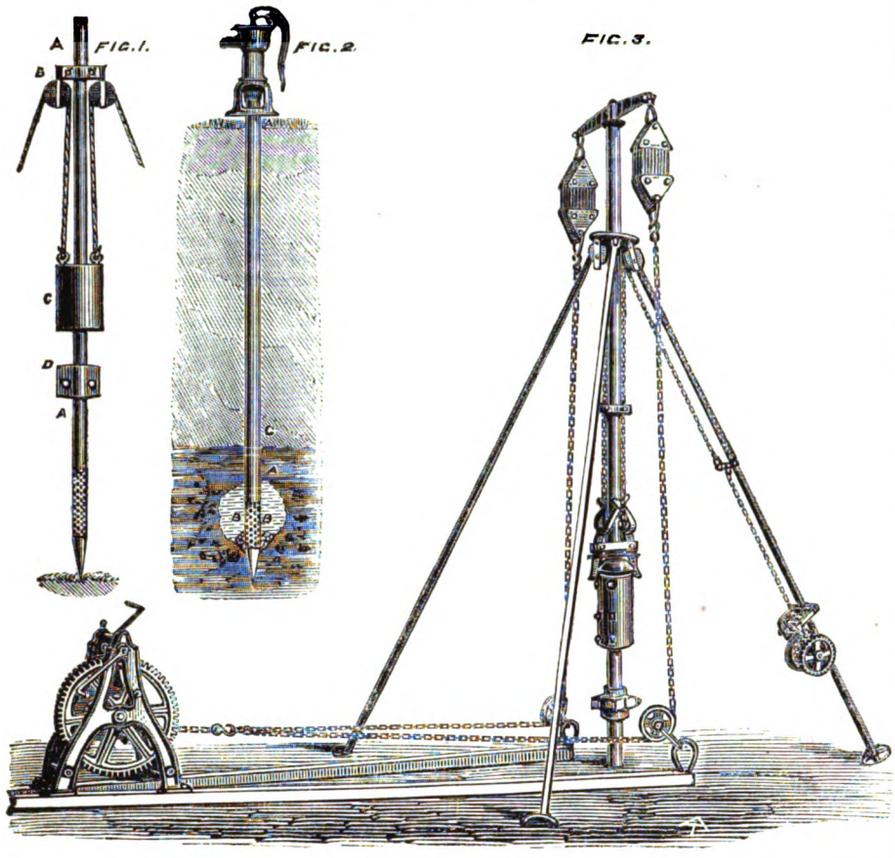
THE AMERICAN TUBE WELL.

BY MR. J. L. NORTON.



THE AMERICAN TUBE WELL.

SOME three months since we noticed in general terms the very ingenious and practical invention of Mr. J. L. Norton, of No. 38, Belle Sauvage-yard, Ludgate-hill, for obtaining a speedy supply of water. It is with pleasure that we now again refer to the subject, for the purpose of describing it in detail and of recording some highly successful experiments which we witnessed on Saturday last. The invention in question is generally known as the American tube well, and it has earned a substantial reputation from its successful working in the Abyssinian operations. First, to describe the tube well, we will refer our readers to fig. 1 of our engraving, where the lower portion is seen in elevation. The tube well is made of wrought iron of various lengths and diameters, the ends being screwed. The lower part is perforated for about 2ft. from the bottom, and the driving point is of steel. The tube well A is driven into the ground by a monkey C, suspended over pulleys attached to the clamp B, from which it is worked by ropes. The monkey falls on the clamp D, which is made in two parts bolted together on the tube. The insides of each of the clamps are serrated so that they take a bite into the tube, and are thereby prevented from slipping. When in the course of driving the clamp D reaches the ground level, it is unscrewed and raised to a higher position, and the operation of driving is resumed, the monkey clamp being also raised. This is repeated until the well is driven the necessary distance to secure a plentiful supply of water, which is ascertained by dropping a leaded line down the tube. With 5ft. or 6ft. of water in the tube or well, an abundant supply may always be depended on, though it may be driven further if thought advisable, care being taken not to drive through and out of the water stratum. As soon as the well is driven the required depth a cleansing pump is attached, and by pumping for a short time the sand, fine gravel, and dirt around the perforated end of the tube is pumped up and a closed reservoir is formed. The tube well as sunk, and having the pump fixed ready for working, is shown at fig. 2, where B shows the reservoir, and C the line of the water-holding stratum. The first water is accompanied by sand and gravel, &c., and when it runs free from these the cleansing pump is replaced by a permanent pump, which completes the well and fits it for use. Should any stoppage occur by reason of the tube having been sunk through clay, or from any cause, water is forced down the tube under any required pressure and clears a ready passage to the water-bearing stratum.

Having described the tube well, we will now direct attention to the experiments which were made last Saturday in a field at Thames Ditton. The little Abyssinian tube was the first point of interest. This tube well is 1¼in. in diameter, and is worked by two men, with a 70lb. monkey, driven over pulleys attached to a light iron tripod, as at fig. 3. This obviates the necessity of shifting the upper clamp, and insures a direct vertical blow. In the present instance, the tube was driven 14ft. into the earth—a gravelly soil—in 17min., when it was found by sounding that water was reached, there being about 5ft. in the well. The cleansing pump was then put on, and in 2min. more, or 19min. from the commencement of the operation, water was pumped. Having demonstrated this point, it was proposed to show how easily the tube well could be removed. By means of a lever the well was drawn up and laid upon the field in a minute and a quarter. In another part of the field a 2-inch pipe was driven 30ft. into the soil, in a proportionately short time water being as readily obtained. Further on was a larger tube of 3in. in diameter, which had been driven to a depth of 14ft., and in which the water rose to a height of 5ft. 6in. The operation of sinking this large tube derived additional interest from the application of Mr. Norton's patent accumulator in the process. This special feature is seen at fig. 3, which represents the method of driving the 3-inch pipe by the aid of the accumulator. This apparatus consists of a crosshead, which is kept in place on top of the tube, and to each end of which is attached an apparatus, formed of two sets of triangular iron plates, bolted through at various points, but kept about half an inch apart. These iron frames are connected by a series of strong india-rubber bands which pass over the connecting bolts in each set. From the bottom of each accumulator a chain passes away to the crab, which is turned sufficiently to bring a pressure on the top of the tube. A constant downward pressure on the pipe of ten, fifteen, or twenty tons, as the case may require, is thus secured. By this highly ingenious arrangement the inertia or rebound of the pipe, when the blow from the monkey comes upon it, is effectually overcome. This result was practically demonstrated on Saturday by the rapidity with which a tube of the comparatively large diameter of 3in. was sunk. The several experiments, which were attended by a number of scientific gentlemen, were a decided success, and showed that tubes of large as well as of small diameters could be sunk with facility and certainty.

The general merits of this system of well sinking are known and admitted, having been proved in all parts of the country, and having been brought prominently under notice by the operations in Abyssinia. Our notice, however, would hardly be complete did we not draw attention to its numerous advantages, and make some deductions from Saturday's trials. But, first, let us say that the inventor does not pretend that the tube well can produce water under any conditions, or where that element does not exist. It is simply an easy, economical, and efficient system for obtaining water in water-holding strata, and as such our experience of its working enables us to recommend it with confidence. The invention facilitates the operations of testing for and obtaining water quicker, cheaper, and purer than by the ordinary tedious and expensive process. In strata where water varies very much in its quality at various depths, instances have been met with in which large sums of money have been spent in attempting to sink curbs or rings in quicksands to form a well, and have failed, where, on the patent tube plan, the most successful results have followed. The difficulty of drawing water from a quicksand is admirably overcome by a filter, which is placed in the perforated end of the tube well. This filter is thus constructed. Within the perforated end of the tube is an inner tube, also perforated, and around which is coiled a sheet of wire gauze, which fills the annular space between the two tubes. By this simple expedient wells are successfully sunk in soils such as the Bagshot sand. In a sanitary point of view, too, the tube well must prove valuable, inasmuch as it frequently happens in sinking a well on the old principle that a stratum of bad water has to be gone through, and which it is impossible to keep out, whilst, under the tube system, no surface or other water can filter through. Water obtained by this plan is thus free from all atmospheric influences, surface drainage, sewage, or cesspool leakage. The conclusions to be drawn from the recent experiments are, that the operation of sinking the tube wells is simple, cleanly, effected without disturbing the ground, and may be performed by unskilled labour. Should the sinker be disappointed in finding water the well may easily be withdrawn and driven in another place, without any loss except that of a little time and labour. On the other hand, especially with a little knowledge of the locality and strata, or if judgment be displayed, should water be present, it will assuredly be found and rendered available more quickly by the tube well system than by any other known means.

TRIALS OF ARMOUR PLATES.

SOME trials of armour plates, from Messrs. Cammell and Co.'s, Cyclops Steel Works, Sheffield, took place last week on board the "Thunderer." They comprised an 8in. plate, for the colonial turret ship "Cerberus," building by the Palmer Shipbuilding Company, Jarrow-on-Tyne, and a 6in. plate for the second-class armoured iron frigate "Audacious," building by Messrs. Napier, of Glasgow. The 8in. plate was 12ft. in length, by 3ft. 6in. in width, and was struck by nine shots within an area of 32in. vertical, and 18½in. longitudinal measurement. The maximum indent was 1·6in., and the minimum 1·5in. Two shots fell on the edge of a bolt without doing any injury, and the result of the total pounding only brought out slight surface cracks within the area of the indentations. On examination, the plate exhibited favourable results, the greatest amount of bulge on its reverse side being only 2⅜in., all the openings in the metal being longitudinal. The 6in. plate measured 16ft. 7in. by 3ft. 8in., and was struck by five shots, within an area of 19in. square. No damage on the obverse side of the plate was done outside the area of the shot indentations. The maximum indentation was 2·1in., and the minimum 1·9in. On examination, this plate was found to have only longitudinal openings on the reverse side, but although undoubtedly one of good character, the plate was softer in metal than the average of plates are found on trial, the extent of the bulge being 3⅞in. On the whole, the plates exhibited favourable results.

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RAILWAYS AND THEIR MANAGEMENT.

A PAPER was read at the meeting of the Society of Arts, on Wednesday night, on the subject of Railways and their Management, by Mr. Robert F. Fairlie, C.E. The Marquis of Clanricarde presided, and there was a numerous attendance of members and their friends. The paper commenced by showing that at least 20 per cent. of existing railway investments are unproductive, but that the whole might be rendered remunerative by an adequate system of working and management. In this respect Ireland furnishes an opportunity for effectively developing the principles by which such results could be secured. An imperial guarantee of 3½ per cent., which would not involve the State in a liability of more than £100,000 per annum, would evoke from private sources sufficient capital to construct nearly one thousand additional miles of railway in Ireland, by which its most distant points would be connected with the best markets for their produce. And this guarantee would not remain a burden upon the State for many years, provided the outlay was judiciously made, and the management adapted to the actual requirements of each locality. At present, Ireland, with less than 2,000 miles of railway, had between thirty and forty independent boards of direction. The consequence was that fares were unnaturally high, and the management without proper combinations for the public benefit. Experience had shown that concentration of control did not involve monopoly, and that it was indispensable to successful administration, as well as to remunerative action. Referring to the English lines, Mr. Fairlie expressed his strong dissent from the practice of expending capital upon palatial stations; and observed that, in future, attention must be directed to the economy of capital. As a general rule, the natural configuration of a country would permit the working of railways upon the principle of surface construction, securing public safety and convenience on the one hand, and on the other a fair return for the capital invested. Capital accounts must be closed, which he contended might be effected without difficulty, if the administration was based upon sound principles. Charges for renewals of road, stock, and stations ought to be placed against revenue; but every new work of an original kind ought to be provided for by a special capital, which capital should be redeemable out of the surplus annual revenue. He strongly condemned the raising of capital at a discount as the worst possible mode of raising money, because its simple effect was to increase all the expenses attending the line, and because it was impossible such a mode of raising money could improve railway credit. The more rational way was to raise the money required by loan, and to redeem the debt by half-yearly payments set aside from profits.

Mr. Fairlie next showed that revenues might be increased concurrently with a large reduction of working expenses. Railway managers seldom took the trouble of ascertaing the returns from each train, compared with its expenses; but he would recommend a debtor and creditor account to be kept of every train run, as the only safe means of ascertaining profits and loss. The gross earnings of the London and North-Western Railway in 1866, were at the rate of 5s. per train per mile for passengers, and 6s. 3¾d. per mile for merchandize; but he contended that the earnings ought to be in proportion to the speed. For passenger trains at twenty miles speed per hour the gross earnings ought not to be less than 7s. 6d. per mile; 10s. for thirty miles; 14s. for forty miles; 20s. for fifty miles; and 30s. for sixty miles. It was absurd for companies to make such slight differences in their charges for high and low speeds, seeing that the cost of working increased in proportion to velocity. The gross earnings of the Brighton line were under 4s. 10d. per mile, though many of their express trains must realize not less than £3 per mile. It was clear, therefore, that a large number of trains on this line must be run at a loss. He counselled, in all cases, the abandonment of non-paying trains, believing that the public would not expect the companies to carry them without a proper return. As to expenditure, he strongly urged the disadvantage of overweighting trains by the use, for example, of tenders, observing that generally they were 200 per cent. in excess of the paying load carried. The load of fuel and water carried by the tender should be made available to increase the power and efficiency of the engine itself. At this moment he had at work on a Welsh railway engines without tenders, where the fuel and water were in the highest degree conducive to the power, economy, and safety of the engine. The weight was distributed equally upon a large number of wheels, thus increasing their adhesion upon the rails, while the weight on each wheel was reduced in proportion. Here was the basis of an entire revolution in our locomotive arrangements, which would be attended with enormous economy. It would reduce the proportion of dead weight to paying loan; and, applying the same principle to passenger traffic, he showed, by calculations, that a saving might be effected equal to a dividend of over 3 per cent. per annum. Ordinary omnibuses weighed about one ton, and carried twenty-eight passengers, or two tons, thus giving two tons of paying to one ton of unpaying load; but the Metropolitan Railway on its present system, carried only one ton of paying load to thirty tons of dead weight. Its effect on the rails was destructive, and it accounted for the necessity of frequent renewals. Mr. Fairlie illustrated by diagrams the mode in which a constant battering was kept up against the rails by the wheels under this arrangement, destructive alike to both; and how effectively this destruction was prevented by engines of his own construction—engines which would turn any curve and ascend any gradient; and he quoted Captain Tyler's and Mr. Eborall's report of their adaptability to such lines as the Grand Trunk of Canada, as combining a minimum of wear and tear to themselves and the rails, with a maximum of adhesion to the rails, and of economy in working. Models were exhibited in demonstration of these conditions, and after some further references to the necessity for the construction of cheap railways in Ireland, Mr. Fairlie concluded.

The paper was followed by a good discussion, at the close of which the Marquis of Clanricarde, in a very able and humorous speech, proposed a vote of thanks to Mr. Fairlie. The Marquis expressed himself very much in favour of Mr. Fairlie's system, and considered it particularly applicable to Ireland, where a cheap and efficient system of railways was very much required.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

THE proposition to hold an exhibition in London, of objects of an aeronautical character, having met with encouragement, the council have determined to act upon the proposition, with the hope that the guarantee and prize fund will be materially increased. The objects hitherto announced for exhibition promise interesting features for the engineer and mechanic, and there will not be wanting experiments of a practical character, which can scarcely fail to interest the general public. The objects are classified as—1. Light engines and machinery. 2. Complete working aerial apparatus. 3. Models. 4. Working models. 5. Plans and illustrative drawings. 6. Separate articles connected with aeronautics, including objects of interest illustrative and commemorative of previous experiments. 7. Kites or other similar apparatus proposed to be used in cases of shipwreck, traction, or in the attainment of other useful ends. 8. Painting and drawing of cloud scenery and landscape as seen from a balloon. The exhibition will be opened on Thursday, the 25th of June, at the Crystal Palace. Arrangements have been made, by order of the Treasury, for facilitating the passing of goods intended for the aeronautical exhibition, through the Custom House, upon the production of a document specifying the mark, number, and contents of each package. The packages will be received at the Crystal Palace on and after the 1st of June, until the day of opening. It may be observed there is no duty upon philosophical instruments or machinery of any kind.

The fund out of which prizes will be apportioned has not attained that amount which will allow of complete specification; but the council are gratified in being able to state that the Shipwrecked Mariners' Society have devoted £50 as a prize for the best form of kite or other aerial arrangement, or modification thereof, for establishing a communication from a wreck on shore, or between two vessels at sea. The Crystal Palace Company have also declared their intention of giving a prize of £50 to the exhibitor of a machine to carry and be worked by a steam engine or other motive power, which shall sustain and move itself in the air, at a height of not less than 10ft. from the ground, for a period of not less than twenty minutes. The Duke of Sutherland offers a prize of £100 to the inventor of a machine which, not being of the nature of a kite or balloon, shall ascend with a man to the height of 120ft. The Aeronautical Society offers a prize of £50, aided by the contributions of several members, to the exhibitor of the lightest engine in proportion to its power, from whatever source the power may be derived.

During the exhibition, it is proposed that daily experiments and partial ascents be made in a captive balloon, upon the plan lately pursued in Paris by M. Giffard. This gentleman's meteorological experiments, confined to an altitude of 1,000ft., were greatly appreciated by the higher classes, who crowded to take advantage of the opportunity to ascend to that height. Of the repetition now contemplated, Mr. Glaisher will probably largely avail himself. During the nine days that the exhibition will remain open under the auspices of the society, arrangements will be made for evening meetings of members and their friends, for explanation and discussion relative to the merits of the various objects exhibited.

MR. SEELY'S PIGS ONCE MORE.

IN our Parliamentary Notes last week, we stated our belief that Mr. Seely's pigs were a drug in the market, seeing that they still remained in dock. But it appears that we were mistaken, for instead of being a drug on market, they are so tightly tied down by red tape of the strongest make, that they cannot get loose from the dockyard. At any rate, this is the only conclusion at which we can arrive, after perusing a letter from Messrs. Shaw and Thompson, of Leadenhall-street, to Messrs. Bird, the metal merchants, of Laurence Pountney-hill. Messrs. Shaw state that on March 22, 1867, they bought, through Messrs. Wm. Bird and Co., 2,000 tons of "Seeley's pigs." They had the option, in the first instance, of taking 100 tons for experimental purposes, and were anxious to obtain immediate delivery of that quantity. They waited patiently, but in vain, for three months, to get delivery, and, at the end of that time, said to Messrs. Bird that if the Admiralty could be persuaded to give them only ten tons they would be willing to make a commencement. They could not even get ten tons, and state that the difficulty entirely lay with the Admiralty. It was only in December of last year, nearly nine months after their purchase, that Messrs. Bird were enabled to offer delivery of 100 tons, but in doing so they stated their inability to supply a further quantity. The natural consequence was that Messrs. Shaw abandoned the affair in complete disgust. They, however, express a very strong opinion that if this ballast iron were fairly tested, the 170,000 would soon be bought up.

GREAT NORTHERN EXPRESS ENGINE.

IN our page engraving we give a side elevation and sectional plan of one of the engines recently supplied to the Great Northern Railway Company by Messrs. J. Fowler and Co., Leeds, which are specially designed for running the heavy express trains on that line of railway. These engines have recently completed the journey from King's-cross to Peterborough, a distance of seventy-seven miles, in one hour and twenty-eight minutes, although they had to contend with heavy gradients for forty miles of the distance, and with twenty carriages behind them. The leading dimensions of these engines are as follows, viz.:—The driving and trailing wheels are 7ft. in diameter, and coupled together; the leading and tender wheels are 4ft. 3in. in diameter throughout; the barrel of the boiler is 10ft. 1in. long by 3ft. 10in. in diameter inside at the smallest part; the firebox casing is 6ft. 4in. long by 4ft. wide outside; the cylinders are 17in. in diameter, with a stroke of 24in.; the heating surface in box is 114¼ square feet, and in the tubes 907 square feet, making a total heating surface of 1,021¼ square feet, with a grate surface of 19⅔ square feet; the tender holds 2,500 gallons of water and two tons of fuel; the propelling power of the engine is equal to 12,000lb., and the adhesion on the rails may be taken at 11,700lb. The designs are by Mr. Sturrock, the late locomotive engineer of the Great Northern Railway, and the engines were built at Messrs. John Fowler and Co.'s works at Leeds, by Mr. Frederick Parker, the late manager of the works of the Great Northern Company at Doncaster, who has the entire management of their works. The engines are fine specimens of English workmanship and finish.

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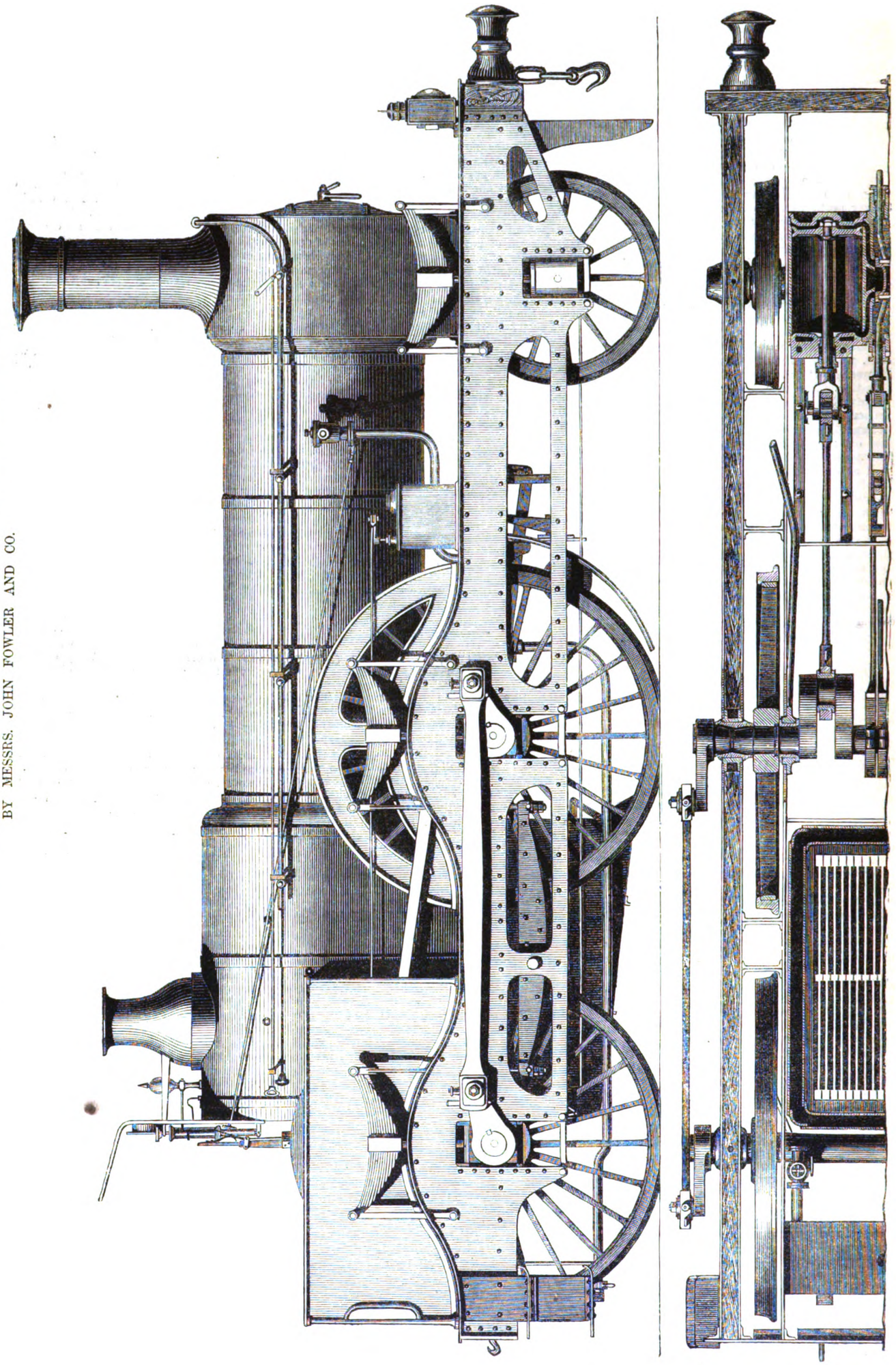
GREAT NORTHERN RAILWAY EXPRESS ENGINE.

BY MESSRS. JOHN FOWLER AND CO.



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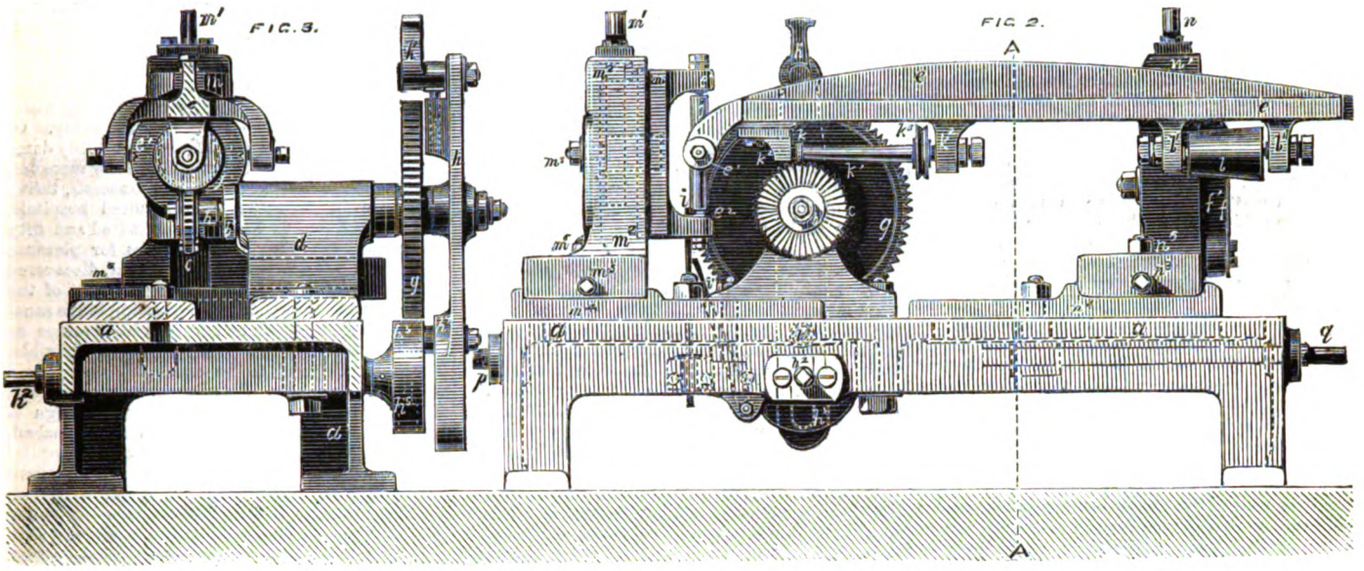
MACHINE FOR MANUFACTURING CIRCULAR CUTTERS AND MILLING TOOLS.

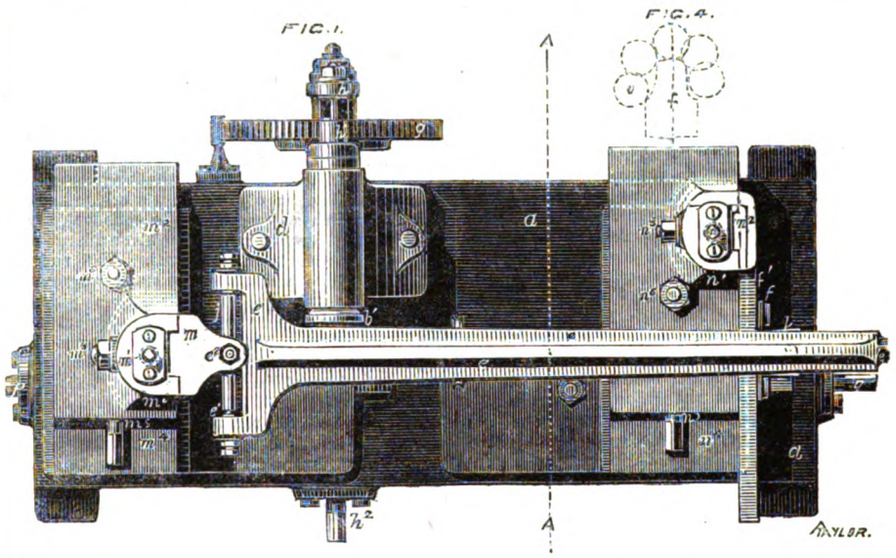
BY M. PAUL FRANCHAT.



MACHINE FOR MANUFACTURING CIRCULAR CUTTERS AND MILLING TOOLS.

THE above engraving illustrates some material improvements in machines for manufacturing circular cutters and milling tools, which form the subject of a patent recently granted in England to M. Paul F. Franchat, of No. 6, Passage des Jardins, Paris. Fig. 1 is a plan of the machine complete, fig. 2 a front elevation, fig. 3 a lateral sectional elevation through A A, figs. 1 and 2, and fig. 4, a diagram. This machine is composed of a table or frame a on which are fitted its four main or constituent parts, which are, firstly, a small horizontal spindle b carrying the cutter to be operated on fitted transversely over the table in a fixed support d. Secondly, a horizontal lever e suspended over the cutter at one of its extremities by an universal joint, and resting by its other extremity on an adjustable guide plate f; this lever carries the working cutter. Thirdly, a front adjustable headstock carrying the universal joint; and, fourthly, a back headstock, also adjustable, to which is attached the guide plate f on which the extremity of the lever e rests. The spindle b carrying the cutter is fitted into a little hollow shaft b^1 which is rotated intermittently in the standard d; a ratchet wheel g is keyed on the extremity of b_1, and outside the ratchet is hung a loose vertical lever h, to which is imparted a to-and-fro motion, in order to partially turn the ratchet either in one or the other direction, according to whether the pawl h^1 is turned over to the right or to the left. The to-and-fro motion is transmitted to the lever by making one revolution of the shaft h^2, which carries on its extremity a disc h^3 with a pin h^4 passing in a slot formed at the lower extremity of the lever h; this pin h_4, as shown in dotted lines, fig. 3, is attached to a small screw h_5, by which it can be moved from or brought towards the centre of the shaft h_2, in order to regulate exactly the throw of the lever, and, consequently, the number of teeth taken.

That the cutter may remain stationary whilst the cut is being made there is a spring lock i which penetrates one of the ratchet teeth, and before rotating the ratchet the spring is disengaged by the point of the lever i^1 suspended at i^2. To produce this result there is on the side of the lever a small roller i_3, and a nick is made on the circumference of the disc in which the roller enters whilst these parts are abreast, but immediately the disc commences to rotate, this roller is expelled from the nick, and the spring i disengaged, the roller remaining in contact with the circumference of the disc until an entire revolution has been completed. The horizontal lever e is suspended at one of its extremities by the two points e^1 e^1 which enter the disc j, so that without in any way moving this disc the lever can be raised and lowered, and since the disc is suspended on the two vertical centres e^2 e^2, the lever can also be moved in a horizontal direction, and by the combination of these two motions, any point within the range of the lever can be reached. The working cutter k is fitted underneath the lever e on a spindle k^1 revolving in bearings k^2 k^2; it is provided with a driving pulley ^{3} to receive rotary motion, and underneath the other extremity of this lever is a conical roller l turning freely on the points l^1 l^1, and



which, during the cutting, rests constantly on the guide plate f. The taper of this roller should correspond exactly with two lines converging to the centre of the disc j, its axis of rotation being exactly on a line with the centre.

According to the dimensions of the cutter to be cut, it is necessary that the position of the two headstocks may be varied vertically as well as transversely. For this purpose, with respect to the front headstock, the points e^2 e^2 of the disc are fitted in a vertical slide m which can be raised or lowered in the standard m^2 by the screw m^1, so as to bring the working cutter k on the top of the circumference of the cutter to be cut, whatever its diameter may be. The bolt m^3 serves to fix the slide at the requisite height, according to the depth or thickness of the cutter to be cut. The lever should be moved transversely, because it is advantageous that the working cutter should describe the same angle in order to reach one or the other of its extremities; for this purpose the standard m^2 is moved on the saddle m^4 by means of the horizontal screw m^5, parts being fixed in their requisite position with the bolt m_6. The same arrangement is adapted to the back headstock, its vertical motion being effected by the screw n in the standard n^1 moving the slide n^2, whilst the screw n^3 actuates the standard n^1 transversely on the saddle n^4; the bolts n^5 and n^6 serve to hold these parts in their definite positions.

In working the machine, the cutter to be cut c being fitted on its spindle b, the guide plate f is attached on the back headstock, which plate represents exactly, on an enlarged scale, the profile of the cutter to be cut (in practice it is found that the relation of five to one gives excellent results), care being taken that this plate coincides exactly in a line with the cutter. The workman then regulates the position of the lever e, so that the working cutter is brought exactly over the centre of the cutter c, whilst the conical roller l is over the guide plate f. He then adjusts the position of the pin h^4 in the slot of the vertical lever h, according to the number of cuts to be made on the cutter. Making sure that the little roller i^3 rests in the nick of the disc h_3, he holds the lever e raised by its handle e_4, puts the working cutter k in motion, and lowers laterally the lever e until its roller l bears on the extremity of the guide f, as shown at o, fig. 4. Then, pressing on the lever he passes the roller successively on the entire profile of the plate, thus making one cut on the cutter. He again raises the lever, bringing it to its former position, revolving once the shaft h^2, in order to rotate the cutter c the required quantity, and then makes another cut, repeating these motions until the entire circumference has been cut.

Instead of converging all the cuts to the centre of the cutter, it is sometimes advantageous that they take an angular direction; for this purpose M. Franchat has provided a means of bringing the working cutter out of the centre of the cutter being cut by moving the saddle m^4 with the screw p. In order to maintain the same relation of five to one between the cutter and the guide plate he also actuates the saddle n^4 by means of the screw q. This faculty of bringing the guide plate f closer to or further from the cutter by means of the screw q is also of great utility, inasmuch as by varying the fixed relation of five to one, it is possible to augment or to diminish within a perceptible limit the calibre of the cutters to be cut.

A RECENT circular from the Minister of Marine draws attention to the regulation which forbids all persons belonging to the French navy to wear moustaches or imperial, and only permits whiskers.

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SOCIETY OF ENGINEERS.

AT the meeting of the Society of Engineers, held on Monday evening, March 16, Mr. Baldwin Latham, president, in the chair, the following paper was read on engineering in India, by Mr. F. C. Danvers, of the India Office:—

Abundant evidences exist that for many centuries past the natives of India have, from time to time, done much towards the improvement of their country by the construction of public works; for the remains of many such works exist to the present day, whilst others have been absorbed in the structures erected within the present century by our own engineers. A full account of the public works constructed by the earlier native rulers of different parts of India would suffice to fill a volume, and in the present necessarily hasty review of what has been done in that direction, it will be sufficient merely to refer to some of the principal noteworthy points of interest as proofs of the existence of a liberal and public spirit in former ages, such as can scarcely be said to be exceeded, if indeed it be equalled, by the present Government of Hindustan. It is worthy of remark that the principal evidences of civilization under former dynasties consist in the lasting monuments raised under their respective sways of public buildings, works for the supply of water, and the planting of trees along canal banks, and by the sides of so-called roads. The almost total absence of the use of wheeled conveyances, except by the wealthy of the land, caused but little attention to be paid to the proper construction of roads; and in many parts of the country even the use of water carriage, where available, would seem to have been but slightly employed.

It is unnecessary to refer more particularly to the numerous mosques and other public edifices which are to be found all over India, as evidences of the architectural taste of former ages, since pictures of many of them must already be familiar to all. With regard to the state of the country as to internal means of communication, the following is an extract from the "first report of the commissioners appointed to inquire into and report upon the system of superintending and executing public works in the Madras Presidency," dated December 23, 1852. In their review of the condition and the treatment of the roads in former times, the commissioners stated, "With regard to the communications of the country, the case was far otherwise" (than with works of irrigation). "It cannot be said that there was any capital invested in the ancient rods; and canals, for the purpose of navigation, had no existence in the south of India. Throughout the whole peninsula there was not one complete road of any length on which it would have answered to employ wheel carriages; their use, therefore, was very limited, and the distant traffic of the country had nowhere the advantage of them. Trucks were used by those who collected stone for the dams and tank embankmeuts, and in some localities the harvest was brought in by carts upon wheels, either formed of solid pieces of timber, or cut from a solid block of stone; these carts were drawn by several pairs of bullocks, and carried nearly a ton, but they were never used for distant journeys; even the main streets of many of the largest towns were not practicable for wheels; and when the most wealthy used light carriages, they rarely left the precincts of their village. The only made roads (if they deserve the name) were the mountain passes, which in the later wars were opened for the passage of artillery; but they had generally been destroyed by the monsoon rains, before the country came into the possession of the East India Company. The only proof of attention to the great roads was to be seen in the fine avenues of trees, which in some districts measured several hundred miles in length; but as the roadways beneath them had never been properly formed or drained, and bridges had not been built, or care taken to keep the pathway practicable, they were roads no longer; but in most cases, from being worn down by former traffic, and washed by the rains of the monsoon, they had become the drain of all the country that they passed through, and were so much more rugged than the land on either side, that their only use was as a guide to travellers who took a course as nearly parallel as the ground permitted. With such a want of roads, it might have been expected that water-carriage, wherever it was available, would have been turned to the best account; but such was not the case; little use was made of the rivers, and nothing seems ever to have been done to improve their navigation. In the heavy freshes, rafts of timber, and circular boats of wickerwork, covered with leather, were floated down some of the larger streams; but on very few of the rivers was any attempt ever made to take laden vessels up the stream. Still less use was made of the canals of irrigation, though many of them were well adapted for water-carriage during six or eight months of the year. The backwaters, both on the eastern and western coast, were turned to somewhat more account; but the boats in use upon them were canoes made from single trees, which, from their narrowness, and consequent deep draught of water, were very ill-suited to the shallow lakes they navigated. A considerable traffic was carried on by means of coasting craft, but that was expensive, slow, and dangerous. On the Coromandel coast the dhoneys were badly shaped for sailing, even when the wind was fair, and from their want of keel could never work to windward. In some respects the pattimar on the other side of the peninsula had advantages, being well built for speed, and having a better form of sail; but in both cases they were quite unfit to trust in such storms as the coasts are subject to. That the carriage was expensive to what it might have been, is to be accounted for by the indolent manner in which the vessels were worked, by the number of men necessary to manage their unwieldly sails, and the time lost by the necessity for waiting till the wind was fair. The cost was also greatly increased by the difficulty of shipping and landing goods, to facilitate which no attempt seems ever to have been made by any of the native rulers of the country."

Whilst on the subject of communications, it may be as well to notice a peculiar instance of a bridge constructed in Mysore, for facilitating access to the town and fort of Seringapatam, which is noticed by Dr. Buchanan in his account of a tour through that province at the beginning of the present century. "Seringapatam," he states, "as is well known, is situated at the upper end of an island surrounded by the Cauvery, which is here a large and rapid river, with a very extensive channel filled with rocks and fragments of granite. At certain seasons it is in many places fordable with facility; but during the rains it rises very high, to the great inconvenience of the inhabitants. On the south branch of the river a bridge has been erected, which serves also as an aqueduct, to convey from the upper part of the river a large canal of water into the town and island. The rudeness of this bridge will show the small progress that the arts have made in Mysore. Square pillars of granite are cut from the rock of a sufficient height to rise above the water at the highest floods. These are placed upright, in rows as long as the intended width of the bridge, and distant about 10ft. from each other. They are secured at the bottom by being let into the solid rock, and, their tops being cut to the level, a long stone is laid upon each row. Above these transverse stones others are placed contiguous to each other, and stretching from row to row in the direction of the length of the bridge. The whole breadth of this may be 20ft. One half is occupied by the aqueduct, which is secured at the bottom and on both sides by brick and plaster. The road is laid with gravel, and secured by a parapet wall on one side, and by the aqueduct on the other."

In Bengal, communications were almost entirely effected by means of the several branches of the Ganges River, which itself acted as the great highway between the Lower and North-Western Provinces for many years after the British occupation of Hindustan; and at the beginning of the present century the traffic on that river gave employment to no less than 20,000 boatmen. Many other rivers also were navigated to a limited extent in former days, including the Indus, the Godavery, and, indeed, most of the great inland rivers; but, under native rule, no attempts appear ever to have been made to improve their channels.

Some of the ancient Indian writings show how highly prized water has ever been for drinking and agricultural purposes, and that the natives used to consider the construction of such works not only an act of benevolence, but also one of religious merit. The Poorana, or ancient chronicles of India—which are Sanscrit works of considerable antiquity, the dates of their compilation being lost—give many proofs of this, as will be seen from the following extracts. In one place it is stated, "No satisfaction is felt without water in the three worlds—heaven, earth, and hell; therefore, a wise and learned man should cause reservoirs, tanks, wells, &c., to be made." Again, "A person that makes wells, gardens, establishments for the distribution of water—also, he that causes trees to be planted, gives his daughters in marriage to others, causes bridges, dams, &c., to be made over rivers—and all these for charity's sake—obtains a perpetual bliss in Paradise. Also a person in whose pond or lake there is a constant supply of water obtains perpetual felicity without question." And in another place it says: "Oh, thou son of Kunti, get large supplies of water made at the sacrifice of your whole property; for the man at whose reservoir the cow becomes satiated of her thirst, becomes the preserver of his family."

It is not, then, surprising to find that hydraulic works were early cultivated throughout Hindustan. The first Indian canal of which we have any satisfactory record dates from the year 1351, and it is stated to have been constructed by Feroze Toghlak, whose reign was distinguished by many improvements in legislative and fiscal policy. Of this monarch it is recorded that he built fifty dams across rivers to promote irrigation, forty mosques, thirty colleges, one hundred caravanserais, thirty reservoirs for irrigation, one hundred hospitals, one hundred public baths, one hundred and fifty bridges, besides many other edifices for pleasure or ornament. An interesting document, discovered by Lieutenant S. A. Abbott, being a decree of the great Akbar, dated A.D. 1568, referring to the canal of Feroze Shah, which at that date had become so choked that its bed was scarcely discernible, directed the canal to be excavated deeper and wider than formerly. Sixty or seventy years later, new works were undertaken during the reign of Shah Jehan. The foundation of Shahjehanabad, and the natural desire to secure for his new capital and favourite residence the benefit of an abundant supply of water, induced the Emperor to project the Delhi Canal. In Ali Murdam Khan—a person distinguished for his architectural taste and skill—he found an agent admirably qualified to give effect to his wishes. For a century and a quarter after its original construction, in 1626, the Delhi Canal continued efficient. Aged men informed a British officer, on survey duty in the neighbourhood in 1807, that they were finally deprived of the canal water about the year 1753, in the reign of Alumgir II. The canal of Feroze had ceased to flow in Hurriana about 1707, and at Suffidun in 1740; so that the Mogul canals became practically extinct nearly in the middle of the eighteenth century. About the year 1780, Zabita Khan, Rohilla, is said to have reopened the Eastern Jumna Canal—a work which is also attributed to Ali Murdan Khan—but his canal is supposed to have remained open only for a few months. The late Colonel Baird Smith, from whose writings the above information regarding early irrigation works in India has been obtained, remarks that the canals of the Mahomedan dynasty in the North-Western Provinces of India were remarkable for their sinuosity of channel, arising from an ignorance of the modern means of regulating the excessive slope of the country, and an irregularity in the distribution of the fall, which caused alternations of rapids with almost still water.

Irrigation works seem to have been very general in the Peninsula of India under its native rulers; but in this part of India tank irrigation was perhaps more general than canal irrigation, although there were evidently many works also constructed of the latter class. Some very interesting works in the Southern Maratha country are clearly traceable to the Hindoo dynasty, and those about the headwaters of the Tombuddra and its tributaries may be especially referred to. "In the delta lands of Tanjore," says Colonel Baird Smith, "it is probable that artificial irrigation was contemporaneous with agriculture itself; but the first marked development of that native system upon which modern improvements have been grafted is traceable to a period corresponding with the close of the second century of our own era, and to the reign of a certain Rajah Veeranum, to whom many of the gigantic pagodas, as well as the great irrigation channels in Tanjore, are attributed. It is worthy of remark that these works were all executed under an intrusive and foreign monarch, who, leading an army from the comparatively desolate tracts in the northern portion of the Peninsula, established himself in the fertile southern regions. In the Teligoo country, from which the invader came, there is not a trace of any such contemporaneous works as are found in Tanjore; and it gives a striking idea of Rajah Veeranum's clearness of perception and energy of character that he should at once have appreciated the system of irrigation pursued by the subject race, and should have given to it that vast and rapid development which, making allowances for exaggeration, is still distinctly traceable to his reign. In the religious works of the period there are evidences of great constructive skill, immense labour, and, in some respects, marked architectural

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taste; while in the works of irrigation there is great boldness of design, considerable knowledge of hydraulic principles, mixed, however, occasionally with curious indications of ignorance, a massiveness of construction so disproportioned to the necessities of the case, as to indicate a very exaggerated idea of the forces dealt with. There was, however, one great object which was entirely lost sight of, and this was the means of intercommunication; for, while the soil was fertilized and protected, its produce found its way into commerce through all sorts of difficulties, from the entire absence of roads, bridges, and other elements of free movement. Besides canals, which were taken from the rivers of the district, tanks were largely employed for purposes of irrigation; and some of these were formed on such a scale as fairly to be denominated gigantic. The embankment of the Poonary Tank, in the Trichinopoly district, for example, was thirty miles in length, that of the Veeranum Tank about ten miles; and numerous others of scarcely inferior dimensions are scattered over the face of the country. All these tanks were provided with sluices for distributing the water to the fields, with escape weirs for regulating the surface level of the water, and with other necessary works of detail. The same authority also refers to native works of a similar character which were in existence in the delta of the Kistnah when the country fell into our hands in 1766. In Guntoor, two ancient channels, having all the characteristic marks of natural rivers, and called respectively the Boodaimair and Pollier, traverse the district in different directions, and for ages have been subservient to the irrigation of the Delta. All the irrigated portion of the Madras Presidency abounds in tanks, and the extent to which tank irrigation there is extended is truly extraordinary. An imperfect record of the number of tanks in fourteen districts shows them to amount to no less than 43,000 in repair and 10,000 out of repair, or 53,000 in all. It would be a moderate estimate of the length of embankment for each to fix it at half a mile; and the number of masonry works in sluices of irrigation, waste weirs, &c., would probably not be overrated at an average of six. These data, only assumed to give some definite idea of the extent of the system, would give close upon 30,000 miles of embankments (sufficient "to put a girdle round the globe" not less than 6ft. thick), and 300,000 separate masonry works; and the whole of this gigantic machinery of irrigation is of purely native origin.

Turning now from ancient to modern engineering works, it is purposed to give a brief account of some of the principal peculiarities of construction as adopted in India. The principal public buildings of modern date will be passed over as appertaining generally more to architecture than engineering.

With respect to communications, there are two classes of roads generally constructed in India, viz., what are called "fair-weather roads," and "first-class roads," the former of these being often little better than cleared tracks, whilst the latter are both bridged and metalled. Prior to the introduction of wheeled conveyances into the country, camels, horses, mules, asses, and bullocks, and not unfrequently even sheep, were employed for the purposes of transport. To construct a fair-weather road, the line is first cleared of jungle for a width of 10ft., 20ft., or 30ft., a ditch is cut on either side to serve as a drain, and the earth excavated is thrown into the centre of the road to assist the rain water to run into the ditches. It is necessary, of course, to level inequalities of surface as far as possible, and small streams are either crossed by means of temporary bridges, if wood is available, and, if not, their banks are cut down, if necessary, to a gentle slope, so as to enable carts to pass when the stream is dry, or nearly so, and such slopes, as well as the bottom of the stream, are in some instances paved, if material suitable for the purpose is available. There are several temporary expedients which may be used as a substitute for metalling; thus stable litter, when available, or even grass strewed on the sandy or dusty surface, will greatly improve it. A road passing through the deep sandy bed of a river may be much improved by cutting down through loose sand to the moist and firmer stratum; on this should be laid a flooring of fascines 6in. in diameter, made of jhow, or of the strong grass which generally grows upon the banks of rivers in that country, and over all, from 1ft. to 1ft. 6in. of earth well beaten down. This plan has been pursued with great success at several of the large rivers, such as the Sutlej. Such a road will hardly last more than one season, but it is inexpensive and greatly facilitates the draught of heavy loads.

Of first-class roads it is not necessary to say anything here beyond that they are rendered passable for wheeled conveyances during the whole year, being metalled and bridged, whereas the fair-weather roads just referred to are generally only passable for, at most, nine months in the year. Even in first-class roads the metalling does not always extend across the entire width of the roadway, but it is often confined to the central portion of it.

For the purposes of crossing rivers there are several temporary expedients which are often resorted to where the want of time, money, or skill prevents the employment of more durable methods. Many Indian watercourses are dry, or nearly so, except during the rainy season, and in some of the very dry districts of the North-West, the watercourses often contain no water for eleven months out of the twelve. The beds of such rivers or streams are, therefore, in general, passable without a bridge, but they require to have the banks cut down to an easy slope, and the bed of the stream to be paved for a sufficient width to save the labour of draught through heavy sand, or sand and water combined. The largest of such causeways is that constructed across the bed of the River Soane on the line of the Grand Trunk road. The distance from the western extremity, or head of the causeway, to the point where the Baroon bank of the river rises above ordinary floods, and the metalled Grand Trunk road again commences, is 11,450ft. The line of the causeway having been marked out, common jungle piles were driven in two parallel lines, at a distance of 17ft. apart, to a depth of about 15ft., the sand having been excavated with shovels in the ordinary way. Between these piles down to the water-level, or a little below, bamboo frames with palm-tree leaf mats were forced down behind, to prevent the sand from the sides slipping into the excavation. The remainder of the sand below water-level was excavated to the required depth by means of the ordinary well sinkers' jham, worked from temporary stages on either side of the excavation. A layer of gunny bags filled with concrete composed of two parts Soane shingle, one part soorkhee, and one part kunkur lime, was then set as closely packed as possible over the whole bottom of the excavation. Over this a layer 2ft. 6in. deep of rubble stone was placed, set in concrete, of the same proportions as above, and on this the roadway, formed of roughly cut stone slabs 1ft. thick, from 1ft. to 1ft. 6in. broad, and alternately 9ft. and 7ft. long, so as to break joint with each other.

Temporary wooden bridges of the simplest type are sometimes used; and rope bridges are employed, of various designs, to cross mountain torrents which run between high steep banks on the hills. In some of the latter a single rope is stretched across the stream, and made fast to trees on either bank; a sort of cradle in which the passenger sits is slung on the rope, and pulled across by means of ropes worked from either shore. In others the bridge consists of three ropes, one for the feet, and two others for the hands of the traveller, kept asunder by triangular pieces of wood placed at intervals.

Ferry boats are in use on nearly all the large Indian rivers, but these are often replaced by boat bridges during the cold season. Boat bridges are maintained over all the great rivers on the main lines of road from September to June, and, occasionally, all the year round, where the stream is not too wide, or where it can be narrowed by the embanked road being carried forward on each side, so as to restrict the deep channel within reasonable limits.

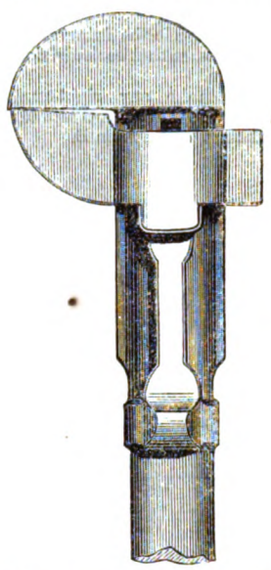
Permanent bridges are made of wood, brick, stone, and iron. The use of wooden bridges is, in India, generally confined to places in or near the hills, where wood is cheap and plentiful; they are also sometimes used in the plains as temporary structures, until it is convenient to construct them in a more permanent manner; but the destructibility of the material, and the liability of its parts to be deranged by the violent atmospheric changes common in the East, render its employment in general unadvisable.

(To be continued.)

"BARNUM'S Museum" in New York was completely destroyed by fire on the night of the 2nd inst., involving a loss of 500,000 dollars. This is the second time within a short period that the famous showman has had his museum burnt, the "New York Herald" building being erected now on the site of the former museum.

WESTON'S PATENT SPANNER.

ONE of the most original and ingenious inventions we have seen for some time is illustrated in the accompanying engraving. It is a spanner which has been invented by Mr. W. T. Weston, and is now being manufactured in large quantities by Messrs. Timmins and Son, of Birmingham. In principle this spanner somewhat resembles Mr. Weston's cramp, in which the lower jaw slides freely on a flat bar of peculiar form. The slightest pressure at the extremity causes it to grip the stem, so that it remains firmly fixed. In effect this movable jaw is a lever of the first order, and any pressure applied at its extremity forces the sliding part into a slightly oblique position when it jams the stem. The jaws of a spanner being shorter than those of a cramp necessitated a further development of the prin-



ciple, which has been satisfactorily effected by Mr. Weston. The result is a spanner without screw or ratchet, and which can be instantly adjusted to fit any nut or bolt. The movable part consists of the hinder jaw of the spanner, which is provided with studs connected by two side straps, with a sliding band, by which means the jaws are kept parallel and to place them under the control of the thumb. The lower jaw is slid up to the required position upon the nut, and there remains fixed so long as the pressure of the work is kept upon it. On being released from the nut the jaw slides down to a stop on the handle. A trial of this spanner convinces us that it is a most useful tool, having the advantage of fitting any sized nut, and being of general utility in the engine room or workshop.

IMPROVED METHOD OF DIVIDING THERMOMETERS.*

By MR. WILLIAM ACKLAND.

IN the manufacture of thermometers for low temperatures, considerable difficulties are experienced, owing to equal increments of temperature not causing an equal increase of volume of the fluid employed; and this unequal expansion gives rise to considerable errors, even within limited ranges of temperature. If, in constructing an alcohol thermometer, we select a tube with uniform bore, we find, on giving it certain fixed points, corresponding to an equal number of degrees between each point, that the spaces so obtained are each diminishing in length as we descend; hence the ordinary mode of equal divisions between the ascertained points is found to give inaccurate results. An important question therefore arises—Can we so subdivide our tube that each subdivision shall be in its proper place?

During the autumn of last year, Mr. Glaisher mentioned this subject to me, and at the same time offered some valuable suggestions to remove this difficulty, and caused me to direct my attention to this subject. Many subsequent interviews with that gentleman, extending over some months, enabled me to mature my first idea, and aided by his valuable assistance and counsel, the success aimed at has been attained; and I am now in a position to state that I have completed a dividing-engine on an entirely new principle, which may

* Proceedings of the Meteorological Society.

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strictly be termed "Interpolating;" for, whilst between any consecutive terms taken at regular and fixed intervals we can, by numerical interpolation, find intermediate terms conformable to the law of the series; so, between fixed and determined points of our thermometer, we can, by using the "interpolating-engine," so divide the intervening spaces that they shall conform to the varying nature of the series, or, in other words, that the divisions shall increase in magnitude as we ascend the scale in such proportions as are demanded by the expansion of the alcohol and the bore of the tube employed.

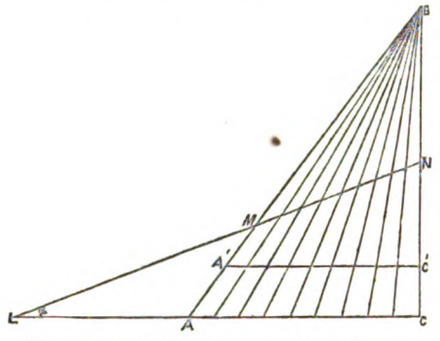
To illustrate this new method I have invented, let us suppose we have obtained the fixed points, P Q R S, of a thermometer corresponding to equal differences of temperature. And let

$$P Q = x_1,\ Q R = x_2,\ R S = x_3$$

	x_1	x_2	x_3	
P		Q	R	S

It is desired to divide the intervening spaces each into ten divisions, so that each division shall occupy its true position.

To do this, take any right-angled triangle, A B C, and divide the side A C into ten equal parts by straight lines drawn from B.



Then, if a straight line, as A' C', be drawn parallel to A C, it will be divided into ten equal parts: but if it be drawn not parallel to A C, it will be divided into ten unequal parts.

To apply this to the thermometer to be divided, draw a transversal L M N cutting A C produced in L, at an angle ϕ, so that

$$\tan.\ \phi = \frac{x_2 - x_1}{x_2 + x_1} \tan A,$$

and

$$M N = x_1.$$

On doing this it becomes evident that such a line, so placed, will be divided into ten unequal parts, proportionate to the law governing the series, and we can in the same manner, by using the same formula, divide any number of spaces with equal accuracy. It remains, therefore, mechanically to transfer such divisions to our thermometer, previously marked off at equal intervals of temperature, in order to secure its correctness to even second differences. This mechanical copying can be done by the dividing-engine before referred to; and it is worthy of note that the formula and engine equally apply to the more correct dividing of mercurial thermometers having unequal or varying diameters of bore, as also to the construction of hydrometers of absolute accuracy.

I can easily understand that whilst the mathematician may appreciate the formula thus introduced, and also its successful application, those accustomed to the construction of thermometers would hesitate to adopt it, from the fact that the plan involves a series of calculations for each thermometer, which would involve considerable loss of time and risks of inaccuracies, if these computations were hastily done; hence my first idea was to compute a series of tables; but this was attended with only partial success. My attention was then directed to the mechanical solution of these problems, the result of which was the invention of a little piece of apparatus, which may be called a computer, consisting of a sliding-rule, index-arm, and scale. Suppose we wish to divide accurately the space x_1, formerly given; we set the distance from P to Q on the slide, to that of Q to R on the fixed scale, and the index-arm at once points to the angle on the scale which M N must make with A C on our divided triangle. In use, this computer is found both trustworthy and simple, and facilitates what would otherwise have been tedious to perform and liable to inaccuracies when done.

Having devised a method of dividing a thermometer tube accurately, I next turned my attention to the most suitable strength of alcohol to be employed in filling these thermometers; and as but little can be gained by referring to our scientific writers on this subject, I undertook a series of experiments to satisfy myself on this point. Now it is well known that the expansion of alcohol by heat is not proportionate to its change of temperature; and we are consequently unable to express its corresponding coefficient by a simple formula, as for metals and mercury, but must adopt the more complex expression of M. Biot,

$$d = a\ t + b\ t^2,$$

where a and b are the required coefficients, and t the temperature. The coefficients of absolute alcohol are constant for all temperatures, but inasmuch as this fluid becomes weaker from momentous exposure to the air, and the mere pouring from one bottle to another not only alters its specific gravity but also its rate of expansion and its coefficient, it becomes an important point to select some other strength less liable to those changes, which only tend to inaccuracies, however much we may strive to prevent them. In making this selection, various specific gravities and of varying purities were tested, and the results led to the selection of alcohol having a specific gravity of ·815, as spirit of this strength, if pure, and free from methylated spirit, fusel-oil, &c., has its coefficients as constant as those of absolute alcohol, and it is but little liable to undergo those changes that seem to thwart our efforts when using a stronger sample.

I had entertained a hope that at this meeting I should have been enabled to have exhibited a series of alcohol thermometers made on the principle above indicated; but a few only have as yet been completed. Those accustomed to scientific investigations will readily appreciate the difficulties met with at every stage, and I must plead the little time at my disposal for the present deficiency, and merely state in conclusion that, before any lengthened period, thermometers made on the plan above indicated, will be ready for those who may wish to tsst their accuracy.

THE NEW DUTCH ARMOUR-CLAD RAM

ON Tuesday last, Messrs. R. Napier and Sons launched from their shipbuilding yard at Govan, near Glasgow, an armour-clad twin-screw turret ram named the "De Buffel," designed and built for the Dutch Government. This new war ship is of about 1,473 tons, builders' measurement. She is 205ft. in length by 40ft. beam, and 24ft. deep. Her sides are plated with armour 6in. thick, backed with 10in. of teak on an inner skin, right forward and aft, extending 3ft. below, and 2ft. above the water-line, and thus protecting the most vulnerable part of the vessel. The main deck consists of 6in. of teak on a 1-inch plate. The wall on the main deck round the base of the turret, which is constructed on Captain Coles's principle, is composed of "eight armour backed by twelve" teak on an inch inner skin. The armour and backing on the turret are similar to those on the wall. The "De Buffel" is to carry two 300-pounder 12½-ton Armstrong guns in the turret, and four smaller broadside guns on the main deck. Her guns train right round the circle, with the exception of a few degrees on each side the keel aft, the funnel preventing the circle from being completed. The turret may be worked by steam, under the care of one man. Accommodation is provided on the main deck for the officers and crew, whose comfort has been considered in every respect in the construction of the vessel. It is expected that the "De Buffel" will attain to a speed of about 13½ knots per hour. Her engines, also constructed by the Messrs. Napier, are of 400 nominal horse power, fitted with surface condensers, superheaters, &c. The "De Buffel" is the second ironclad for the Dutch Government which has issued from the works of Messrs. Napier within the last three weeks, the "D Tijger," a monitor, having been launched within that period.

THE ROYAL MICROSCOPICAL SOCIETY.

AT the ordinary meeting, held at King's College, on Wednesday, the Rev. J. B. Reade, F.R.S., vice-president, in the chair, five new fellows were elected. A paper was read by Dr. Muirhead on the "Classification and arrangement of objects in microscopic cabinets," in which, after reviewing the various methods which had been from time to time adopted, preference was given to the plan of Professor Quekett, with some slight modifications. A paper was also read by Dr. Collingwood "On the Algæ which cause the coloration of the sea in various parts of the world." This was for the most part a detail of the results of personal observation and examination in the India and China seas, where the author had frequently found the water to be deeply tinged of a yellow or brown colour by immense quantities of microscopic algæ, chiefly being species of trichodesmium; but neither he nor any of the speakers who took part in the discussion had ever observed the sea to be coloured red as so often described by early writers upon the subject. A binocular microscope with a new rotating glass stage was exhibited by Messrs. Crouch; and Mr. C. Collins introduced a new metallic chimney for microscope lamps, which appeared to be admirably adapted to the purpose. The presents to the society since the previous meeting included a series of slides and models, from the Rev. Lord S. G. Osborne; a very valuable and complete series of preparations of bones and teeth, numbering 434 slides, from Mr. Joseph Beck; and a first-class binocular microscope, from Mr. Baker.

OPENING OF THE MILLWALL DOCKS.

ON Saturday last the new docks at Millwall were formally opened with as much ceremony as could be imported into the occasion. These docks will prove of great benefit to the river, as it forms an important addition to its private dock accommodation. The docks and warehouses occupy about 204 acres, and of this extensive area there are 35 acres of water for dock accommodation. When the scheme is entirely completed, there will be upwards of 52 acres, leaving 152 acres available for wharves and warehouses. The floating dock is 350ft. in width; it has two entrance locks, one, the first, of 250ft. long, and the second 200ft., and both with a width of 80ft., and a depth at the sill of the lock of 28ft. below Trinity high-water mark. This allows for the admission of vessels of greater length and breadth than any at present built, the "Great Eastern" alone excepted. Near the floating dock is a graving dock for the repairs of vessels. Its length is, inside the sill, 415ft., and its width 65ft., with a depth of water of 25ft. below Trinity datum. All the locks are provided with hydraulic power for working the gates, the bridge, and sluices, and one 3-ton and one 5-ton capstan. Hydraulic power is also applied to the drawbridge between the inner and outer dock, and to some of the cranes in connection with the warehouses. Nine warehouses have already been constructed, two of which are 300ft. long, four 200ft. long, and three 100ft. long. They are fitted with twelve 35-cwt. cranes, one 5-ton crane, one of 15 tons, and a sheerlegs, equal to a weight of 80 tons, is in course of erection. The works have been constructed well and cheaply, the land not having been costly to acquire. The docks offer unusual facilities to vessels entering or leaving the river; there is ample railway communication close at hand, and, if a short canal of about 200ft. long were cut, it would give access to the West India, and through them to the East India Docks, thus opening up one of the finest series of docks in the kingdom.

THE ABERDEEN EXHIBITION OF 1869.

WE are glad to inform our readers that arrangements are now far advanced for the Arts and Manufactures Exhibition, which is intended to take place at Aberdeen next year. The exhibition will consist of two branches—one an art collection, including art manufactures; the other industrial, including materials and machinery as well as manufactures. It is intended that the whole collection exhibited shall be drawn from the northern counties of Scotland, except in respect to the works of native artists and the products of native workmen's skill or ingenuity, which will be sought for wherever they can be procured. The line of division, marking the northern counties of Scotland, may not be very strictly adhered to, but it is generally understood to be the River Tay. The exhibition will thus be strictly a representative provincial one, and whilst this plan in some respects limits the extent and importance of the collection, on the other hand it will attach to it a special interest. We believe, however, that the north of Scotland will not be found deficient in native talent, whether in art or mechanical skill. And some branches of industry, such as granite cutting and polishing, are almost peculiar to the district, whilst in others, such as shipbuilding, special excellence has been attained. The Queen has consented to patronize

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the undertaking. The Prince of Wales allows himself to be named president, and the list of its supporters already includes nearly all the nobility and prominent men of all classes in the north of Scotland. It is contemplated that the exhibition will take place in the months of July, August, and September, 1869, being the time of the year during which the north of Scotland is thronged with strangers from the south, and when most of the proprietors are at home. At that season also, excursions might be expected to be made from populous places at a distance, partly attracted by such an object of interest.

Correspondence.

SQUARING THE CIRCLE.

TO THE EDITOR OF THE "MECHANICS MAGAZINE."

SIR,—The Observatory at Greenwich was built in 1665 for Flamsteed, who was the first astronomer paid by the British Government to discover the best method of finding the longitude at sea. On his first-class observations, Newton mainly calculated by his doctrine of infinite approximation his theory of the moon. But this method, even in his own hands, was so fallible that his computed place for the moon was frequently in error of the true place as much as 5min. of time=1¼deg. of longitude. In 1719 Halley succeeded Flamsteed at Greenwich, and during his life somewhat greater accuracy was obtained in computations from the theory of the moon. Dr. Maskelcyne became Greenwich astronomer in 1765, a position which he occupied for forty-seven years. Two years after his accession the first British "Nautical Almanack" was published under his auspices, the principal approximative accuracy from which was attributable to the theory of the moon and accompanying tables of Tobias Mayer, of Maspach, adopted by the Board of Longitude in 1770, and for the copyright of which a sum of £3,000 was paid to Mayer's widow. The amount of practical accuracy at this time in determining the longitudinal position of a ship at sea with the help of the "Nautical Almanack" is well described by Dr. Hutton, as follows:—"These new tables, when compared with the above-mentioned series of observations, a proper allowance being made for the unavoidable error of observation, seem to give always the moon's longitude in the heavens correctly within thirty seconds of a degree, which greatest error added to a possible error of one minute in taking the moon's distance from the sun, or a star at sea, will at a medium only produce an error of forty-two minutes of longitude." This, too, was after the invention of Harrison's chronometer, for which the Board of Longitude rewarded him with £24,000. Dr. Hutton adds, "It is well known that from various unavoidable causes all astronomical computations are but approximations to perfect accuracy." I shall leave this approximation at the point to which it had been brought last year by quoting the words of Edwin Dunkin, F.R.A.S., of the Greenwich Observatory, viz:—"The publication of the reductions of the Greenwich observations of the moon, made since 1750 up to a modern date, has to a great extent been the origin of all these important investigations. As one great result, Professor Hausen, of Gotha, using these observations for the perfection of the theory, has formed lunar tables, which from their general agreement with a considerable number of modern observations with which they have been compared, are considered worthy of being classed amongst the greatest triumphs of theoretical astronomy."

I do not wish by this statement of facts to underrate the "Nautical Almanack," but merely to confine it to its proper sphere of a comparatively useful theoretically approximative publication, but at the same time destitute in any sense of a geometrically exact result. I trust your correspondent, "Commander, R.N.," will reconsider his expression in his letter of 9th current, "and as the computed distances agree exactly with the observed distances, the accuracy of the value of trigonometrical lines may be safely accepted." If we "may reasonably rely upon the trigonometrical survey of England," how has the director of that survey—Colonel James—committed the error I pointed out in my letter of 19th December last. We might just as reasonably rely on the wondrous paralogism advertised in your columns, a week or two since, by "Edward Thornton on the Quadrature of the Circle."

In reply to Mr. T. C. Haines, 2nd March, I refer him to my question to Mr. W. Hayden in the same number of your Magazine. When I have their answer to that question I shall show them what they now ask for.—I am, Sir, yours, &c.,

London, March 14. WILLIAM HARVEY.

THE steam line between Baltimore and Liverpool is again in operation, after a suspension of several months. The steamer "Worcester" cleared for Baltimore on the 26th of February for Liverpool.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—J. M.—Messrs. C. G. and Co.—E. S.—G. W. H.—Messrs. A. M. and Son—J. L. N.—G. W.—G. G. P.—E. M.—W. L. Y.—W. H.—A. W.—G. L.—T. I.—T. W. T.—C. B.—S. K. M.—J. B. T.—F. W. B.—N. M.L.—R. F. F.—W. H. H.—B. T.—T. W. T.—G. L.—J. S.—P. H.—H. D. R.—R. G. S.—W. T. H.—F. J. T.—P. L. S.—Messrs. G. and M.—T. C. W.—J. L.—J. N.—E. W. Y.

Meetings for the Week.

MON.—Royal Geographical Society.—"A Journey to Shasa and the Source of the Brahmaputra." By a Pundit, under the direction of Captain T. G. Montgomerie, R.E., at 8.30 p.m.

TUES.—The Institution of Civil Engineers.—Continued discussion upon Mr. Sandberg's paper on "The Manufacture and Wear of Rails," at 8 p.m.

Royal Institution.—Dr. Foster on "The Development of Animals," at 3 p.m.

WED.—Society of Arts.—Mr. A. S. Bicknell, on "Horse as an Article of Food," at 8 p.m.

THURS. — Royal Institution.—Dr. Foster on "The Development of Animals," at 3 p.m.

Aeronautical Society of Great Britain.—Reading and Discussing Papers, at 8 p.m.

FRI. — Royal Institution. — Dr. Carpenter on "The Unconscious Action of the Brain," at 8 p.m.

Royal United Service Institution.—Major S. Bevan Edwards, R.E., on "An Organization for the Army of England," at 3 p.m.

Society of Arts.—Chlorine and its Compounds with Oxygen. Chlorate of Potash—its Manufacture and Remarkable Properties. Hydrochloric Acid, or Spirit of Salt—its Production and Applications in Arts and Manufactures, viz., Galvanizing of Iron, Sal Ammoniac, Chloride of Tin, &c. Illustrations. At 8 p.m.

SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

Naval, Military, and Gunnery Items.

IT appears from advices from Annesley Bay of the 19th of February that the vessels of the British India Steam Navigation Company had done good service, not only in landing troops and stores without accident, but also from the fact that by their powerful condensing apparatus they were able to supply daily to the troops many thousand gallons of good fresh water, not otherwise to be obtained.

The Bureau Veritas states that the number of vessels totally lost during the month of January was 264—viz., 141 English, 35 French, 24 American, 12 Prussian, 8 Dutch, 7 Norwegian, 5 Danish, and 32 of divers flags. The number of steamers included in the above enumeration was ten. There is a diminution of 157 vessels, as compared with the corresponding month of 1867, and 147 with that of 1866.

WE are glad to observe that notice has been given that rolls of officers and men of No. 6 company, 11th Battalion, Royal Artillery, who were employed in the operations leading to the capture of Banda and Kirwee, between the 19th of April and the 6th of June, 1858, has been received at the Secretary's office, Royal Hospital, Chelsea, from the Government of India, with authority for the payment of the shares of prize money, including first and second distributions, to which they are respectively entitled; and that such payment, in the proportion of £63 to each individual or private's share, will commence on the termination of one month from the 11th inst.

Two fine new lifeboats have just been sent by the National Lifeboat Institution to the coast. One of them is stationed at Ross Links, Holy Island, where Grace Darling immortalized her name by her heroic services to the crew of the "Forfarshire" steamer, which was wrecked off that place in 1838. The Ross Links boat, which is 32ft. long, is named the "Bombay," and is the gift to the institution of Mr. and Mrs. J. G. Frith, of London. The second boat has been sent to Stonehaven, on the east coast of Scotland, and is named the "St. George." This boat was presented to the society by Mrs. George Burgess, sister-in-law of Captain Burgess, secretary of the United Service Institution.

ONE of the eight gunboats now building in private yards for the Admiralty, was launched by Messrs. Pearse, Lockwood and Co., Stockton, on Tuesday week. She is named the "Hornet," and has been built from the designs of Mr. E. J. Reed. Her dimensions are—length between perpendiculars, 155ft.; breadth, moulded, 25ft.; depth, 14ft. 2in.; burden, in tons, 463 88-94. She is a composite vessel, having iron frames, beams, &c., covered with two thicknesses of teak planking, the whole of the fastenings being of brass and copper. She is bark rigged. Her armament will consist of two guns, one 100-pounder, and one 64-pounder. Her machinery consists of two pairs of horizontal trunk engines, with three boilers of the nominal power of 120 horses. She is on the twin-screw principle, one pair of engines driving each propeller, the latter being of gun-metal, and of the form known as Griffith's patent. The "Hornet" is for the Indian service, and, when fully equipped, will only draw 7ft. of water.

FROM the Clyde we learn that Messrs. A. and J. Inglis, of Point House, have launched an iron twin-screw, named the "Selix," for the South American trade. Her dimensions are 170ft. by 27ft. and 9ft. The vessel will be fitted by her builders with two pairs of compound engines of 90-horse power nominal collectively. Mr. J. G. Lawrie, of Whiteinch, has launched a screw of 1,000 tons, named the "Illawarra," intended for the conveyance of passengers in Australian waters. The "Bremen, screw, built by Messrs. Caird and Company for the North German Lloyd, has made an excellent run from the Clyde to Bremen; she will ply between Bremen and Baltimore, via Southampton. The screw steamer "Dunvegan Castle," recently launched by Messrs. Blackwood and Gordon, of Port Glasgow, and owned by Mr. Lang, of Groatholm, has made a trial trip. The steamer, which is intended for the Highland trade, attained during the trip an average speed of about thirteen miles per hour.

THE officers of the Royal Artillery have taken M'Lean's Gallery, No. 7, Haymarket, from the month of June next, for the purpose of exhibiting original pictures, photographs, and sketches, the work of members of the corps. Our readers are doubtless aware that drawing is taught to the cadets at the Royal Military Academy, and the universal service of the regiment affords artillery officers excellent opportunities for describing, by the pencil or the camera, scenes to which artists never penetrate. It is not probable that the exhibition will claim notice for the artistic value of the works. Indeed, the committee, in a circular lately issued to all stations, grounds its appeal to officers upon the unusual character of the works likely to be exhibited. There will be framed pictures and drawings upon the walls, but the chief interest of the exhibition will probably consist in the sketches from nature, which will be shown in portfolios. Any surplus funds remaining after the expenses have been defrayed, will be devoted to some charitable object connected with the corps, and the exhibitors confidently expect that the novelty of the scheme will attract a considerable number of visitors.

THERE has been issued in the form of a parliamentary return, a list (made up to Dec. 31) with the names of every merchant vessel or steamer engaged in the Abyssinian expedition chartered in England, with the net and gross register tonnage of each ship, the horse-power of each engine, the price per ton each ship is chartered at; also the name of each registered owner of such ship as appeared upon the register when the ship was tendered to the Government for hire, and the name of each owner as now stands upon the register, with the name of the broker who tendered such ship. The ships taken up are eighteen:—namely, the "City of Manchester," "City of Dublin," "England," "Queen," "Peruvian," "Kangaroo," "Californian," "West Indian," "American," "Bosphorus" (lost), "Golden Fleece," "Mauritius," "Queen of the South," "Empress," "Parana," "Coumoundouros," "Bolivar," and "Venetian." The gross tonnage is 34,290. The gross horse-power is 4,670. The average rate per ton if discharged at home is 30s. 6d. The rate if discharged abroad varies considerably. It is 45s. per ton in the case of several vessels, and as low as 25s. in one only, the "Parana."

Miscellanea.

THE number of visitors at the Patent Office, South Kensington, for the week ending March 14, was 3,433; total number since the opening of the museum free daily (May 12, 1858), 1,260,322.

THERE are now 63 telegraph stations in New South Wales, and 3,346 miles of wire, costing for construction on an average £45 9s. 9d. per mile. The revenue for 1866 amounted to £30,698. In 1865 there were 138,789 messages, which in 1866 had increased to 145,523.

A CURIOUS fit of rough weather for March set in in the North Riding on the night of Tuesday week when, and during next day, several smart showers with thunder and lightning, occurred. During Wednesday the weather was very wild, and a considerable depth of rain fell.

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INTELLIGENCE having been received by the directors of the Oude and Rohilkund Railway of the commencement of extended operations on their lines, they intend to issue at an early date a further £1,000,000 of capital in shares of £10 each, to be offered rateably to the proprietors.

A MEETING of the members of the Aeronautical Society of Great Britain will be held at the Society of Arts, Adelphi, on Thursday, March 26, at eight p.m., for the reading and discussion of papers, and generally for the advancement of the society's interests. The Duke of Argyll has consented to preside.

THERE have of late been heavy storms of slete and snow throughout America, blocking up the railways, and causing a general interference with business. An unprecedented amount of snow has fallen this winter, and in some localities snow has lain upon the ground for ninety days continuously.

THE visitors to the South Kensington Museum during the week ending March 14, 1868, were as follows:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., 10,288. On Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 5 p.m., 1,536.—Total, 11,824 Average of corresponding week in former years, 10,311. Total from the opening of the museum, 7,242,688.

LETTER from Kurrachee state that Sir Seymour Fitzgerald, the Governor of Bombay, has given much satisfaction to the mercantile community of that port by his recent visit, and that hopes are entertained of the speedy completion of the long-delayed harbour works designed by the late Mr. Walker, and of the extension of the Scinde Railway to the Punjab.

MR. R. JONES, of Henfachen, has published a book containing many hundreds of sheep's ear marks. This extraordinary book will be useful to farmers and shepherds from Llangollen to Mawddy. It contains a full description of ear marks for twenty-two parishes around Llanrhaidr. We have seen plenty of books with dog's ear marks, but never before heard of one with sheep's ear marks.

A VOTE of £2,000 having been made for encouragement of manufactures in New Zealand, the Government have had under consideration the offering of a bonus of £1,000 for the first 50 tons of sugar manufactured within the province from beetroot grown in the province, and a bonus of £500 to any person or persons producing 20,000 bushels of marketable malt within the province. It has also been suggested that encouragement should be offered to meat-curing on a large scale.

A CURIOUS point arose on Friday at the Rolls Chambers as to Lord H. Seymour's bequest to the charities of London. His lordship died in 1859, and the definition of London by the Master of the Rolls was not a four mile radius, nor the metropolitan police district, but a "continuous line of houses." An application was made to participate in the fund on the part of the Home for Soldiers' Daughters at Hampstead (within four miles), and the Chief Clerk (Mr. Marshall) refused the application, on the ground that there was not in 1859 a continuous line of houses to the Home.

The "Illustrated Australian News" says:—"One of our enterprising breeders upon the Murrumbiggee, in the neighbourhood of Gundagai, recently experimented upon a fat but otherwise useless horse, as to the profit of boiling down. After the process had been carefully carried out, he realized fifteen gallons of pure oil, that he readily sold at the first offer in Gundagai, for currying purposes, at 6s. 6d. To this is to be added the price of the hide, the value of the hair, the glue from the hoofs, and the bones for manure—all of which would be realized if the process was carried out in a large and systematic manner."

A WRITER in the "Law Journal" complains that nearly every fireplace in each of the comparatively new buildings in the Temple—Paper-buildings, Dr. Johnson's-buildings, and Crown Office-row—is a nuisance to the inhabitant. Some smoke persistently, some at intervals, some when you put on coals, some when they get low for want of coals, some when the window is shut, some when the door is open, and some seemingly only when you are very busy, or bad-tempered. Verily, barristers are a long-suffering and patient race. But why don't they try Mr. Meelie's principle, and remove the chimney pots? If that don't answer, then they should adopt the orthodox remedy of a taller pot surmounted by an elegant cowl. They should consult the architect of the Middle Temple Library on this point.

THE following return of the receipts of the Atlantic Telegraph Cable shows in a remarkable manner the importance of this communication between the Old and the New World to the interests of the mercantile community of England and America. Receipts each day from midnight to midnight compared with those at the corresponding period of last year:—

1868.		1867.	
Feb. 16, Sunday.....	£764	Feb. 16, Saturday	£1,181
„ 17, Monday.....	1,497*	„ 17, Sunday.....	436
„ 18, Tuesday.....	1,599	„ 18, Monday.....	668
„ 19, Wednesday	1,620	„ 19, Tuesday.....	1,026
„ 20, Thursday....	1,929	„ 20, Wednesday	1,031

* On this day the land lines of telegraph in Ireland were broken by a gale of wind.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—2389, 2422, 2425
BUILDINGS AND BUILDING MATERIALS—None.
CHEMISTRY AND PHOTOGRAPHY—2344
CULTIVATION OF THE SOIL, including agricultural implements and machines—2367, 2391, 2426
ELECTRICAL APPARATUS—None.
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2349, 2356, 2364, 2365, 2366, 2374, 2378, 2390, 2401, 2405, 2410, 2411, 2416, 2424
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—2417
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—2358, 2359, 2383, 2388
GENERAL MACHINERY—2345, 2346, 2350, 2351, 2354, 2360, 2371, 2373, 2379, 2385, 2363, 2397, 2398, 2404, 2406, 2408
LIGHTING, HEATING, AND VENTILATING—2361, 2414
METALS, including apparatus for their manufacture—2376, 2395, 2420
MISCELLANEOUS—2347, 2348, 2353, 2357, 2363, 2368, 2370, 2372, 2375, 2377, 2380, 2382, 2384, 2386, 2387, 2394, 2396, 2399, 2400, 2418
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2355, 2362, 2381, 2392
SHIPS AND BOATS, including their fittings—2352, 2412, 2413, 2415, 2423
STEAM ENGINES—2402, 2419
WARFARE—2369, 2403, 2409, 2421

2342 A. W. WILLIAMSON. *Improvements in lamps.* Dated August 14, 1867.

This invention relates to lamps for burning heavy oils. To burn such oil efficiently, however, it should, as it rises to the burner, and after it has been separated from the bulk of the oil in the reservoir, be highly heated by bringing it in contact with a heated wick tube of some length. To fulfil these conditions, the inventor employs, in order to draw the oil up out of the reservoir, a wick or wicks of large size, which he calls feeders; they are much larger than the wick on which the oil is ignited to form the flame of the lamp, and with the latter or flame wick the feeder wick or wicks are kept in close contact near up to the flame of the lamp.—Patent abandoned.

2344 J. T. WAY. *Improvements in treating phosphate of lime for the manufacture of manure, and for other purposes.* Dated August 14, 1867.

This invention relates to the production from ordinary phosphate of lime, and the use for manure, of a compound of lime and phosphoric acid, intermediate in composition and character between ordinary insoluble phosphate of lime and acid, or soluble phosphate of lime. The details of this invention are very voluminous.—Patent completed.

2345 J. PEACOCK. *An improved machine for cleaning barrels or casks.* Dated August 15, 1867.

This invention relates to the construction of a machine wherein the barrels or casks are cleansed by the centrifugal action of water or other liquid, which action is produced by the rotation of the barrels upon a central axis. The invention consists, chiefly, in the employment of two or more rotating frames arranged to turn upon the same horizontal axis, and adjusted to balance one with the other when loaded. The invention also consists, partly, in the construction of the frames, in the devices for holding the barrels and adjusting them in different positions therein to insure the desired action of the cleansing liquid on all parts of their surfaces, in the means for adapting the rotating frames to receive barrels or casks of various sizes, and for holding a number of barrels evenly balanced during their rotation; also in the devices for locking the frames together, and adjusting and securing them in the position to allow the barrels to be secured and released, and also while they are being filled and emptied. The invention also consists in the construction and arrangement of a trough or vat in combination with the said rotating frames, whereby the barrels can be filled with the cleansing liquid after they are placed in the said frame, and in the arrangement of adjustable valves and tubes whereby the barrels in the frames are all supplied with the liquid at one time—Patent completed.

2346 F. H. WENHAM. *Improvements in heated air engines.* Dated August 15, 1867.

This invention consists in so arranging the top of the cylinder that it shall act as an air pump. In hot air engines the body of air forced into and heated by the furnace must be less in bulk than the capacity of the cylinder, as determined by one stroke of the engine. In order to obtain this condition, according to one method, the patentee provides the top of the cylinder with a sliding or other valve opening to the external air; this serves as the inlet valve of the pump. After the piston has descended to the bottom of the stroke, this valve remains open for a portion of the return stroke, so that some of the air that has just entered is allowed to escape again into the atmosphere. At the time when the air pump contains the requisite charge of air (varying in quantity from three-fourths to one-half the lower capacity of the cylinder) the inlet valve is suddenly closed by the action of the engine, and the contained volume of air is forced through the usual outlet valve into the furnace.—Patent completed.

2347 T. BUSHBY. *Improvements in pill-making machines.* Dated August 15, 1867.

Here the patentee passes the mass from which the pills are to be made between two plain rollers at the distance apart to form the sheet, which sheet is formed into strips or bars by a self-acting knife or grooved rollers, and the bars one after the other fall upon a number of circular grooved cutters. At a portion of the circumference of each grooved cutter there is a stationary grooved cutter, the grooves being opposite each other, forming a circle in transverse section, so that, when revolving motion is given to the circular grooved cutters, the bars shall be cut and shaped into pills.—Patent completed.

2348 J. COSGRAVE. *Improvements in apparatus employed in the heating of bakers' ovens.* Dated August 15, 1867.

Here the inventor employs a chaffer box of the ordinary construction, and supplies air thereto in the usual way. Instead, however, of using a chaffer fitting carefully into the box, he employs one formed with overhanging end flanges, so that, when shipped or set in position, the ends fit over the box and the sides into it. In this way an increased area is obtained through which air may be admitted to the fuel; and that it shall be freely admitted he employs movable bars with apertures therein, and places them longitudinally instead of transversely, as hitherto has been the practice.—Patent abandoned.

2349 R. CLELAND and R. CUNNINGHAM. *A new manufacture of woven fabrics, imitating fabrics woven with horse hair.* Dated August 15, 1867.

This invention consists in weaving "seating" or fabrics for covering furniture and "crinoline," or fabrics for skirts and other parts of wearing apparel, and also other fabrics, with cotton thread, or other suitable spun material, instead of the horsehair hitherto used in weaving such fabrics, the cotton thread or other spun material having the requisite hair-like consistency and glaze imparted to it by process of dressing and polishing.—Patent abandoned.

2350 E. ORMEROD. *Certain improvements in safety apparatus to be employed for preventing accidents in winding coals and other minerals from mines.* Dated August 15, 1867.

This invention relates to a description of link or shackle which is interposed between the winding rope and the cage or receptacle, and which is designed for rendering such attachment either permanent or releasing by self-acting means, according to its position when employed for raising or lowering weights, coal, or other minerals, the said links being so arranged that, in the event of the cage being "over wound," it is released from the rope, and at the same time retained at the point where the link became uncoupled or disconnected. The improvements consist in the employment and use of a link or shackle formed of three plates placed side by side, and connected together at or about the middle of their length by the central pin or stud upon which the plates may turn; in these plates grooves or slots are formed, in which the shackle pins that connect the rope with the cage are contained.—Patent completed.

2351 A. F. BAIRD. *An improved earth closet.* Dated August 15, 1867.

Here the patentee places a receptacle beneath the seat for receiving the deposits with which the earth is to be mixed with a shoot or passage opening into the said receptacle for conveying the earth into the same, and at the other end to that above mentioned another opening by which the earth is supplied from a hopper to the said shoot; the bottom of this hopper being curved and provided with the last-mentioned opening for communication with the shoot, is opened and closed by the action of a sector piece or other valve weighted as a counterbalance, such piece or valve being secured to, and forming part of, a flap or valve hung at the centre, the office of which flap or valve is to close the opening from the shoot into the receptacle first mentioned, the same being effected by means of a projection from the centre of the said flap or valve situate just beneath the seat of the closet, so that, when at rest, the sector valve closes the entrance from the hopper to the shoot, and prevents the discharge of earth into the said shoot; and when the closet is used, the weight of the "sitter" presses the seat on the said projection, and thus gives motion to the valve arrangement and opens the entrance from the hopper to the shoot, shutting the entrance to the receptacle for deposits, thus causing the shoot to be filled up with earth, which is to be discharged therefrom into the receptacle by the removal of pressure of the "sitter" getting up from the seat. The sector valve has a rod or rods attached to it, working in the hopper, to prevent the consolidation of the earth, and cause it to remove as required.—Patent completed.

2352 H. BODART and A. SIGODART. *Improvements in apparatus for propelling vessels.* Dated August 15, 1867.

The objects to be attained by this invention are simplicity of machinery, economy of motive power, and rapidity of action. By means of an axis with three cranks, and driven by a steam engine, or any other suitable motive power, the patentees work three paddles which replace advantageously in every description of vessel the screws and paddle wheels before employed.—Patent completed.

2353 W. R. LAKE. *Improvements in metal ties or bands for securing bales of cotton or other substance.* (A communication.) Dated August 15, 1867.

Here the inventor makes use of ordinary hoop or band iron of the requisite width. The two ends of the band are brought together, and made to overlap each other sufficiently to answer the desired purpose. Slots are cut in the outer overlapping end of the band, and a key is fastened to the other end of the said band. This key is made in a peculiar shape, with one side extending much further from its entire pivot than the other, and the surface of its head is made to incline at an angle of about 10deg. The said key is fastened permanently to the end of the band, and this end is turned back so as to form a double thickness, through which the key passes or it may be made with a washer instead of having the end turned back, the object being to give greater strength to this part of the band.—Patent abandoned.

2354 G. CLARKE. *Improvements in fire-escapes.* Dated August 16, 1867.

This invention has reference to certain well-known fire escapes constructed by the present inventor, and for certain improvements upon which he registered a design on March 12, 1863 (No. 4543). Among the features of the present invention are the following:—One of these improvements consists in strengthening the main ladder against twisting strains by a diagonal wire truss at the back of the ladder, the upper ends of which truss are fixed to the brackets upon the end of the ladder, whence the

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wire ropes or rods pass diagonally to the opposite ends of the transverse stay bar of the guiding quadrants; here they are led over pulleys attached to the bar, and then again, crossing each other, they pass down to the framing at bottom, to which they are attached by screw bolts arranged so as to be capable of tightening the truss when requisite. Another improvement consists in providing each of the two guiding quadrants for the levers to the fly ladder with three pulleys, instead of one, as heretofore, over which the two side wire trusses are made to pass, so as to render both the quadrants and the side trusses more rigid. Another improvement consists in forming the two levers for working the fly ladder with two arms or "split" levers, to one of which arms the ordinary rope for raising the fly ladder is attached, such rope being worked by a small windlass fixed to the main ladder at bottom, in place of working the rope by hand, as heretofore. To the second arm is attached a check rope, for preventing the fly ladder when raised to the vertical position from falling forward too rapidly. Another improvement consists in substituting for the canvas and wire gauze trough heretofore employed attached to the main ladder a collapsible tube of fireproof canvas netting held open at the upper and lower ends by a framing fixed to the ladder.—Patent abandoned.

2355 J. DAY and W. DORBER. *Certain improvements in the manufacture and construction of cabs, coaches, carriages, omnibuses, and other similar vehicles.* Dated August 16, 1867.

This invention consists in the use of angle or T-iron or steel, or tubular iron or steel, for the framework, and of corrugated metal for the roof and floor, and of tubular metal for the shafts and centre pillar in Hansom cabs, such framework being connected together by metal screw bolts or rivets, and, if required, the whole or part may be galvanized or painted to prevent corrosion.—Patent completed.

2356 M. HENRY. *Improvements in the method of, and apparatus for, treating certain vegetable substances in order to obtain fibrous materials and paper pulp therefrom.* (A communication.) Dated August 16, 1867.

This invention relates, principally, to the treatment of trees and plants of the palm tribe, such as palms, palmettes, chamerops humilis, St. Peter the Martyr palm, cephaglioli, cephaglioni, &c., and consists in subjecting the vegetable substance to two operations in apparatus for the purposes, one process and apparatus being for crushing, triturating, or macerating the vegetable substance, and the other process and apparatus being for combing it.—Patent completed.

2357 H. FRANKENBURG and S. PHILLIPS. *A new or improved fastening, particularly applicable for leggings and gaiters.* Dated August 16, 1867.

This invention consists in inserting a movable button or stud in a piece of steel inserted on one side of the legging or other article to which it is to be fitted, and forming a slot in a piece of steel inserted on the other side of the legging, and which is somewhat curved or bent outwards, always having a tendency to spring from the other side, by pressing the slot over the button, and by turning the latter the fastening is secure.—Patent abandoned.

2358 R. JOSEPH. *Improvements in stays or corsets.* Dated August 16, 1867.

Here the inventor makes each half of the stay in two pieces in the depth, the lower piece being about half the depth of the upper one, and, instead of cutting the material straight, as usual, he gives it a curved form or outline, the lower edge being cut much wider than the top, and deeper also at the ends than in the centre of the curve. Two of these curved pieces are employed, one for each lower half of the stay, and are sewn to the upper part, the lower edge of which is cut to the curve of the piece to be attached thereto. In this manner the lower part of the stay will have sufficient fulness to readily adapt itself to the form of the hip without the aid of gores. The upper part of the stay is made in a similar manner to the bottom part.—Patent completed.

2359 T. JACKSON. *Improvements in pianoforte actions.* Dated August 16, 1867.

In order to obtain the escapement in a pianoforte action—that is to say, in order to cause the point of the fly or hopper at the moment that the blow is struck to escape on to the inclined part of the lever or instrument on which it acts, so that the hammer may not be blocked against the string, or so close to it as to cause a second blow to be struck upon it, the inventor mounts on the block which carries the fly or hopper a bent lever; this lever is jointed to the block at a point intermediate of its length, and when the finger key is depressed the outer end of the lever, or, rather, an adjustable button upon it, is brought up against a fixed stop or rail just at the time when the escape is required. The bent lever is then caused to turn on its centre, and its other end acting on a button on the fly or hopper pushes it off.—Patent abandoned.

2360 J. W. DUDLEY. *Improvements in machinery for cutting corks.* Dated August 16, 1867.

In machinery constructed according to this invention, the sheet of cork is first cut into strips of the width required for the length of the cork, and is of a thickness more or less approaching the diameter of the corks required. The strip of cork is fed between two dogs which grip it; a knife then comes forward and cuts off a piece from the strip sufficient for making one cork. Immediately following the knife first mentioned, and in the same plane, is a second knife not quite so wide as the first, but of great length, and shaped like the segment of a circle; this knife is mounted on arms which converge to the centre of the segment, and are there connected to an axis on which it moves working in a suitable bearing. The curved knife is capable of reciprocating movement, oscillating from its centre, so that its edge is always presented to the piece of cork cut off from the strip. This piece of cork is held between the two dogs, and so soon as the curved knife commences to cut it, a lever arm mounted on the framing actuates the dogs by suitable gearing, causing them to revolve the piece of cork against the edge of the curved knife as it travels along, thus rendering the cork cylindrical. When the curved knife reaches the end of its course, the cork now finished is released from the dogs by a lever arm acting on one of the dogs, and falls into a shoot or receptacle; the lower end of this lever arm is connected with a cam by which it is operated, the other end acting upon one of the dogs for releasing the cork. During the return movement of the knife-carrying frame, the lever arm is returned to its original position by the cam above mentioned, at the same time holding open one of the dogs for again receiving the strip of cork, a piece of which is cut off and turned as before. The oscillation of the knife frame is produced by a connecting rod attached thereto at a suitable distance from its axis, motion being transmitted to the connecting rod by gearing, the whole being operated by any suitable motive power. The patentee also provides two grindstones, which are kept continually rotating by the gearing operating the connecting rod. At each oscillation of the frame the edges of the curved knife come in contact with the revolving pieces of the grindstones, and it is thus always kept in a sharp condition. By simply lowering and slightly altering the direction of one of the dogs, a taper cork is produced. The knife frame can be adjusted on its axis at any distance from the dogs, according to the size of the cork required, and can be made to move to and fro in order to produce an oval cork.—Patent completed.

2361 J. WAVISH. *Apparatus applicable to the heating of greenhouses, causing bottom heat to plants, and other heating purposes.* Dated August 17, 1867.

This apparatus for heating greenhouses consists of a peculiar arrangement of stove and hot water or liquid boiler, such stove being devised and adapted for being heated by lamps burning mineral or other oil, or lamps or burners of any similar character.—Patent abandoned.

2362 A. LEVESON. *Certain improvements in hoods or coverings for perambulators, bath chairs, carriages, and other vehicles.* Dated August 17, 1867.

This invention consists in the application of a coiled wire or plate spring to the pivot or centre pin of the hinge joint on which the hood turns, when being raised or lowered, or in the application of india-rubber or other spring to the front frame of such hoods, so arranged that the hood shall be raised thereby and opened and held in such position when it is released from a strap or cord which retains it in its folded position, so that the spring forms a self-acting hood lifter, or opener and retainer.—Patent completed.

2363 L. AVOYNE-BAINEE and M. J. SIBILLAT. *A new system of metal spring mattresses.* Dated August 17, 1867.

This spring mattress is formed entirely of iron. In its most simple construction it receives its elasticity simply from two helical springs, or even from a single plate spring, such as those upon which carriages are suspended.—Patent completed.

2364 A. LEES and W. H. RHODER. *Improvements in machines for spinning and doubling cotton, wool, and other fibrous substances.* Dated August 17, 1867.

This invention is applicable to the machines for spinning and doubling, called self-acting mules, and it consists, first, in an improved change motion applicable to the cam shaft. This motion is composed of an internal ratchet wheel keyed on the shaft passing through the hollow cam shaft, to which is hinged a catch which is brought alternately into gear at opposite sides of the said ratchet wheel by a pair of sliding rods, acting, when required, on a swell fixed to the catch above referred to. These sliding rods are actuated at the end of the stretch, and, when the carriage has run in, by stops on the usual side rod.—Patent completed.

2365 T. SAGAR and T. RICHMOND. *Improvements in looms for weaving.* Dated August 17, 1867.

This invention relates to the "letting off" motion of looms, and has reference to a former patent, dated July 4, 1866 (No 1775). It consists in dispensing with the catches and ratchet wheels described in the former patent, and in using in lieu thereof the following parts:—To the axle of the usual vibrator the inventors fix a toothed segment or lever with a stud or studs; the teeth of this segment, or the studs of the lever, take into the teeth of a wheel, on the boss of which is a pinion gearing into a wheel on the axle of the warp beam. When the tension of the warp depresses the vibrator, the tooth of the segment, or the stud of the lever, is raised, and allows one tooth of the wheel in which it gears to slip, thereby letting off a portion of the warp; the parts remain in these positions until the tension of the warp depressing the vibrator again allows another tooth to slip, and thus the warp is let off as required. The teeth of the segment, or the studs of the lever, and the teeth of the wheel in which they work, are, or may be, case hardened, or made of hardened steel. The second part of the invention consists in tightening the warp when the reed is beating up the weft by an eccentric on the crank shaft acting on a lever to which the vibrator is connected; or by connecting the lay sword, or the lay, to a lever loose on the axle of the vibrator, in the upper arm of which lever is a set screw, against which the vibrator presses when the reed beats up; or the same result may be obtained by connecting the lay or the crank shaft by other equivalent to the vibrator.—Patent abandoned.

2366 J. HOLROYD and W. FIELDHOUSE. *An improved method of twisting or doubling yarns in mule spinning machinery.* Dated August 17, 1867.

The object here is to produce yarns with an irregular twist at stated intervals upon mule frames. This irregular twist is effected by dispensing with the usual motion to the drawing or delivery roller, and by causing it to pause at given periods in its revolutions whilst delivering the yarn to be twisted, such period being dependent upon the space required between each irregularity, the intermediate space presenting the ordinary spiral twist.—Patent abandoned.

2367 M. FROW. *Improvements in reaping machines.* Dated August 17, 1867.

This invention consists in a mode of arranging the gathering and sheafing parts of reaping machines, and in constructing additional parts thereto in such a manner that one or more of the raking boards will gather the growing crop towards the cutters, and deposit it upon the table or platform when cut; and also that one or more of the raking boards will, in addition to gathering the growing crop as above stated, also deliver the cut crop off the table or platform in quantities suitable for sheafing.—Patent completed.

2368 A. M. CLARK. *Improvements in the construction of moulds for casting aluminium and other metal plates for artificial teeth, also in the method of casting said plates and securing the teeth therein, and in apparatus connected therewith, part of which improvements is applicable for producing other fine metal castings.* (A communication.) Dated August 17, 1867.

This invention is not described apart from the drawings.—Patent completed.

2369 J. W. DIXON and W. BUTTERY. *Improvements in apparatus for turning or closing cartridges for breech-loading firearms.* Dated August 17, 1867.

Here the patentees employ a tube or barrel of such a size as to receive the cartridge case freely; it is usually made in one piece with a jaw and an arm carrying a binding screw, by which the apparatus may be clamped to a table opposite. One end of the tube or barrel is a hollow cone capable of being rotated by a crank handle, and whilst it is thus turned, the cartridge case to be closed is pressed against it by a lever rammer entering the other end of the tube or barrel, and bearing against the base of the cartridge, and so the case is closed. Afterwards it is expelled by a rammer passing through the closing cone or instrument. The invention, however, consists especially in the way in which the cartridge case is prevented rotating in the barrel or tube whilst the closing cone or instrument is acting upon it. The patentees form a longitudinal slot in the tube or barrel, and into this slot they insert a button or stud with teeth upon it on the end which projects into the tube or barrel. The button or stud has a flat head on which a strong spring presses. As the cartridge is pushed up the barrel or tube, the teeth of the button or stud engage with its base, and whilst the button or stud prevents the cartridge case turning, it travels with it towards the closing cone or instrument. It is driven back with the cartridge when the turning or closing is complete.—Patent completed.

2370 F. B. HOUGHTON. *Improvements in treating products obtained when operating on wood and other vegetable substances to obtain fibre therefrom.* Dated August 17, 1867.

The patentee claims evaporating the spent alkali which has been employed to boil wood or other vegetable substance to obtain fibre in a pan heated by a coil of seated water pipes contained partly within the pan and partly within a furnace, as described.—Patent completed.

2371 W. W. POCOCK. *Improvements in indexes or tell-tales applicable to fluid meters and other counting or measuring apparatus.* Dated August 17, 1867.

This invention is intended to show the amount of money due for gas burnt during any given period, or the amount of money received at the entrances of public places, &c., and it consists, mainly, in the addition to the train of wheels usually employed for measuring and counting of other wheels the spindles of which carry discs marked with figures to indicate pounds, shillings, and pence, one figure upon each such disc being visible at all times through an aperture corresponding with such disc in the face of the apparatus, or otherwise.—Patent completed.

2372 M. CAHEN. *An improved apparatus for sealing letters, envelopes, and other papers.* Dated August 17, 1867.

This invention is not described apart from the drawings.—Patent completed.

2373 W. R. GOULTY. *Improvements in machinery for cutting, crushing, bruising, or otherwise preparing furze or gorse, straw, bark, or other vegetable substances.* Dated August 17, 1867.

The patentee claims the arrangement of a series of revolving spiral or parallel cutting surfaces in combination with revolving pressing or crushing surfaces so driven as to have a shearing as well as a pressing action upon the vegetable materials to be cut crushed or bruised as they are caused to pass between them, in the manner described.—Patent completed.

2374 T. TUNSTILL. *Improved means and apparatus for preparing size for warps or other purposes.* Dated August 19, 1867.

This invention consists in the use of a boiling vessel or pipe placed, by preference, in or near a vertical position, having an inlet at bottom and outlet at top. A steam pipe is introduced through the top which extends to near the bottom of the vessel, and having perforations therein. The usual mixing vessel is employed, and an ordinary force pump is connected thereto and to the inlet of the boiling vessel. The pump draws the size from the mixing vessel and forces it into and gradually up the boiling vessel or pipe through the outlet into another vessel for supply; or it may be conducted from the outlet direct to the sizing machine. Steam at high pressure is forced through the perforations of the central pipe, which mixes and combines with the size, whereby it becomes thoroughly boiled in its passage therethrough. A tap or valve is applied to the outlet for closing the same and regulating the quantity and time of discharge, and a pipe with a weighted valve is also connected to the inlet pipe for returning the surplus quantity forced by the pump back into the mixing vessel.—Patent completed.

2375 J. CRONIER. *An improved rotary heel for boots and shoes.* Dated August 19, 1867.

This rotary heel is made of leather adapted by a metal plate well riveted to the heel, the same having a round hole for a screw or screws to pass through to an interior plate of a smaller size from the inside of the boot or shoe, not interfering with rotatory movement, part of the heel giving facility to be repaired, the same as any ordinary boot or shoe.—Patent abandoned.

2376 W. B. ADAMS. *Improvements in uniting and treating iron, steel, and other metals in sheets, plates, rails, or other forms, applicable to navigable vessels, forts, guns, bridges, or like structures.* Dated August 19, 1867.

We cannot here give space to the details of this invention.—Patent abandoned.

2377 J. HOOKER and F. BRABY. *Improvements in fire-lighters, also applicable for fuel generally.* Dated August 19, 1867.

This invention consists, essentially, in the use of "napthlin" in the preparation or manufacture of fire-lighters; it is also applicable to fuel generally.—Patent abandoned.

2378 C. E. BROOMAN. *An improved mode, or improved means, of colouring or ornamenting fabrics and other surfaces, and of preparing printing surfaces.* (A communication.) Dated August 19, 1867.

This invention mainly consists in applying upon fabrics and other surfaces to be coloured or ornamented a liquid in a state of fine mist, or very fine spray—that is to say, in the state of extreme reduction or of pulverization, such liquid containing colouring matters or substances, which will colour or ornament the fabric or surface.—Patent completed.

2379 W. E. NEWTON. *Improvements in crank motions.* (A communication.) Dated August 19, 1867.

The object here is to avoid the "dead points" and "dead centres" of a crank motion, and to make the power that drives the crank available during the whole or any part of the rotation of the crank. The invention consists

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in the use of two connecting rods working on one crank, and at nearly or right angle to each other. They are connected within an oscillating frame, and are furnished with catches and let goes, so that they will at the proper time and place, by self-connecting with and self-detaching from the crank, will take hold of and let go alternately, and at such angle of the crank with regard to its crank pin and shaft or journals as will most readily apply or transmit the propelling power to it.—Patent completed.

2380 F. and G. PARKES. *Certain improvements in spades and shovels.* Dated August 19, 1867.

In the manufacture of an ordinary shovel, where langets are required, these improvements consist, not in forming the langets out of the two pieces of steel or iron combined composing the blade of the shovel, but in raising both thicknesses into a ridge down the middle, which the inventors purpose connecting simply to the part raised, and welding the two thicknesses of metal right up to the raised or corrugated part, by which means a large amount of additional strength is given to the lengthway of the blade of the shovel, as also to the langets, which form a continuation of the raised or corrugated part. Second, the improvements apply to screening shovels, or like implements, in which case the langet is formed with the back or main part of the shovel; and by preference they use steel, more particularly for the part of the langet denominated the "coffering," where it unites and forms a part of the back for the sake of obtaining additional strength and lightness.—Patent abandoned.

2381 C. REISERT. *Improvements in railway carriages.* Dated August 19, 1867.

This invention comprises many features, the details of which are too voluminous to be produced here. One part of the invention consists in completely isolating railway carriages from their frames. Another in the employment of a species of double springs.—Patent completed.

2382 E. A. COWPER. *Improvements in the construction of safes for containing articles of value.* Dated August 19, 1867.

This invention consists in forming safes of wrought-iron plates welded together, or of compound plates of wrought iron and steel first welded together and formed into plates, and then welded together to form the safes, and the inventor also rolls such plates with a thick edge or projection, or with a recess or rabbit to facilitate the welding up of the edges of the plates, and to prevent them from being too much cut away by the action of the welding fire.—Patent abandoned.

2383 A. MARTIN. *Improvements in apparatus for uniting the brims to hat shapes or foundations.* Dated August 20, 1867.

Here the edges of the brim and crown are damped and placed on a block in the usual way. This block is placed in a screw or lever press, to which is attached a metal ring or hoop, similar in form to the hat, and the lower edge of which corresponds with the curve of the brim. This ring or hoop is heated by means of small gas jets impinging on its surface from a pipe provided with perforations attached to and encircling the said hoop, which pipe is connected by a flexible tube with the source of supply. In order to unite the brim to the hat-shape the ring is brought down by the action of the screw or other press so as to tightly embrace the blocked shape, its lower edge compressing the lapping edges of the brim and head-piece, the heated ring at same time effecting the drying of the uniting joint, while the starch or other adhesive matter contained in the material causes the two parts to adhere firmly together.—Patent abandoned.

2384 W. BURROW. *An improved rack for mineral or aerated waters, or other liquids in bottles.* Dated August 20, 1867.

This rack is constructed as follows:—An upright standard at each end is provided with a number of horizontal arms (say six) upon each side, and the ends of these arms are respectively connected together by horizontal rods or bars, each rod or bar being of sufficient length to support (say) six bottles without touching each other; between each pair of horizontal rods (and also connecting the two standards together) is a plate of the same length as the rods placed on edge, and perforated with (say) twelve holes to receive the necks of the bottles. The bottles are placed in the rack with the corks inwards and their necks through the perforations in the plates, the thick part of the body near the base resting on the horizontal bars, and the neck being lower than the body, each alternate bottle being reversed in position, so that when the rack is full there are (say) six layers of one dozen each.—Patent completed.

2385 W. DIXON. *Preservation of life from fire, or raising or lowering persons or goods from buildings.* Dated August 20, 1867.

This invention consists in placing a ring or eye-bolt over the windows of houses, and to which this portable apparatus can be attached. The apparatus consists of a block with hook and spring clip, which may be connected at pleasure with the eye-bolt above; through this block runs a rope, to one end of which is attached a pulley or snatch block, the other end of the rope passing underneath the sheave, and thence to the person working the apparatus. To the pulley or snatch block is attached a cradle or chair for the removal of persons, or hook and rope for goods.—Patent abandoned.

2386 H. CRIDLAND. *Improved applications to be used for removing the wool or hair from the skins of animals.* Dated August 20, 1867.

Here the patentee uses a solution of potash or soda, separately or in conjunction, of such strength as the thickness of the skin or hide may render requisite. He paints the flesh sides of the skins therewith. This causes the speedy severance of the wool from the skin, avoids the injurious action caused by the use of lime, as well as its after presence, and leaves the pelt or skin more bulky in appearance.—Patent completed.

2387 A. S. STOCKER. *Improvements in bottles, and in the manufacture of caps or covers for the same.* Dated August 20, 1867.

This invention consists in lining such or other caps or covers having screws, or their equivalents, formed in their inner peripheries with a thin soft metal such as will yield and take the inside figure thereof when pressure is applied thereto. The invention relates to a former patent granted to the present patentee, dated March 26, 1867.—Patent completed.

2388 A. COHEN. *Improvements in watches.* (A communication.) Dated August 20, 1867.

The patentee claims, first, the general construction and arrangement of mechanism for winding up watches, and setting the hands thereof, as described. Second, the combination with the hinge of a watch case of mechanism for operating upon the main spring, and effecting the winding of the same by the act of opening and closing the case. Third, the combination of a toothed rack in gear with a ratchet wheel on the axis or spindle of the main spring of a watch, and jointed to the end of a lever which derives its motion from the hinge of the watch case, the whole operating substantially as and for the purpose described. Fourth, the connecting the main spring with a friction piece or bridle fitted inside the barrel in lieu of to the barrel itself, substantially as and for the purpose described Fifth, the peculiar combination of mechanism for setting or adjusting hands of what are known as keyless watches, as described.—Patent completed.

2389 J. MURGATROYD. *Improvements in the construction of steam boilers, and apparatus connected therewith.* Dated August 21, 1867.

In constructing boilers having the firegrate under a projecting end, and the roof of the fireplace connected to the upper part of the boiler, or in any other boilers having the firegrate within the cylindrical casing, it is very desirable to form the roof part over the fire so as to be self-cleaning, and also so that no rivets be exposed to the action of the fire. In order to effect these objects the patentee makes each plate of the whole length of the firebox or roof part over the fire, and without any cross joints; these plates are fixed in an inclined position. The longitudinal connections of these plates are secured by rivets placed in the internal part of the boiler.—Patent completed.

2390 W. BOSTOCK. *Improvements in spools, reels, or bobbins, and in the method of manufacturing the same.* Dated August 21, 1867.

In the case of spools, the ends of which are formed separately from the barrel, and of the same or a different material, and are afterwards attached to the barrel, the patentee removes a portion of the wood from the centre of the barrel by boring, so as to form a cylindrical hole through the barrel of larger diameter than is ordinarily made to suit the spindles of the winding machines, the thickness of wood in the barrel after being bored being sufficient only to give a suitable strength to the barrel. The ends he forms of wood, bone, metal, &c., by turning an annular groove in one side of each "end" of a suitable size to fit the end of the barrel, the said "ends" being otherwise formed to give a suitable appearance to the spool, and to enable the smoke to be filled in the ordinary machines in the usual manner. The ends are attached to the barrel by forcing the ends of the barrel into the annular grooves in the "ends," either with or without the application of glue, &c., washers of thin calico being interposed between the barrel and the "ends," if preferred.—Patent completed.

2391 C. E. HALL. *Improved means or apparatus for hoeing, thinning, or chopping out turnips or any other root crops requiring such process.* Dated August 21, 1867.

This invention is not described apart from the drawings. —Patent completed.

2392 W. THOMAS. *Improvements in apparatus for registering the number of passengers carried in omnibuses.* (A communication.) Dated August 21, 1867.

Here the manner in which the registration is accomplished, so as to secure proper indication of the number of passengers carried during a day, or other longer or shorter period, is by the conductor moving a certain handle whenever a passenger enters or leaves the omnibus, or at a particular part of the journey; or, if desired, the passengers may move the handle. The movement of the handle is conveyed by certain transmitters to a registering apparatus, which, each time it is moved, causes the next higher consecutive number to appear, and, at the same time, to sound a bell, or give an audible signal.—Patent completed.

2393 J. ROBINSON and J. SMITH. *Improvements in applying motive power to saw frames.* Dated August 21, 1867.

This invention consists in arrangements whereby the patentees are enabled to drive saw frames by the direct action of steam, air, or gas cylinders. First, they use the steam, air, or gas as an elastic abutment for the piston, and this they effect by admitting steam, air, or gas to the cylinder before the piston has completed its stroke. The elastic fluid, therefore, exerts a resistance to the impetus of the piston and saw frame, but, at the same time, yields thereto so as to constitute an elastic abutment.—Patent completed.

2394 G. LUYCKX. *Improvements in the manufacture of waterproof tubes.* Dated August 21, 1867.

One mode of manufacturing tubes in accordance with this invention is as follows:—A seamless tube is, in the first instance, constructed of hemp, flax, &c., and of any desired length, the same being rendered durable by being tanned with oak bark, either by a hot or cold process. A sufficient quantity of caoutchouc in solution is then introduced into the interior of the tube to thoroughly impregnate the substance of which it is made. This the patentee effects by passing the tube between a pair of rollers. He then makes a roller or cylinder of sheet india-rubber, prepared, but not fully vulcanized, the same being of a less diameter than that of the tube of hemp, &c., and into which it is introduced. Each end of the tube is then drawn over or otherwise secured to the nozzle of a cock provided with a key for opening or closing it. One of these cocks is connected by a union joint to a pipe leading from a steam generator or source of steam. On the last mentioned cock being opened, a jet of steam is admitted into the india-rubber tube, which causes it to expand, and by very gradually increasing the pressure and the heat, a degree of vulcanization is obtained sufficient to perfect the adhesion of the two substances, so as to render them inseparable. The cock at the opposite end of the tube is kept closed when the steam is first admitted into the tube, but is opened occasionally during the process to allow of the escape of any condensed vapour.—Patent completed.

2395 C. W. SIEMENS. *Improvements in furnaces, and in apparatus in connection therewith, principally applicable to metallurgical operations.* Dated August 21, 1867.

The patentee claims, first, making cast steel upon the open hearth of a furnace by effecting simultaneously the reduction of iron ores in vertical heated hoppers, and the dissolution of the reduced metal, without exposing it to the flame in the metallic bath provided in the furnace. Second, making cast steel upon the open hearth of a furnace by causing wrought iron, steel, or white cast iron, to descend upon inclined planes, or through hoppers, where they become gradually heated into a fluid bath of cast iron under the influence of very intense heat, where they are dissolved and converted into cast steel. Third, applying regenerative gas furnaces to the operations set forth in the first and second claims, in such a manner that a portion of the products of combustion are withdrawn to heat the materials descending into the service by gravity, while the remaining products of combustion which have not been reduced in temperature by contact with cold materials pass through generators to the chimney in the usual manner, the effect being that the temperature of the furnace is not reduced by the introduction of such cold materials. Fourth, he claims, in combination, the general details of construction and management of the improved furnaces, substantially as described. Fifth, constructing kilns for calcining ores, limestone, cement, and plaster of Paris, wherein the required heat is produced by the combustion of air with gaseous fuel made to enter the kiln both centrally and at the circumference at some distance above the openings through which the air enters, substantially as described.—Patent completed.

2396 J. SAINTY. *Improvements in hurdles, lifts, and fencing for agricultural and other purposes.* Dated August 21, 1867.

This invention consists in the use of pieces of wood and iron made in different lengths, each length being constructed of two heads, and two or more longitudinal bars of wood, the heads being mortised to receive the end of each bar, which is tenoned down to a shoulder to fit each mortice in the head. The wood bars are secured into the heads by iron rods passing through each head, forming of themselves additional bars, and, by machinery, the wood bars are forced into each mortice of the head, and secured by the iron rods or wire being coiled round each head of the lift or fencing, and secured by a twisted joint. Each lift or length of fencing is provided with struts or braces nailed into the wood bars at different spaces, and each iron rod is secured to each strut or brace by iron staples. —Patent abandoned.

2397 J. GOUCHER. *Improvements in an apparatus for preserving life in water, and propelling, floating, or manœuvring in water any body, vessel, or mechanical contrivance, and for floating or manœuvring in the air any mechanical contrivance.* Dated August 21, 1867.

This invention is not described apart from the drawings. —Patent completed.

2398 J. M. NAPIER. *Improvements in coining presses* Dated August 21, 1867.

This invention consists in the application of hydraulic pressure exerted through a force pump, or other means, upon a ram or piston, and so employed as to bring the coining dies forcibly to act upon, and impress, blanks supplied in succession to them. To separate the dies, and allow the piece last under pressure to be displaced, and a fresh blank introduced, the patentee provides valves, by actuating which the flow of the water may be reversed and caused to act upon the opposite side of the piston, where the area is less, and so withdraw it while the water on the other side of the piston is at the same time forced out of the cylinder through a valve which is opened to admit of its egress.—Patent completed.

2399 J. MANGNALL. *Improvements in elastic mattresses* Dated August 21, 1867.

This invention consists in using vulcanized rubber in combination with wooden or other laths or bearing pieces, the elasticity of the rubber being called into play by extension, and not compression.—Patent completed.

2400 T. WIDDOWSON. *Improvements in the manufacture of umbrellas and parasols.* Dated August 21, 1867.

The object here is to dispense with the two wire springs usually employed to hold the umbrella or parasol in its open and in its closed position. To hold the umbrella in its open position the patentee employs a spring catch fastened to the outside of the stick, and catching against the edge of the runner, the said catch being released (when it is desired to close the umbrella or parasol) by pressing it outwards with the thumb or finger. In order to hold the umbrella or parasol in its closed position, he fixes the runner which carries the stretchers to the inner end of a tube, and to the other end he attaches a second tube or ferrule capable of sliding a short distance, and acted on by a spiral spring; this second tube or ferrule is slightly bell mouthed. When the umbrella or parasol is closed, this tube is drawn upwards (or towards the handle), compressing the spiral spring, and the points of the ribs are pressed round the stick under the bell mouth; the tube being now released, the spiral spring forces the tube slightly downwards (or from the handle), and the bell mouth holds the points of all the ribs, and prevents the umbrella or parasol from opening. When it is desired to open the umbrella or parasol, all that is necessary is to withdraw the bell-mouthed tube from the points of the ribs, and slide the runner up till the spring catch holds it. —Patent completed.

2401 A. SMALLEY, B. CROASDALE, and W. L. L. LEAVER. *Certain improvements in looms for weaving.* Dated August 22, 1867.

This invention consists in making the back bearer elastic, and in dispensing with the weights and levers used in weighting the yarn.—Patent abandoned.

2402 T. SAULT. *Improvements in slide valves.* Dated August 22, 1867.

This invention relates to means for preventing friction between a slide valve and its seat or bearing, and the consequent wearing of the surfaces of the same, and the improvements consist, chiefly, in supporting the valve upon rollers provided with means for adjustment, whereby the proximity of the said valve to its seat can be regulated with great facility and accuracy.—Patent completed.

2403 J. NEWARK. *Improvements in breech-loading firearms* Dated August 22, 1867.

This invention relates to those kinds of breech-loading firearms in which the breech end is opened for loading and closed for discharge by a block or closer hinged to the breech end of the barrel, and the invention consists of the arrangement or combination of parts hereinafter described for fastening down the hinged blocks, and actuating the discharging pins or strikers of the said firearms. The patentee arranges or combines the parts in the following manner:—The block or closer by which the breech chamber or chase of the gun or rifle is opened and closed may be hinged to either side of the breech chamber, or to the end of the barrel, and in the axis of the said block is a pin or striker by which the gun is discharged. He introduces into the tail pin or rear end of the breech chamber or chase a piston or sliding bolt, which is of the size of, and situated in a line with, the pin or striker in the axis of the hinged block. This piston or bolt is pressed inwards by

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a coiled spring so as to lie flush with the face of the tail pin. On about the middle of the axis of the tumbler of the lock, and behind the head of the piston or bolt described, a cam or arm is fixed, or the said cam or arm may be made in one piece with the said axis. When the cartridge has been introduced into the barrel of the gun or rifle, and the hinged block has been shut down into the breech chamber, by pulling the trigger of the lock the cam or arm described on the axis of the tumbler is made to act upon the head of the piston or bolt in the tail pin and project it towards the muzzle of the gun or rifle. On the advance of the piston or bolt, it is made to strike the pin or striker in the hinged block and explode the cartridge and discharge the gun or rifle, and at the same time, by entering the hole in the block in which the pin or striker works, to effectually fasten down the block during the discharge of the gun or rifle. When it is wished to reload the gun or rifle, the cam or arm is lifted from the head of the piston or bolt in the tail pin by a lever fixed on the axis of the tumbler, and situated in front of the lock plate. On removing the cam or arm from the piston or bolt, the latter is withdrawn from the hinged block into the tail pin by its coiled spring. The hinged block may now be raised for reloading. The exploded cartridges may be removed from the barrel on opening the breech by an extractor attached to the joint of the hinged block, or worked in any other convenient manner.—Patent completed.

2404 S. LYNES. *An improved self-acting lubricator.* Dated August 22, 1867.

This invention has for its object the lubricating of the necks or bearings of shafting by a simple and self-feeding method, which economizes the use of oil, and dispenses with constant attendance. In proximity to the neck of a shaft the patentee affixes to the bracket carrying the same a smaller bracket, by which he supports two small rollers one above the other, the lower one having a groove cut in its centre in the circle of its rotation, and receiving motion through a grooved pulley on its axis by a band of cotton, tow, india-rubber, &c., driven by the shaft to be lubricated. Pinion wheels are secured to the axis of both rollers, consequently the lower one drives the upper one. An oil feeder and receiver are placed under the neck into which a supply of oil is poured, and by means of a band passing between the two rollers named, and around a friction roller placed in the bottom of the oil receiver, the oil is carried upwards, and being squeezed out between the rollers falls into a spout placed underneath them, and is conducted to the neck. By this means the oil is kept in constant circulation, as it no sooner drops from the neck of the shaft into the receiver that it is again carried upwards upon coming in contact with the band.—Patent completed.

2405 R. KING, J. LOWDEN, and W. GARTSIDE. *Certain improvements in carding engines.* Dated August 22, 1897.

The patentee claims, first, the novel application and use of a roller or rollers partly covered with cards employed to "strip" or clean the doffing cylinder in carding engines, and having an intermittent slow and accelerated revolution effected by the aforesaid means, or other mechanical equivalent, and also the combination therewith of a reciprocating or constantly revolving comb to clean the said partly covered stripping roller, Second, the novel arrangement of "cards" on cleaning rollers (as shown), whereby the teeth or "cards" enter the "card" surface to be stripped whilst moving in the same direction as such surface, but at a reduced speed, instead of the teeth being opposed and moving in reverse directions (as hitherto), as described.—Patent completed.

2406 W. NEWSOME. *Improved apparatus for cutting or forming metal joints.* Dated August 22, 1867.

This invention is designed for the purpose of cutting or forming the working faces of metal joints, and consists of an instrument or tool having four discoidal cutters, and adapted to be used either in an ordinary lathe, or to be worked with a lever as a ratchet brace.—Patent abandoned.

2407 D. HOWARD. *Certain improvements in the manufacture of fabrics termed union flannels, and in other similar union fabrics.* Dated August 22, 1867.

This invention consists in weaving "union fabrics" from warps consisting of all woollen fibres, and from weft which is composed of all cotton fibres, such warp and weft being woven or employed either in a dyed or undyed state.—Patent completed

2408 A. M. CLARK. *Improvements in apparatus for raising water or other liquids by steam power.* (A communication.) Dated August 22, 1867.

This invention consists in the use of a floating piston within a stationary cylinder, the piston being alternately depressed by the steam and elevated by the water, the steam being condensed by the water as soon as the piston is down, so that thereby the piston is relieved from the pressure of the steam, and is free to be acted upon by the water. With a proportionately small amount of steam power a large column of water can, by these means, be elevated to a considerable height.—Patent completed.

2409 J. JONES and F. J. JONES. *Improvements in cartridges for breech-loading firearms.* Dated August 22, 1867.

We cannot here give space to the details of this invention. The patentees claim, first, the arrangements or combinations of parts constituting a self-acting valve, or self-sealing gas check, substantially as described. Second, the arrangements of a short additional wrap of metal or other material, such additional wrap being of a part or piece with that forming the structure of the tube or case, and the mode or process of cutting the material for the same, so as to avoid waste. Third, the arrangements or combinations of and for attaching the barrel, tube, or case to the head independently of its being compressed into the hollow rim or shoulder of the head. Fourth, the arrangements or combinations of parts for compressing the case of the cartridge into the hollow rim of the head, substantially as described. Fifth, the arrangements or combinations for placing and retaining the anvil within the percussion cap, substantially as described. Last, the application of any or all the foregoing arrangements or combinations, or any mere modifications thereof, to all descriptions of "self-ignition" cartridges.—Patent completed.

2410 J. G. MARSHALL. *Improvements in solvent or detergent processes.* Dated August 22, 1867.

This invention relates to a mode of combining the influences of high temperature and great pressure in solvent or detergent processes, to be applied to dissolving the gummy or resinous matters adhering to the fibres of various fibre-yielding plants, or for cleaning fibrous material of animal origin, such as wool or silk, from extraneous matters that may be adherent thereto. The patentee effects these objects by enclosing the material, fibres, or fabric to be operated upon in a closed vessel or chamber of a shape and strength suited to resist the amount of internal pressure that is intended to be employed to force the solvent or detergent liquids through the fibres when the goods to be operated upon are arranged in the vessel. —Patent completed.

2411 H. HIGGINS and T. S. WHITWORTH. *Improvements in machinery for preparing cotton and other fibrous materials for spinning.* Dated August 22, 1867.

This invention relates, first, to those carding engines in which a series of flats is mounted upon a travelling chain, and consists in an arrangement whereby the grinding of the flats is regulated by the surfaces which register them when they are in operation for carding. Second, the inventors attach the chain which carries the flats to one side thereof, instead of to the middle, as is usual. Third, the invention relates to carding engines in which the flats are moved forward and are individually carried back. In machines of this class they cause the flats to pass in contact with stripping and grinding surfaces, and they propose to use a stripping and grinding arrangement similar to that for which provisional protection has been granted to J. Higgins, dated April 11, 1867 (No. 1079). Fourth, the invention consists in a method of supporting top cards or flats. Another part of the invention relates to the slubbing or roving frame, and consists in methods of adapting the flyer to the spindle.—Patent abandoned.

2412 T. W. LAWSON. *Improvements in the construction of ships and vessels.* Dated August 22, 1867.

This invention consists in constructing the bottoms of ships and vessels concaved longitudinally, the concavity extending only to where the floors begin to rise at each end, thus admitting at the same time of a fine run and entrance.—Patent completed.

2413 J. M'INTYRE. *Improvements in the mode of covering and protecting iron plates from the action of sea-water.* Dated August 22, 1867.

This invention consists in fastening on to the plates to be preserved sheets of Muntz's metal, zinc, copper, &c., in the manner hereinafter described:—The patentee fixes by screws or rivets to the iron plates strips of metal, so formed in the cross section as to leave grooves to admit of the insertion of the sheets of covering metal. The strips may be placed in any position along the ship or vessel, &c., that may suit the width of the iron plates used in the structure. By means of this arrangement the sheets of metal are confined at the top and bottom in the grooves of the strips, and are fastened to the iron plates by rivets or screws between the strips when required.—Patent completed.

2414 J. L. NORTON and G. HAWKSLEY. *Improvements in apparatus and means for burning combustible liquids, vapours, and gases to obtain heat and light therefrom.* Dated August 22, 1867.

Here the patentees produce a suitable jet by forcing the liquid by a heavy pressure between two surfaces which are exceedingly close together, but which can separate or be separated to discharge any impurity from between them, and to regulate the flame they prefer that these surfaces should be held together by a spring, and that the liquid should be compelled to force its way between them, overcoming the spring. The orifice which the patentees use is formed by a conical valve and valve seat of hardened steel, and a spring adjustable by a screw holds the valve against the seat until it is overpowered by the liquid striving to lift the valve and escape. When the pressure of the liquid and the tension of the spring are suitably adjusted, the required smoke-like jet is readily adjusted; it may be ignited, and, if desired, directed into a furnace, or against any article it is required to heat.—Patent completed.

2415 F. ZIFFER and W. GOODBRAND. *Improvements in the method of warming carriages employed in the conveyance of passengers on railways.* Dated August 23, 1867.

This invention consists in effecting the warming by heaters in the form of cases, coils, tubes, or chambers of metal, or other suitable material, which are placed in the interior of the carriages in any convenient position, or in a chamber or in chambers in communication therewith, the cases, coils, or tubes being heated by steam conveyed from the locomotive and distributed to the heaters in a special manner.—Patent abandoned.

2416 D. WHITTAKER. *Improvements in healds or heddles used in looms for weaving.* Dated August 23, 1867.

This invention relates to those descriptions of healds or heddles in which metal wires having eyes are substituted for the ordinary heald cords and eyes, and consists in attaching loose eyes to metal wires, and in the modes of bending or shaping the wires so that this object can be attained. In one mode the inventor forms two loops at the ends of two pieces of wire, and links two eyes to the loops.—Patent abandoned.

2417 H. A. BONNEVILLE. *Self-acting cooking apparatus.* (A communication.) Dated August 23, 1867.

The patentee claims the use of apparatus consisting of a cooking vessel in which food or other substance is boiled or heated for a short time on a fire, or heated by other means, and a heat retainer in which the said vessel is afterwards enclosed, and in which the process of cooking or coction is completed, as described.—Patent completed.

2418 D. TAYLOR. *Improvements in the means of stopping or closing bottles and other vessels of capacity.* Dated August 23, 1867.

Here a cap of metal, &c., is provided to close the bottle, &c., at the neck, and this cap is filled, plugged, or fitted internally with cork, &c., made by preference on its lower surface with a part of its material projecting slightly downwards, and concentric with the circumference: slots, nicks, notches, or small openings are cut in the cap at the lower edge thereof, and studs, projections, ribs or nibs are formed on the outside of the neck of the bottle, &c. When the bottle, &c., is to be closed, the cap is placed on the neck, so that these openings come over these projections, and the cap is turned partially round on the neck, so as to bring the openings away from the projections, the elasticity of the cork or plug allowing a passage for the projections between it and the inner side of the cap. The cork, plug, or fitting enters the mouth of the bottle, &c., and a tight closure is effected.—Patent abandoned.

2419 W. S. ASHTON. *Certain improvements in metallic packing to be employed for the glands and stuffing-boxes of valves or cylinders used for steam or liquid.* Dated August 23 1867.

This invention consists in the employment of a novel arrangement and application of metallic spring packing within the "gland" or stuffing box, such spring packing being constructed to embrace the sliding rod in such a manner as to exert lateral pressure on the rod or spindle, which pressure may be adjusted so as to prevent steam or water escaping through the gland or stuffing box.—Patent abandoned.

2420 W. R. LAKE. *Improvements in the manufacture of iron and steel, and in apparatus employed in the said manufacture.* (A communication.) Dated August 23, 1867.

This invention consists in decarbonizing molten iron, or otherwise purifying it, thereby converting it into steel or malleable iron, or otherwise improving its quality, by the forcible dispersion of a stream of the melted metal into globules, particles, or atoms by a jet or jets of steam, air, or a mixture of the two, or any other gaseous element or elements adapted by their affinities for the purpose, within a vessel within which each globule, atom, or particle of the melted metal is brought into free and immediate contact with the gaseous element or elements within the vessel, whereby the elimination of the impurities which it may contain is effected.—Patent completed.

2421 E. A. DANA. *Improvements in the construction of concussion fuzes for the explosion of projectiles.* Dated August 23, 1867.

The nature of this invention consists, first, in suspending a striker or friction match carrier (longitudinally) in the friction chamber of the fuse, so that if the shell in which the fuse is placed strikes head on obliquely, or even sideways, the said match carrier shell, by its own momentum, frees itself and ignites the composition, and thus explodes the shell. Second, in the general combination and arrangement of the friction match carrier, the match chamber, and the friction match mixtures. Third, in the peculiar means adopted to prevent the carrier being liberated by any other force than that of the concussion of the shell when it strikes a solid object, and to ensure its being liberated by that force, and so explode the shell. —Patent completed.

2422 J. VARLEY. *Improvements in apparatus for raising, supplying, and measuring water to steam boilers, part of which invention is also applicable to measuring water for other purposes.* Dated August 23, 1867.

In order to supply water to steam boilers the patentee erects a closed cistern of a given capacity in a convenient position above the boiler. At the bottom of this cistern, and in connection with it, is another vessel of comparatively small capacity; this vessel is carried to a trunnion on which it is able to rock, and through which water passes from one vessel to the other, and in order that the water may flow freely from one vessel to the other a small pipe is led from the top of the rocking vessel to the top of the cistern. When the rocking vessel is empty, it is held up by a counterbalance weight, but when the vessel is full, or nearly so the weight is overbalanced and the vessel descends. Above the cistern is a small case or box, from the bottom of which a water supply pipe passes into the cistern. The top of the case or box is also connected by a pipe with the top of the cistern, and within the cistern each of these pipes is fitted with a valve. A steam pipe from the boiler is connected to the upper part of the cistern, and the end of this pipe within the cistern is also fitted with a valve. These three valves are all worked by the rocking vessel above mentioned, so that when the rocking vessel is in its highest position, the valves on the water supply pipe, and on the pipe which connects the top of the case or box with the top of the cistern, are open, whilst the valve on the steam pipe is closed; but when the rocking vessel descends, the valve on the steam pipe is opened, whilst the other valves are closed. There is also a valve at the bottom of the cistern on a pipe leading to the boiler, and dipping beneath the water in it. This valve is counterbalanced so that it requires to open it the weight of a column of water somewhat longer than the distance between the water line in the cistern when full and the high-water line in the boiler. —Patent completed.

2423 G. ALLIBON and E. WILSON. *Improvements in apparatus or gearing for steering ships.* Dated August 24, 1867.

This invention is not described apart from the drawings —Patent completed.

2424 J. and J. CASH. *An improvement in the manufacture of towels.* Dated August 24, 1867.

The object of this invention is to manufacture a good and durable friction towel. For this purpose the patentees take round cord and knit it or form it into loops by hand or machinery so as to constitute a complete towel, a selvage being formed all round. The cord must be sufficiently thick to give to the towels made therefrom the necessary roughness to enable them to be used as friction towels.—Patent completed.

2427 J. HANSON. *Improvements in agricultural apparatus for spacing and digging roots.* Dated August 24, 1867.

This invention relates to an apparatus patented July 30, 1865 (No. 1732), for digging potatoes, which may be briefly described as consisting of a light frame mounted on a pair of spiked wheels, the axle of which drives a horizontal shaft disposed longitudinally at right angles to the axle, such longitudinal shaft projecting at the back of the frame, and having on its projecting end a series of forks. When the machine is drawn by a horse or horses along a drill of potatoes, the forks rotate across the drill, and throw out the potatoes. The present invention consists in providing for driving the longitudinal shaft at either of two different speeds, and in arranging or adapting the machine for spacing turnips or other roots by removing the potato digging forks and plough piece used beneath those forks, and by fixing on the end of the longitudinal shaft a series of holes, and attaching to the frame a pair of coulters, one on each side.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated January 8, 1868.

68 L. Simon, Hutchinson-street, Wilford-road, Nottinghamshire. A new mode of laying metal leaves on printed surfaces, and the apparatus connected therewith. (A communication.)

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259 J. Mason, Sunderland, coal merchant. An improved composition to be used as fuel for household purposes, and the method of preparing or manufacturing the same.

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418 A. B. Ibbotson, Sheffield. Improved steel spring railway fastenings. (A communication.)

Dated February 8, 1868.

440 N. C. Szerelmey, Belgrave-road, Pimlico. Improvements in rendering paper fabrics and other articles waterproof.

Dated February 11, 1868.

462 H. T. Humphreys, Westbourne Park-road, Middlesex. A new process for the decarbonization of molten iron for its conversion into steel, which process is also applicable for the decarbonization of other substances.

Dated February 12, 1868.

474 J. Thornton, Polygon, St. Pancras, cabinet maker, and F. W. Voss, Compton-street, Brunswick-square, engineer. Improvements in portable weighing apparatus.

Dated February 18, 1868.

538 A. M. Keighley, Beeston, Nottinghamshire, station master. Improvements in the method of, and means or apparatus for, signalling from one part of a railway train to another.

Dated February 19, 1868.

548 E. W. Young, New-street, Spring-gardens, Middlesex, civil engineer. Improvements in the construction of bridges.

561 M. Henry, Fleet-street, City. Improvements in the manufacture of nails, and in machinery or apparatus employed in the said manufacture. (A communication.)

Dated February 20, 1868.

564 J. M. Kilner, Chaplain of Chester Castle. Improvements in bedsteads or sleeping accommodation, principally intended for military purposes.

Dated February 21, 1868.

579 C. Cochrane, Woodside Iron Works, near Dudley, Worcestershire. Improvements in blast furnaces.

Dated February 24, 1868.

606 A. Stenger, Gresham-street, City, merchant. Improvements in umbrellas and parasols.

608 J. S. Gisborne, Liverpool, electrical engineer. An improved mode of, and means or apparatus for, indicating a ship's course, and preventing collisions at sea.

610 J. Fordred, Blackheath, Kent, chemist, and F. Lambe and A. C. Sterry, Rotherhithe New-road, Surrey, paraffin refiners. Improvements in the treatment of paraffin.

Dated February 25, 1868.

619 F. Le Roy, Commercial-road, manufacturer. An improved non-conducting composition for preventing the radiation or transmission of heat or cold, and an improved method of applying the same.

620 J. Elce, Manchester, machine maker. Improvements in lubricating the spindles of machines for spinning and doubling.

622 E. Hutchinson, Darlington, Durham, iron manufacturer. Improvements in the construction of multiple drilling machines.

624 G. W. R. Pigott, Halifax. Improvements in coated or covered wire.

626 J. J. and E. Harrison, Manchester, engineers. Certain improvements in the healds of looms for weaving.

627 J. C. Davies and E. Zahn, Kingsland-road, City, manufacturers. Improvements in muffs.

631 O. Ollivier, Panton-street, Haymarket. Improved apparatus, and means or method for, exhibiting advertisements and affording publicity thereto.

632 J. L. Jaquet, Vincent-square, Pimlico, sculptor. Improvements in heels for boots and shoes. (A communication.)

634 G. T. Bousfield, Loughborough Park, Brixton, Surrey. Improvements in apparatus for raising and forcing water, and for feeding steam boilers. (A communication.)

638 R. Ramsey, Upsal Pit, near Eston, Yorkshire, engine brakesman, and J. Cooke, Darlington, Durham, mining engineer. Improvements in signal indicators, applicable to mining and other purposes.

Dated February 26, 1868.

642 T. Hill, Merrylee, Cathcart, Renfrew. Improvements in bearings for axles and shafts. (A communication.)

643 R. Laidlaw and J. Thomson, Glasgow, engineers. Improvements in apparatus for exhausting gas for blowing air, for pumping or forcing liquids, and for measuring liquids.

646 J. Perrett, Eagle House, Herne Hill, Dulwich. Improvements in bottles and apparatus for feeding infants.

648 F. Lambe and A. C. Sterry, Rotherhite New-road, Surrey, paraffin refiners, and J. Fordred, Blackheath, Kent, chemist. Improvements in purifying hydrocarbon oils.

650 W. E. Newton, Chancery-lane. A new and improved washing machine. (A communication.)

652 R. and J. W. Gaunt, Springfield Mill, Farsley, Yorkshire. Improvements in spinning and twisting machinery.

Dated February 27, 1868.

655 J. R. Cooper, Birmingham, gun manufacturer. An improvement or improvements in breech-loading firearms.

657 T. Blocksage, Dukinfield, Chester, brick manufacturer. Certain improvements in the construction of boilers or steam generators.

659 R. E. Green, Church, near Accrington, Lancashire. Improvements in the preparation of cotton yarns or fabrics intended to be dyed with madder or a preparation of madder.

660 L. Boyce, Manchester, Venetian blind manufacturer. An improved mode of raising and lowering Venetian blinds.

661 J. B. Whiteley, Lockwood, near Huddersfield, Yorkshire. Improvements in machinery for stretching and drying or finishing woven fabrics.

662 W. Weldon, Park Villa, West Hill, Highgate. Improvements in the regeneration from chlorine residues of oxides of manganese, suitable for use again in the manufacture of chlorine, and capable of being applied also to other purposes.

663 J. Adams, turner, and H. Barrett, soda water manufacturer, St. Helier, Jersey. An improved stopper for bottles.

664 W. E. Newton, Chancery-lane. Improvements in the construction or building of boats or vessels. (A communication.)

667 J. H. Bass, Featherstone-street, City, machine cork manufacturer. Improvements in double cans or vessels to contain liquids or substances which it is desired to protect from the influence of external temperature.

668 W. M. Bullivant, Fenchurch-street, City, wire rope manufacturer. An improved composition for preventing the fouling of iron and other ships' bottoms, and for preserving metal and other surfaces generally.

669 G. Eldridge and W. C. Loe, Grange-road, Dalston. Improvements in the means of closing or stoppering bottles and vessels for containing aerated and other liquids or fluids.

Dated February 28, 1868.

671 J. Christie, Newcastle-upon-Tyne, stationer. An improved lithographic printing machine, by means of an endless tympan and self-acting gripping scraper, to be worked by hand, steam, or other power.

672 R. Mills, Bury, Lancashire, machinist. Improvements in machines for washing, wringing, and mangling textile fabrics.

675 A. S. Stocker, Artillery-street, Horsleydown, Surrey. Improvements in machinery or apparatus for the manufacture of caps or covers applicable to bottles and other vessels, and in the construction of such or other caps or covers.

676 R. Howard, Southampton, corn factor. Improvements applicable to taps and cocks for various useful purposes.

677 C. E. Brooman, Fleet-street, City, patent agent. Improvements in the manufacture of moulds for moulding glass or like material. (A communication.)

678 J. Leacock, Castlewellan, Downshire, Ireland. Improvements in paving for streets, roads, and ways.

679 J. Robinson, Greenfield, Yorkshire. Improvements in cleaning the surfaces of feed-water heating apparatus employed in boilers for generating steam, and in the apparatus connected therewith.

681 G. Thomas, Oldham, Lancashire, mechanic. Certain improvements in sewing machines.

682 T. Warren, Glasgow, glass manufacturer. Improvements in glass furnaces.

683 J. F. Low, Monifieth, Forfar, machine maker. Improvements in apparatus for preparing jute and similar fibrous materials.

684 T. Trotman, High-street, Camden Town, carriage builder. Improvements in the construction of doubling-up or folding carriages and chairs.

685 W. E. Newton, Chancery-lane. Improved apparatus for drying and finishing felted goods and fabrics. (A communication.)

686 C. Sanderson, Worksop, Nottinghamshire, steel manufacturer. Improvements in the manufacture of iron and steel.

687 T. S. Whilock, Aston, Warwickshire, ale and porter merchant, and H. Harford, Birmingham, carpenter. Improvements in fastenings for window sashes.

688 J. Gjers, Middlesborough, Yorkshire, engineer. Improvements in the manufacture of cast steel and homogeneous iron, and in furnaces applicable thereto.

Dated February 29, 1868.

689 C. Cochrane, Woodside Iron Works, near Dudley, Worcestershire. A new or improved appliance for hot blast water tuyeres.

695 G. Lindsley, Swindon, Wilts. Improvements in obtaining and applying motive power for propelling carriages and for other purposes, and in apparatus employed therein.

697 A. H. Hill, Inner Temple, City, Barrister-at-Law. Improvements in luggage labels or pads.

699 J. L. Norton, Belle Sauvage-yard, Ludgate-hill, City. Improvements in sinking or forming wells, and in apparatus to be used for this and similar purposes.

701 B. Solomons, Albermarle-street, Piccadilly, optician. Improvements in telescopes.

Dated March 2, 1868.

703 W. J. Armstrong and C. Browne, Burton-terrace, Brixton, Surrey, master mariners. Improvements in anchors.

707 J. Rawsthorn, Preston, Lancashire, corn miller. Improvements in machinery for dressing millstones.

711 S. Sharrock, Liverpool, engineer. Improvements in the construction of piles.

Dated March 3, 1867.

713 A. A. Usher, Compton-road, Canonbury. Improvements in respirators.

715 C. Cochrane, Woodside Iron Works, near Dudley, Worcestershire. Improvements in valves or dampers for pipes, passages, or flues serving to conduct gases at high temperatures.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated March 9, 1868.

818 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in the treatment of fibrous materials for the manufacture of various articles, and in the means for rendering the same fire and waterproof. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," March 17, 1868.

3061 C. and J. Jobson. Screw propellers.
3089 J. J. Hicks. Backs and handles for brushes.
3094 C. Riley. Tubular boilers.
3096 J. Fraser and G. Duncan. Counter-check books.
3098 R. Ackroyd and G. Hodgson. Looms for weaving.
3108 W. R. Lake. Artificial compound to be used as a substitute for india-rubber. (A communication.)
3131 R. Newton. Fuel-feeding apparatus for steam boilers.
3139 T. R. Bardsley and W. Blackshaw. Apparatus for smoke-consuming in steam boiler and other furnaces.
3143 C. H. Bright. Tramways for streets.
3147 I. Hewitt. Machine for forming labels.
3157 G. W. R. Pigott. Apparatus for covering wire with metal.
3170 S. Simon. Manufacturing aprons. (A communication.)
3173 C. Bedells. Manufacturing elastic fabrics.
3184 T. J. Leonard. Machinery for rolling iron into bars.
3186 W. R. Lake. Cylinder printing machines. (A communication.)
3187 W. R. Lake. Cartridges for breech-loading firearms. (A communication.)
3189 W. R. Lake. Breech-loading firearms. (A communication.)
3194 J. C. Bayley and D. Campbell. Fire-lighters.
3196 H. A. Bonneville. Machines for moulding bricks. (A communication.)
3206 J. Carter and T. Chalmers. Fittings of windows and doors.
3214 W. R. Lake. Breech-loading firearms. (A communication.)
3215 U. P. Wurflein. Instruments for joining blind cords.
3216 R. Adams. Breech-loading firearms.
3217 E. Madge. Apparatus for the reduction of sulphate of iron crystals. (Partly a communication.)
3218 E. Madge. Apparatus for feeding metal plates to rolls.
3221 R. F. Fairlie. Locomotive engines.
3224 G. Kent. Kneading machines. (A communication.)
3226 W. H. Richardson. Manufacture of iron and steel.
3228 L. A. Wainman. Apparatus for raising water.
3229 A. M. Clark. Apparatus for applying bronze powders on paper. (A communication.)
3230 J. P. L. Heckmans and F. J. Nunney. Washing machines.
2231 W. R. Lake. Steering apparatus. (A communication.)
3233 R. G. Harcourt. Manufacture of fire-lighting material.
3238 A. Airian. Hydraulic clocks.
3245 R. Howson. Gas furnaces.
3251 R. Garbett. Constructing parts of certain games.
3258 W. R. Lake. Covering buckles. (A communication.)
3262 R. Husband. Manufacture of hats.
3263 E. Lord. Machinery for opening cotton.
3279 A. Barclay. Motive-power engines.
3282 W. H. Richardson. Manufacture of iron and steel.
3312 G. Welch. Mode of killing whales.
3505 C. Conner. Umbrellas.
3616 J. Kerr. Breech-loading firearms.
57 H. Smyth. Umbrellas.
138 J. Kidd. Obtaining artificial light.
389 S. G. Taylor. Lubricating the spindles of machines for spinning.
430 J. Howard and E. T. Bousfield. Construction of steam boilers.
575 R. Fennelly and P. Kenny. Apparatus for singeing off the hairs on pigs.
579 C. Cochrane. Blast furnaces.
610 J. Fordred, F. Lambe, and A. C. Sterry. Treating paraffin.
637 A. M. Birchall. Manufacture of twist tobacco.
648 F. Lambe, A. C. Sterry, and J. Fordred. Purifying hydrocarbon oils.
818 W. R. Lake. Treating fibrous materials. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed March 13, 1868.

2599 W. G. Brownson
2606 G. Pickin
2613 W. Brailsford and J. Gadsby
2610 W. J. Cunningham
2615 T. Turner
2645 F. T. M. A. Guyon
2811 N. F. Taylor

Sealed March 17, 1868.

2625 T. Adams and G. J. Parson
2632 J. Rust
2636 T. Bletcher
2639 J. H. Sams
2640 W. W. Gibson
2649 R. Raffault
2650 S. Dreyfous
2652 W. Hall
2664 J. Baird
2667 T. Muir
2669 J. Rives
2673 G. W. M'George
2674 C. Ritchie
2698 J. Musgrave
2699 A. Tod and J. Heatley
2791 S. Johnson
2817 R. P. Faucheux
2837 J. H. Johnson
2867 H. B. Barlow
2887 W. R. Lake
2898 B. Latham
2971 A. V. Newton
2991 H. Adcock
3381 E. H. Bentall
19 E. J. and W. A. Kruss
69 S. Goldstein
76 J. Dawson and J. Howorth

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

671 E. A. Phillips
693 J. M. Napier
695 J. Tann
697 R. M. Roberts
701 R. Marsden
712 R. A. Brooman
722 N. N. Solly
730 J. F. Brinjes
736 J. Ramsbottom
765 J. C. Stevenson
779 W. Menelaus
893 W. M. Fuller
913 A. V. Newton
914 A. V. Newton
2921 H. C. Davis

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

506 J. Taylor
637 E. T. Truman
638 E. A. Pontifex.
753 J. Chatterton and W. Smith

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending March 14, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2063	1 8	2208	1 4	2226	0 6	2247	0 4	2269	0 6	2285	0 4
2083	0 8	2209	0 10	2227	0 8	2250	0 6	2270	0 4	2289	0 4
2192	0 6	2211	1 4	2234	1 4	2251	0 4	2271	0 6	2290	0 4
2194	0 10	2212	0 10	2235	0 8	2256	0 4	2272	0 4	2292	0 4
2196	0 10	2214	1 2	2239	0 8	2259	0 4	2276	0 8	2294	0 4
2199	0 10	2215	0 8	2241	0 4	2261	0 10	2278	0 8	2395	0 4
2201	0 10	2217	2 2	2242	0 10	2262	0 8	2280	0 10	2297	0 8
2203	0 4	2218	1 6	2244	0 10	2266	0 4	2282	0 4	2305	0 4
2204	1 10	2219	1 4	2245	1 0	2267	0 4	2283	0 4	2330	0 4
2206	1 0	2222	0 4	2246	0 4	2268	0 4	2284	0 4	2335	0 6
2207	1 2										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, MARCH 27, 1868.

NATIONAL INTERCOMMUNICATION.

EVERY nation, even those existing in a state of semi-barbarism, may be said at the present time to be actively engaged in the arduous task of improving their means of intercommunication with adjacent countries, as well as distant lands. To relieve the physical features of a country from their native isolation and primeval ruggedness, and to place the interior, as well as the coast, *en rapport* with its neighbours, is one of the first efforts that awaits the labours of the Government. A complete system of main routes must be opened up, whether the means adopted be that of common roads or the more modern one of steam locomotion. The misguided policy so frequently and fruitlessly adopted of making short roads literally leading nowhere, and having no terminus of any importance at either extremity, should be discarded. A main arterial route of intercommunication should not consist of a number of disjointed fragments, of a variety of short lengths, connected with one another as time and local circumstances presented either the opportunity or the necessity of so doing. It may be impossible to construct without interruption, without perhaps a prolonged delay, the whole of an important route 200 or 300 miles in extent, but still the principle should be adhered to of laying out the main arteries of traffic in a manner so that they should connect the principal towns and local foci by the most direct course. As a rule, deviations, unless very slight, should not be introduced when the purpose in view is to include a small town or village lying contiguous to the line of route. Instead of deviating the main line, its course should be kept as nearly uniform as the features of the district will allow, and small branches should be constructed to all places situated right or left that may need them. Our own main lines of railways afford an example of what may be termed piecemeal construction. There are but one or two—the Great Western from London to Bristol is a case in point—which were originally laid out to their full extent, but the large majority are made up of short local lines, joined together as the necessity arose, and comprise a most imperfect and defective system. Hence the construction of future loop lines and new routes, which would have been altogether unnecessary had the guiding principle we have alluded to been adhered to in their original laying out. An admirable corroboration of our views is to be found in the older South-Eastern line to Dover. At first it was never intended to extend from London any farther than Reigate, but in 1863 the extension to Dover was commenced. A glance at the map is sufficient to show what a great bend occurs at the former place, constituting, in fact, a deviation at nearly right angles to the absolute course of the line. What has been the result of constructing between the two termini so protracted and indirect a route? In the first place, another company has made a rival line having a better selected course; and in the second, the South-Eastern itself has demonstrated the fallacy of its original plan of communication, by constructing a loop line over twenty miles in length, cutting off the angle made by the older line at Reigate.

It is undeniable that commercial prosperity and national wealth is a sheer impossibility with a people who have not reduced what our Gallic neighbours call *les ponts et chaussées* to a definite organization, and embodied the plan of intercommunication in all their municipal and local acts of jurisprudence. The Eastern nations, who from the almost exclusive use they make of horses, mules, and camels as beasts of burden, have less need of carriage roads than others, are at the present engaged in their construction, and also in that of railways. Probably, the interests of commerce are not the only spur to the lethargic orientals; it is a question of policy for them to imitate the example set them by their western brethren, and the administrative power possesses greater energy and vigour, in proportion as the confines of the State are more easily accessible from the central seat of the Government of the empire. There is very little doubt but that in new countries, not new in the sense of discovery or colonization, but in that of civilization, such as India, railways have been constructed, in many instances, where the immediate interests and welfare of the community would have been best consulted and advanced by the establishment of a good system of carriage roads. Greece is a new country in the sense understood, and it is satisfactory to observe that the first efforts of the Government have been directed towards the construction of several main lines of road traffic, and the ultimate completion of the whole system. The physical difficulties presented by the country are well known, but the pick of the navvy and the blast of the miner will speedily open up the pathless valleys and level the superincumbent precipices. About nineteen separate roads have been opened up or are in course of formation, comprising a total extent of nearly 300 miles, the greater portion of which runs through mountainous districts of exceeding beauty and sublimity. Some of the views through the gorges and ravines are described as perfectly magnificent. The chief portion of the work of these roads was performed by the inhabitants themselves, the Government supplying assistance only in the more arduous and expensive items of bridges, culverts, and viaducts. Greece has been liberally provided by Nature with mineral wealth, and in order to attain facilities for its exportation, several small lines of railway have been projected from the interior to the various ports along its shores. One of the most important and most needed is a line which, starting from the southermost point of the Peloponesus, and taking in as many towns as possible situated in the interior, would touch at Corinth, traverse nearly the entire isthmus, and finally debouch upon the Turkish frontiers, where a junction could be readily effected with the great lines of the Italian system. Another route, equally important as the one just described, should be laid out so as to connect the Peloponesus and the interior of Greece with the ports upon the Egean and Ionian Seas, and a third should connect the shores of the latter sea with Athens and the Piræus. Branches and feeders, either in the shape of carriage roads or small railways, could be added as the resources of the country permitted, and as the traffic and internal commerce afforded the funds. The total extent of this system of communication would not exceed, at a rough estimate, 500 miles, a distance comparatively insignificant when contrasted with the great American and Indian railways. The locomotive route from Calcutta to Delhi exceeds 1,100 miles in length, and crosses on its way rivers of considerable dimensions. The Jumna and the Saone, the latter of which is traversed by a bridge 3,000ft. in length, are not likely to find many rivals of similar magnitude in Greece. It is needless to remark that the land would cost nothing, and that there is abundance of timber in the country available for bridges and other works, which might, in the first instance, be constructed of that material, as it would be necessary, for obvious reasons, to keep the expenditure as low as possible.

THE "VALIANT" AND HER SCUPPER-HOLES.

THE "Valiant" is by no means the most useful vessel we possess for defensive purposes, seeing that her armour-plating is only 4½in. thick. She might, however, have answered very well for some purposes; for instance, armed with Major Palliser's converted 68-pounder rifled gun, she would have made a very good channel or harbour guardship. But what little efficiency she did possess is unquestionably being drilled out of her now, as she is having a number of scupper and scuttle-holes cut through her armour-plating and sides. The work, however, affords an opportunity for testing a new system of drilling, which appears to be very successful; so, we suppose, we must console ourselves therewith. The holes are being cut through the armour-plating by two methods, the old and the new. The old method consists in boring a number of holes close together round the scupper or scuttle-hole to be cut through the armour-plating, and afterwards cross cutting them and bevelling off the hole. Each hole under this system occupied about a week to complete; by the new method, however, it takes but nine hours to cut and finish a hole through the 4½-inch plating. In the latter case, a series of six cutters are set round a piece of shafting, the end of which, and the points of the cutters, being firmly pressed against the ship's side by temporary iron stays. To the shaft is attached a ratchet arrangement worked by three men, and by this apparatus the piece of iron is taken clean out of the armour-plate. The cutters can be set at any angle on the shafting by means of regulating screws, and they can also be fixed to cut a hole of any given diameter. By this ingenious arrangement any slope can be given to the sides of the scuttle, and the work can be finished off at one operation. So far, then, the "Valiant" has been of service in affording evidence of the practical value of this new system of piercing scuppers through armour-plating. But this is at the expense of the public purse and her own strength, for what will she be worth for defensive purposes with a maximum thickness of only 4½in. of plating, and that armour pierced throughout the length of the ship with a double row of holes for scuppers and scuttles just above the water line? It is more than a pity that all this time and money should be expended upon a vessel which could not originally boast very great defensive strength, and it is still worse that the only result of the expenditure will be to destroy what little strength she had. This ship of 800-horse power was completed by the Thames Ironworks Company more than three years since, and has never yet been in commission, save a few days, when the fleet was reviewed by the Queen and the Sultan. When she is ready to be placed in commission—which cannot be for some time yet—she will have cost a very large sum, and, with her perforated sides, will be of very little service. Her usefulness will have been confined to demonstrating the efficiency of a new boring tool. If an improved apparatus be brought out in time, we suggest it should be set to pierce another set of holes a little below the water line.

WHAT IS A METAL? WHAT IS A METALLOID?

M. NAQUET, Professor Agrégé à la Faculté de Médecine de Paris, has just published a species of physico-chemical work wherein he gives definitions of matter in general, and of the kinds of matter in particular, which surround us. We love a definition, clear, comprehensive, and precise; in fact, without such no conclusive reasoning can be carried on, and no discussion should be attempted. We can have no cause of complaint against M. Naquet's general definition

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of matter on this head: we think it is perfect. We will give a sentence or two from his book which lead up to it. "If we cast our eyes on that which surrounds us, we are struck by the view of a multitude of objects, of an infinite diversity: all these objects, whatever they may be, have received the generic name of bodies. That which constitutes these bodies is called matter or substance. In a general manner, one may say that matter is all that which strikes the senses, and in a manner more scientific that matter is, all that which obeys the laws of gravitation." Here, then, is a definition, clear, comprehensive, and precise. Matter is that which obeys the law of gravity: or has weight. But it is here taken for granted that we have a clear and distinct idea of what we mean by gravity. It may be that it is taking a little too much for granted. Perhaps there needs another definition to make this definition perfectly intelligible; as, indeed, Newton's law of gravity needs another law of force in act and in effort to make it perfectly understandable. However, we will leave this for the present, and turn to definitions which are much less satisfactory. With the work at large we do not here purpose to meddle.

M. Naquet divides matter into two classes, which he designates metals and metalloids. He gives the properties of these two classes of bodies in two categories, as follow—

METALS.

I. There is no gaseous metal.
II. Metals possess metallic lustre.
III. Metals are good conductors of electricity and heat.
IV. Metals have a density relatively high.
V. Oxides of metals, on combining with water, produce bases—seldom acids.
VI. Metals are always electro-positive in compounds which they form on uniting with metalloids.

METALLOIDS.

I. Several metalloids are gaseous.
II. Metalloids have not the lustre called metallic.
III. Metalloids are bad conductors of heat and electricity.
IV. Metalloids have a density relatively low.
V. Oxides of metalloids, on combining with water, ordinarily produce acids—seldom bases.
VI. Metalloids are always electro-negative in compounds which they form on uniting with metals.

Now, what are we to make of these two lists of properties. No. 1 of metallic properties says that there is no gaseous metal. If M. Naquet had added, at the freezing point of water, it might have been true, but is not true as it stands. Are not mercury, magnesium, sodium, potassium, arsenic, zinc, &c., well known in a state of vapour or gas. Faraday has shown that gas is simply a solid in a state of vapour. It is simply a question of heat. No. 2 says that metals possess metallic lustre; of course, what other lustre can they possess. No. 3 is certainly true of metals, less or more; but still expresses no definitive property. No. 4 says that metals have a density relatively high. But some metals have a density relatively low also; for example, magnesium, and many others, are much less dense than sulphur, carbon, &c. No. 5 describes a property that is not common to all metals. No. 6 is the only property which is stated to be universal to all metals, except No. 1, which certainly is not universally true in the unrestricted form in which it stands. Metals are always electro-positive in compounds which they form with metalloids. But, then, what is a metalloid. The descriptions or definitions of its properties are as undefined as those of a metal; perhaps more so, for they are principally negative. Some metalloids are said to be gaseous. That of course is not a general property of a metalloid, and will not serve as a distinguishing mark. Metalloids are said not to have metallic lustre. Of course, if they have lustre, it will be metalloidal. Nos. 4, 5, and 6 are simply the opposites of the properties assigned to metals under the same numbers. Now, what is a metal, and what a metalloid after these definitions of properties.

The only thing like a definition of a metal is that it is electro-positive in the compounds which it forms with metalloids, and that of course the metalloid is negative. But if we take this as a precise general definition, how are we to apply it? We think in this way; that when we find a compound we must call the positive constituent of that compound a metal and the negative constituent a metalloid. Then, in the compound water, hydrogen is a metal and oxygen a metalloid; but the first article in the category of metallic properties says that no metal is gaseous, much less a permanent gas at all known temperatures. Hydrogen may be a metal in the state of gas—probably is—but it does not agree with M. Naquet's definitions. Natural objects refuse to be catalogued and put in exact and precise categories of order, genus, species, &c. Nevertheless, these artificial means of assisting the mind to grasp this infinity of natural objects have been and will still be of incalculable use; but it must not be pushed beyond its legitimate use. We must class and define; but let our definitions be clear, and let them not contradict each other. We fear that as yet our knowledge is such that we shall have to be content to place physical objects under more classes than two. It may be that there is but one substance, and that the varieties of matter are but the varieties of form. Nay, we think it is even more than probable.

RAILWAYS AND THEIR MANAGEMENT.

WE last week gave an abstract of a remarkable paper which was read before the Society of Arts by Mr. R. F. Fairlie, C.E., on the subject heading this article. A copy of Mr. Fairlie's paper, and the discussion upon it, is now before us, and from the grave nature of the questions therein, and the originality of the facts set forth, we are induced to bring it again before our readers. It ranks, in our opinion, among the most interesting and practically suggestive papers that have been produced before any society. The importance of the subject will be at once admitted, when it is remembered that considerably over £500,000,000 sterling is involved in its consideration, a very large proportion of which is at this moment wholly unproductive, if not entirely lost, and we hail with satisfaction the suggestion of any measures that shall remedy the present unfortunate condition of our railways. Mr. Fairlie does not stop to mourn over the past, but earnestly sets to work to change the aspect of things in the future. He says, "It would be of no avail to refer to the waste of past expenditure in construction, except to say that the teachings of the past are the only safe guides to the policy of the future"—which means we cannot undo what has been done, but should strive to make the most of that we have by careful, economical, and yet efficient management, and so bring back what, at this moment, is apparently lost to the unfortunate shareholders. We should then make our railway property what—from the enormity of our traffic it ought assuredly to be—the best and safest class of investment. Mr. Fairlie very properly deprecates great waste of the shareholders' money in building palatial stations, and considers there has been a greater desire on the part of our engineers to create monuments to their own fame than properties useful and beneficial to their employers. We write and talk much about the law of master and servant, and are very wroth when we hear of a few tailors or cabmen combining to protect themselves from the encroachments of their masters, but, we ask, was ever combination more complete, more perfect, or were men ever more masters of the situation, than the engineers of this country. Rattening is well understood in Sheffield, but we question whether even they there understand the refined cruelty inflicted on the widows and orphans, who find their little all, which they had invested on the faith of some great name, hopelessly gone, —and gone where? Into extravagancies of all kinds, to suit the fancies of those whose personal benefits are in proportion to the monsters of their creation.

The Marquis Clanricarde, in his reply to the discussions on Mr. Fairlie's paper, speaking of the enormous capital invested and the facility of its extension, made use of the following striking words, which are remarkably corroborative of what we have just advanced. Said the Marquis:—"The consequence is that an immense quantity of money has been thrown away, which might just as well have been spent in building a pyramid in a desert." We who pride ourselves on our intelligence, and in our commercial probity and knowledge, are at this moment the laughing stock of the whole world, because this grand intelligence has involved us in a loss of nearly £125,000,000 which might readily have been avoided. We have need, forsooth, to alter our policy in the future if we intend to prevent the whole railway system from becoming hopelessly bankrupt. However strange it may appear, our railway managers are determined not to be behindhand in wasteful extravagance. Only imagine a company like the London and Brighton Railway earning, it is said, as much as £3 per train per mile, yet the average for each train mile is under 4s. 10d. Surely this requires no comment of ours: it speaks for itself; we can only account for it by the dispatch of as many trains earning below 4s. 10d. as above that amount to bring the whole to this average. The fact is that many trains must actually run at a heavy loss on the plea of accommodation to the public, but this is not so. And here we cannot do better than quote Mr. Fairlie's own words. He says, "The best test of this is the patronage bestowed on particular trains, and the neglect of others which consequently do not pay." Nothing can be more clear than that if the trains which now earn nothing were a convenience, the public would avail themselves of them, and the natural course of things would be that each train would pay.

This despatching of unremunerative trains accounts for the great disproportion of the paying to the unpaying load, as shown by Mr. Fairlie, and corroborated in a letter of Mr. Samuel, which appeared in the money article of the "Times" on Monday last, although it will not account for the enormous disproportion of paying to unpaying loads on the Metropolitan Railway, which is said to be only one ton to every thirty tons. Then, again, there is the persistency with which our locomotive engineers continue to run those useless and expensive appendages to the locomotive engine called tenders, which weigh more than eight tons each. The average paying load of our passenger trains has long surprised us, more especially as it has been over and over again shown that the supplies which the tender carries, if placed on the engine, can be made available for increasing its power; we do not mean in the ordinary destructive form of tank engine, but the weight distributed over a large number of wheels, yet having a small wheel base, as in the bogie engine. The same reasoning holds good with the merchandize trains. In this case the tender weight would equal two waggons carrying five tons each, thus giving a nett paying load of ten tons of goods for every train mile run in lieu of tender. These ten tons at one penny per ton per mile would give tenpence per mile, or about one-third more than the present amount derived from mer-

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chandize traffic for division amongst those shareholders who may be so fortunate as to get anything like two shillings and sixpence per train per mile from this source.

In speaking of the Metropolitan Railway, Mr. Fairlie paid a well-merited compliment to its designers and constructors, but he considered the management altogether bad, so bad that, if persisted in, a very few years would suffice to reduce it to a very low condition indeed. The expense of maintaining and working this line is something enormous, and this, we believe, could be very much improved, not only to the great advantage of the company, but to the travelling public. In explanation of this, Mr. Fairlie says, "The carriages have very long wheel bases, consequently they offer great resistance to the tractive force of the engine, besides being very injurious to the rails rounding the curves. The engines have thirty-two tons on four wheels, or sixteen tons per pair. We have only to imagine this enormous weight ploughing along at thirty miles an hour, to form some idea of the destructive effect, not only to the rails, but to the substructure and the machines, the effect being destructive alike to all. No wonder that the line has, as it is stated, been relaid in many places three times with steel rails since it opened five years ago. Not content with this rate of destruction to road and stock, the Metropolitan Company are now receiving, or about to receive, locomotive engines of a still more destructive character to work the St. John's-wood branch, weighing forty-five tons on six wheels, with a wheel base of 14ft. The only approach to a saving feature in the 42-ton engines—viz., carrying the leading end of the engine on a bissel truck with four wheels—is in these new engines omitted. The bissel arrangement does, to some extent, reduce the enormous friction of the engines on rounding the curves, notwithstanding which the grating and grinding noise of the wheels can be heard at a considerable distance. The spirit of rivalry between armour-plates and guns is reproduced in steel rails and locomotive engines, with this difference, that the armour-plates can be made to withstand the power of the heaviest guns, whilst steel rails cannot withstand the battering of these 45-ton steam-hammer locomotive engines." To sum up the matter is only to repeat what we have already said several times of late, that unless a hearty and thoroughgoing reform—as pointed out by Mr. Fairlie—both in construction and management be introduced in our railway system, we can never hope for improved dividends, much less for a recovery of any portion of the vast sum of money now apparently, but, we trust, not irretrievably, lost.

THE HARVEY TORPEDO.

SOME interesting and highly successful experiments have recently been made with the torpedo which has been invented and perfected by Captain John Harvey, R.N., and of which full particulars will be found at page 189 of the MECHANICS' MAGAZINE for March 29, 1867. The experiments in question came off last Wednesday week, in the presence of two members of the Floating Obstruction Committee and a number of naval and military officers. On the day in question, the "Lightning" and the "Asp" proceeded out of Milford Haven to test the practicability of Captain Harvey's diverging torpedoes for the destruction of vessels at sea. The shells diverged from two to three points on each quarter, and one was brought into collision with the "Asp." The levers immediately acted, proving that had it been a live torpedo the "Asp" would soon have disappeared from the face of the water, as she would have experienced the full force of the explosion of 100lb. of Horsley's powder. The application of the safety key was then tested, and the results proved equally satisfactory. This concluded the experiments made by the Government. The inventor—Captain Harvey—had provided a small smack inside of the harbour for the purpose of testing the working of the exploding apparatus. A small "right astern" shell, containing 19lb. 6oz. of Horsley's powder, was towed into collision with the smack, but owing to her small height above water, and owing also to the "Lightning" having to round her stern close, on account of shallow water, the tow line slipped over the counter, and the shell, instead of exploding under the bottom, as intended, jumped on the deck and there exploded. It, however, shattered everything on board to atoms, leaving the hull of the smack a charred mass, with her upper works clean gone, and her beams fractured, proving to any unprejudiced mind the extraordinary power of Horsley's powder. There can be no question that had the torpedo been towed into collision with the bottom of the smack she would have been totally destroyed, if not lifted out of the water. Our readers are so well aware of the specialities and general excellence of Captain Harvey's torpedo that we are content to let the results of these experiments speak for themselves; their success places them beyond comment. We may, however, point out that this invention can be used with as much success in a gale of wind as in a calm, which is more than can be said of any torpedo boat. Another great advantage is that no battery nor other complicated exploding apparatus is required. We congratulate Captain Harvey on having succeeded in drawing the attention of the Government to his highly practical apparatus, and we hope it is the first step to a series of trials, preparatory to its adoption for defensive purposes.

BREECH-LOADING RIFLES.

OUR readers will doubtless remember that on the 22nd of October, 1866, a War Office advertisement appeared, offering three prizes for breech-loading rifles and ammunition. These were a prize of £1,000 for the arm which, on combination of all the qualities, should be considered by the committee to be the best submitted; a second reward of £600 for the arm which, while attaining a satisfactory degree of excellence in other particulars, should be selected for merit in respect to its breech mechanism; and a third reward of £400 for the best cartridge. The first report of the sub-committee has just been published; it only deals with the first stage of the inquiry, that is, with the selection of the prize arm. It appears that none of the arms submitted satisfied the whole of the conditions. The committee selected nine for trial, viz., the Albini and Braendlin, the Remington, the Fosbery, the Burton (two systems), the Peabody, the Martini, the Joslyn, and the Henry rifles. Every one of the competing arms sooner or later fell short in some degree of the minimum of excellence prescribed. The committee have not awarded their £1,000 prize at all, but have given the £600 prize (for breech mechanism) to Mr. Henry's gun. This arm is a smallbore (·455-in.) rifle, very similar in the arrangement of its breech action to Sharp's carbine. The breech is closed by a sliding vertical block, which is depressed for the admission of the cartridge by a lever underneath the trigger-guard. The striker passes diagonally downwards through the breech-block, and is struck by a hammer. The Boxer cartridge is employed with the gun. This arm won the £100 prize of the National Rifle Association in 1865, and acquitted itself very creditably last year at Wimbledon. With regard to the cartridge prize we are glad to find that the trials of ammunition having been concluded, the committee by whom they were conducted have reported that the ammunition submitted by Mr. Daw, of Threadneedle-street, has so far fulfilled the prescribed conditions as to justify them in awarding the prize of £400 to that gentleman. Sir John Pakington has accordingly given directions for the payment of this sum to Mr. Daw.

THE PHOTOGRAPHIC SOCIETIES.

THERE are three photographic societies in the metropolis, namely, the London Society, the North London Photographic Society, and the South London Photographic Society. The result of this division among photographers is, that all three societies do little more than clear the expenses of their meetings for the reading of papers, and have no funds for the establishment of a laboratory for scientific investigation, or for the formation of a photographic museum. Hence photography, as a science, is not pushed on as it should be by its public representatives, research being left entirely to private individuals. The latter investigators, as a rule, make researches in photography only on casual occasions, when they have leisure from other pursuits; hence the papers read at the societies refer, for the most part, to modifications in photographic apparatus or processes, and the higher branches of the subject are neglected more than is creditable to the fraternity. One very strong reason why improvement should be attempted is that the three disunited societies now expend enough to raise a very creditable yearly fund for the promotion of scientific research, but this surplus is at present wasted, because the societies, being separated, have to provide three different places of meeting, and incur a constant outlay to pay the rent of the same: likewise to keep the rooms in order. One of the societies, also, will soon have a considerable balance in hand, because its secretary, who formerly received nearly all its funds in the shape of salary, has volunteered to act as honorary secretary for the future. The annual subscriptions to some of the societies are less than those paid by the members of the others, so that if the latter gentlemen only agreed to have their contributions slightly raised to reach the higher level, the result altogether would be to produce a considerable sum of money annually, to help to raise photography, both as a science and an art.

Although to every outside spectator the union here suggested seems nothing but a common sense and obviously unobjectionable arrangement, it is one unfortunately which seems little likely to be adopted in practice. One reason is that feuds and petty jealousies exist among a few of the members of the different bodies, though in each of the three societies are many who overlook such trivial matters, and long for union. Trade interests, also, are said to have something to do with the divisions in the camp, for which reason it really would be a very good rule to adopt, that no member commercially interested in photography should be eligible to become one of the council. As such a rule would prevent many clever men from occupying the position, it would be invidious and wrong for an amateur to move the above proposition of non-eligibility, but the difficulty might be overcome by two large manufacturers of photographic goods moving and seconding, for the good of the art science, the proposition which prevents them from taking office. There would afterwards be a greater prospect of peace and union among the members, because then one leading photographer or manufacturer would never have reason to suppose he was unfairly treated, because one or two of his competitors in business chanced to be in office on the council of the society.

In all stages of photographic history, from its earliest days, the question of the permanency of photographs has always been a great one, and nothing is more disappointing than the absence of accurate evidence respecting the durability of different classes of silver-printed pictures. Now, this would never have

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been the case had one of the societies ever had the forethought to make the beginning of a museum, in the shape of a large glass case with lock and key, wherein the advocates of new processes should be compelled to place one specimen of their work, with minutely detailed particulars of the formulæ and manipulations. These pictures, being the property of the society, and exposed daily to strong daylight in the glass case, would not only form a most interesting historical record of the progress of photography, but the society would have ocular and authenticated evidence as to the durability of the different kinds of pictures. Yet, to this day, not one of the societies has adopted even such a simple and cheap plan as this. While such is the case, the expectation that a laboratory for scientific experiments will ever be established by the members of photographic societies, does indeed seem hopeless. Under these discouraging circumstances, with little hope of the council of one society favouring union with the council of another, coupled with a fresh general election of officers, we think the best practical thing to be done by those members of the three societies who desire union, is to ascertain their own numerical strength, and see whether they cannot fuse themselves into a stronger photographic association than any now in London. Above all things, care should be taken to avoid the representation of trade interests in the governing body of the society, this being a most fertile source of discord.

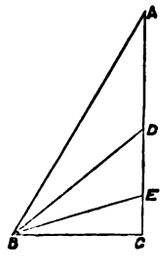
BOWSTRING GIRDERS.

IN the bowstring girder we have an arched iron rib, the horizontal thrust of which at the abutments or points of support is resisted by a tie-bar, the platform which carries the load being suspended by vertical pieces from the arched rib or bow. In order to determine the straining action exerted in such a form of girder, having a load uniformly distributed over the platform, let L denote the length in feet of platform, or span of bow, and w the load per foot of span; then w L = total load. Now, since the load is uniformly distributed, each of the points of support will bear one-half of this load or $\frac{w\,L}{2}$. There are thus two equal forces at each end of the bow acting vertically upwards, due to the resistance of the supports. The direction of the resultant of all the downward forces, or total load, is also vertical, and will pass through the crown of arch and middle of span. If we confine our attention to one-half of the girder we find that the result of the action of these forces is a "couple," the equal and opposite forces of which are $= \frac{w\,L}{2}$. The arm of this couple is $\frac{L}{4}$, because the resultant of the load on half the span acts through a point at a distance from end of girder, equal to one fourth of the span. The "moment," then, of this couple is $\frac{w\,L}{2} \times \frac{L}{4} = \frac{w\,L^2}{8}$, and the effect of its action is to cause depression at the crown of the arch. To resist this action an equal and opposite couple must be introduced by means of the tie-bar. This is effected by the resistance opposed by the tie-bar to the horizontal thrust of the bow at the points of support; this thrust is constant throughout the whole of the bow, and, therefore, we get for the forces of this new couple the tension on tie-bar and the equal and opposite horizontal thrust at crown of arch; the arm of this couple is the rise of the arch or vertical distance between the middle of platform and crown of arch. Let R denote the rise and T the thrust or tension, then T R = moment of couple and $T\,R = \frac{w\,L^2}{8}$

$$\therefore T = \frac{w\,L^2}{8\,R}.$$

Sufficient sectional areas must be allowed to resist the action of this stress. These areas are the same as those for the middle sections of the top and bottom members of a plate or lattice girder of the same depth and span, the formula being the same in both cases. In plate or lattice girders, however, the sectional areas decrease towards the points of support, whilst in the bowstring girder an increase should be made, the sectional area of tie-bar remaining constant; thus in its upper and lower members the bowstring girder must be much heavier than the plate or lattice girder.

The thrust throughout the bow in the direction of its curvature may be found at any point by constructing a diagram similar to that annexed, in which the vertical line



A C represents the half load $= \frac{w\,L}{2}$, and the horizontal line B C the tension on the tie-bar = horizontal thrust in bow $= \frac{w\,L^2}{8\,R}$; join A B, then the line A B will represent in magnitude and direction the thrust through the arch at the point of support. Take any point D in the bow and let the line D C represent the load acting upon the girder from the centre of span to that point, B C, as before, representing the tension on tie-bar, then B D represents the thrust at the point in question. To distribute the action of a rolling load, diagonal pieces are introduced between the vertical bars; these diagonals will act alternately as ties and struts. Comparing the weights of bowstring and lattice girders, we find that the former is the heavier. Theoretically speaking, the top and bottom members of a lattice girder will contain less than two-thirds of the material in the same members of a bow and string girder; and the greater quantity of material required for the diagonals of a lattice girder, as compared with that for the stiffening diagonals of the bowstring, will not make up the difference already mentioned. W. J. M.

NOTICES OF BOOKS.

THE constant improvements which are being made in mechanical engineering, and the changes that take place almost daily in matters of constructive detail, combine to render necessary the constant revision of any treatise specially devoted to the subject. Indeed, we may go further, and say that in a few years, at the most, such works now become comparatively antiquated, so rapidly do improvements succeed each other and lead to radical changes in practice. It is, therefore, with satisfaction that we announce the issue of another—the eighth—edition of Mr. Bourne's well-known treatise on the steam engine.* It is, however, but just to remark here that the present work does not fall entirely within the category of books that soon become antiquated, inasmuch as it deals largely with principles, as well as with practice. It treats of the steam engine in all its varied applications, and contains some sound theoretical investigations respecting the motive power of heat. The proportions of steam engines are given, with elaborate tables of the correct dimensions of every part. Then we also have a series of practical instructions for the manufacture and management of engines in general. So far it will be seen that the work in no way departs from the beaten track of its predecessors, but, in fact, is still the "Artizan Club" treatise. Mr. Bourne has, however, modernized the work in his treatment of the subjects; he has introduced such emendations as render it consistent with the maxims and practice of the present day. The alterations in constructive form are fully indicated, although generally the descriptions are retained, Mr. Bourne's object being to have a record of former practice.

On looking through the work we were at first struck with the absence of any of the latest examples of engineering, which Mr. Bourne had so good an opportunity for introducing. But on reading the author's preface we were exceedingly glad to find that it had proved impossible to embody in the present treatise a vast amount of important information at the author's command. So we are promised a new work, supplementary to the present one, which will treat only of modern engines. When we add that their forms are to be minutely described, and illustrated by working drawings of a character so detailed that the engines may be made from them, our readers will be able to form some idea of the value of the promised work But with regard to the volume before us. we may observe that, embodying as it does those scientific principles which are of tolerably permanent application, it must ever remain the text book of the steam engine. As such we warmly commend it to our readers, who will find it to embody the results of the ripened experience of our leading engineers, and of the investigations of our professors and men of science. The present edition is well illustrated by thirty-eight beautifully drawn plates and five hundred and forty-six woodcuts. A capital portrait of the author faces the title page, and plate XIV. shows a sugar mill of improved construction, which is far superior to that illustrated in previous editions of this work.

Mr. N. P. Burgh is now engaged upon a new work on modern screw propulsion,† which promises to take its place as a standard book of reference on this subject. It is to be completed in fifteen monthly parts, two of which have already appeared. Mr. Burgh is assisted by a number of the leading engineering firms of England and Scotland, as well as by several professional gentlemen, and from this combination we may reasonably expect a sound practical work of abiding interest and value. The first chapter contains a series of preliminary considerations by Mr. Burgh, the second is the introduction to the general subject, and is written by Mr. G. B. Rennie, who gives an outline of the history of the screw propeller in England, and then touches on the various forms of propellers in use. He then discusses the question of the slip of the screw propeller, the effect of the angle, and depth of immersion, and finally the friction of the blades of screws in water. Mr. Burgh then takes up the theme, and devotes the third chapter to the geometry of the screw propeller, in the middle of which part II. leaves him. Each part is illustrated by two page plates and one folding plate of well executed lithographs, illustrative of the principles and practice of the subject. On the whole, we are led upon practical grounds to form a very favourable opinion of this work, and which will be enhanced if Mr. Burgh will only consent to withdraw nine-tenths of his inverted commas, and to give up the indiscriminate and senseless use of italics. He may depend upon it that this method of emphasising weakens far more

* "A Treatise on the Steam Engine." By JOHN BOURNE. Eighth edition. London: Longmans, Green, and Company. 1868.

† "Modern Screw Propulsion." By N. P. BURGH, Engineer. London: E. and F. N. Spon, 48, Charing-cross.

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than it strengthens the passage, especially when it extends to four words in a sentence, as in several instances before us. This, of course, is but a question of taste, and does not vitiate the practical value of the book, which, when complete, will be found to contain the best and most useful information upon the subject. From the character of the numbers before us we have no hesitation in commending the work to those of our readers who wish for information on the principles and practice of the screw propeller. Mr. Burgh has also published in pamphlet form a paper read by him before the Society of Arts, on the subject of the future development of marine engineering.* The author divides his subject into three parts, one of which he assigns to the boiler, another to the engine, and a third to the screw propeller, laying down principles for their further improvement. His conclusions are, that as heat is the prime mover, to it we must turn more of our attention, and, in place of 30lb., steam from 60lb. to 80lb. must be adopted for universal practice.

A very useful work has just been compiled by Mr. Washington Hudson, in the shape of a clear and concise treatise on practical geometry.† The want of such a work has long been felt by science teachers and their pupils, and Mr. Hudson, himself a Government science master, has supplied that want in the most exact and perfect manner. The work embraces all the branches of geometrical drawing applied in the arts and sciences, and it is so arranged as to be especially suitable for science classes. But, besides this, it will prove very useful to mechanics and workmen in various branches of trade; plane and solid geometry being united with orthographic, isometrical, parallel, and linear perspective projections in a clear and condensed form. A glance through this work shows it to possess peculiar merits in the direction we have indicated, and as its price places it within reach of the humblest artizan, we unreservedly recommend it. By its aid, persons having no previous knowledge of geometry may easily and thoroughly comprehend this science, and although there is no royal road to learning, Mr. Hudson has certainly rendered it uncommonly smooth, as far as geometry is concerned.

We have several other books for notice, which we are obliged, for want of space, to defer until our next number. We will, however, make one exception, and this for the purpose of endeavouring to set at rest, once and for all, a point upon which some misconception still exists, although we and others have done our best before now to place the matter in a right light before the public. The question is simply the position Mr. William Fothergill Cooke holds with regard to the introduction of the electric telegraph, of the honours of which position Mr. Cooke's friends assert Professor Wheatstone and his friends periodically attempt to deprive him. In other words, it is a question of Cooke v. Wheatstone, and we regret to see it again brought up, as almost every one had considered it finally settled. However, the honour lately conferred upon Professor Wheatstone appears to have been made the occasion of another pamphlet† by Mr. Cooke's friends. It is edited by Mr. Cooke's brother, the Rev. T. F. Cooke, who has sent us a copy, asking our notice of the matter. The pamphlet consists of a series of letters containing extracts from the arbitration evidence of 1841. If there should happen to be any who are unacquainted with the subject, and who desire to go into the matter, we would refer them to the pamphlet, but would not confine them to it, because there are two sides to the question.

To our mind, and to the mind of the scientific world, the case honestly stands thus:—When the arbitration took place many years since, it was then placed on record that Mr. Cooke had undoubtedly the merit of introducing the telegraph into Great Britain, and that in its general adoption he was materially assisted by Professor Wheatstone. The arbitration had reference also to the division of certain moneys arising from mutual patents, &c. When the Electric Telegraph Company purchased their entire rights, Mr. Cooke received £91,000 as against Professor Wheatstone's £33,000. Since then Mr. Cooke has been a director of the Electric and International Telegraph Company, and has never done anything further for the advancement of telegraphy scientifically. He has been content to rest upon his *golden* laurels, whilst Professor Wheatstone has been continually gathering laurels—not always golden in a pecuniary sense—for his many improvements in electrical science. Instruments, too numerous to mention, of which he is the inventor, are in general use, and he is ever active in bringing forward new things, not only in electricity, but in science generally. The honour of knighthood was conferred upon the Professor for his general scientific discoveries and inventions, and *not* because he introduced the telegraph, as Mr. Cooke's friends seem either themselves to think, or to fear others may think. To our mind, it is very questionable taste on the part of Mr. Cooke's friends to find another occasion on which to stir up old and long-settled questions, and to endeavour to make out that Mr. Cooke is a persecuted, an ill-used, and an injured man. There has never been, except in the minds of Mr. Cooke and his friends, any attempt to rob him of his just merits. They have everywhere, and at all times, been freely and willingly acknowledged, and full justice has always been done to him. If he is not content with his position in the matter, nor his friends with anything less than dragging him into unenviable notoriety, they must thank themselves for the results. We have, however, stated our views with regard to the case, and we believe they are those of the scientific world generally. We have now done with the question, and hope never to see it raised again. No practical good can be done to science by its further discussion, nor can it either add to or detract from the merits of either Mr. Cooke or Professor Wheatstone with respect to the introduction and development of the electric telegraph in Great Britain.

* "The Principles that Govern the Future Development of the Marine Boiler, Engine, and Screw Propeller." By N. P. BURGH, Engineer. London: E. and F. N. Spon.

† "Practical Plane and Solid Geometry." By WASHINGTON HUDSON. London: Whittaker and Company, Ave Maria-lane. 1868.

‡ "Authorship of the Practical Electric Telegraph of Great Britain." Edited in assertion of his Brother's Rights, by the Rev. THOMAS FOTHERGILL COOKE, M.A. London: Simpkin, Marshall, and Co. 1868.

ELECTRICITY AND TELEGRAPHY.

THE Chancellor of the Exchequer gave notice on Monday last that he should move for leave to introduce a bill to enable the Postmaster-General to obtain possession of the electric telegraphs throughout the country. The bill was brought in and read a first time last evening. We hope in our next impression to discuss the principal points in the bill.

We have lately been unfortunate with regard to our submarine cables, many of which have been broken. The Persian Gulf cable was broken on the 14th inst. between Mussendom and Gwadur; during the interruption, which is not expected to last long, messages are conveyed over the interrupted section by steamer. The Dover and Calais cable is again broken, an accident having happened to it during one of the recent storms; messages are sent by the Boulogne and Dieppe route.

The Portpatrick and Donaghadee cable has just been repaired after an unusually protracted breakdown; the operations were materially interfered with by the weather, and the cable itself being old and very weak, rendered care most necessary. The picking up entailed a great amount of time, for the cable parted wherever it was grappled, and it was some time before a sound piece could be buoyed. A further delay was occasioned by an accident to the cable during the paying out. It is intended to strengthen the shore ends of the cables that go across these straits. The Malta and Alexandria cable is still interrupted, messages in the meantime coming by the Syrian route, but frequently with great delay. The repairs to this cable have been greatly lengthened on account of the very bad weather. The Isle of Wight cable, which was lately interrupted, has just been repaired and put in working order.

The Telegraph Construction and Maintenance Company have issued their report, recommending a dividend at the rate of 5 per cent. per annum. Their past year's operations consisted in laying the Placentia and Sydney cable, a length of 320 miles, and of twice repairing the Atlantic cable. The first repairs were effected in an unprecedentedly short time, communication having been restored three weeks after the agreement was signed. The fault occurring off Newfoundland rendered a long sea voyage necessary, occupying a large amount of the above time. The second fault occurred whilst the "Chilterns" was engaged in the Placentia cable, a fact that was very fortunate, as it did not necessitate a vessel being sent over specially. With regard to these repairs, the report remarks that "they have an important bearing upon the practicability and economy with which submarine telegraphs can be maintained, and the experience gained forms a very valuable addition to that acquired in the Atlantic expeditions of 1865 and 1866."

In order to improve their means of communication with the East, they have taken steps to consolidate and improve the company's property in Italy, the Mediterranean, and in Egypt. "With this object, and in order to obviate the delays arising in telegrams passing through continental countries, the company are erecting a land line, connecting Susa in Italy with Modica in Sicily, which will greatly facilitate the transmission of dispatches. This line, it is hoped, will be open in June next." They have every hope of obtaining the contract for the Tasmania Victoria cable. They, with ourselves, hope that the depression as regards business generally, and more particularly with regard to cable business, is only temporary, and that submarine telegraph enterprise must revive, especially "when the well-known fact is taken into consideration that large as are the present receipts from all telegraph lines, the greater proportion of the profit is being realized from the Atlantic and other submarine cables."

An important meeting was held on Monday last at the Mansion House, to consider the question of telegraphic communication with the East, in reference to a memorial addressed to Sir Stafford Northcote, signed by numerous leading houses in the City, and presented by the Lord Mayor. The prevailing feeling throughout the meeting was in favour of a submarine line, viâ the Red Sea, to India, as one speaker deprecated the idea of a land communication as being "essentially unsound, dependent as we were at the present time on the goodwill of foreign countries, and circumstances might arise that might absolutely cut us off from all communication with India." Some went so far as to revive the old scheme of a submarine line all the way from England to Egypt, and from thence by the Red Sea route. Whilst complaining of the delays relative to the Abyssinia war, and the saving of time if there had been a submarine cable, it was rather unfortunate—a fact that seemed to be lost sight of—that a great part of the delay was owing to an interruption in one of the links of the chains so strongly advocated. There is no doubt that the meeting will do good by agitating the question of our Indian telegraphic communication, to which we so lately alluded, and we hope shortly to see means adopted for enabling us to obtain earlier as well as more certain intelligence.

The Electric and International Telegraph Company have lately contracted with the India-Rubber, Gutta-Percha, and Telegraph Works Company for the manufacture at their works, at Silvertown, of thirty-three miles of cable, for renewals in the North Sea. A portion of this is to be shore end of the great weight of seventeen tons to the mile. The core is now being commenced at the same works.

General Smith, the President of the American Company—the International Ocean Telegraph—is now over here with regard to making arrangements for the manufacture of a second cable to connect Cuba with Florida, and some mention has

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been made of laying it this summer. We trust we are misinformed on that point, for after the experience obtained last year, when the vessel arrived out there in the middle of the hot season, and with yellow fever in every direction, from which the staff suffered so severely, such an undertaking would be foolhardy in the extreme, and we cannot think that any contractor would undertake submerging a cable at such a time.

A great improvement has been effected in Wheatstone's Automatic Telegraph by Mr. Culley, in the preparation of the punched paper ribbon for this system of telegraphy. In the ordinary way the punches are struck by pieces of vulcanite held in the hand, but Mr Culley has placed above each punch a small cylinder containing a piston acted upon either by vacuum or compressed air. The valves are worked by finger keys as light in their touch as those of a pianoforte, and the result is that "punching" is effected with the greatest ease and at a much more rapid rate. The apparatus is manufactured by Mr. Stroh, of the Hampstead-road.

The necessity for another cable is a striking proof of the amount of business that must take place between Cuba and the States. We trust shortly to hear of the proposed extension to Panama

Professor Grove tried lately a novel experiment with a small induction coil of 3¼in. long by 2in. in diameter, containing a secondary wire of about three-quarters of a mile in length. To the primary wires of this coil he connected the wires from a small medical magneto machine. The contact breaker of the coil was closed, as the success of the experiment was considered to depend upon that. On setting the machine in motion no effects whatever were observed in the secondary wire, and it was only when the contact breaker was released and allowed to work as usual that any results were obtained. He then obtained sparks about three-quarters of an inch in length, and vacuum tubes were readily illuminated. The result is, he states, dependent in some manner upon the condenser, for without it no effects are obtained. It must be borne in mind that the currents obtained from these small magneto machines are of a rapidly alternate character, and that they would probably neutralize each other. The experiment might possibly be different if a commutator were used, and the currents passed into the coil in one direction only. The rapidity of the currents induced would then probably answer similar to a contact breaker. With the contact breaker in rapid action, is it not probable that the opposite current of the machine was cut off and neutralized, and that the usual effects followed similar to a single current?

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

AN IMPROVED SAFETY LAMP—DANGERS OF LEADEN TOBACCO BOXES—INKS FROM ANILINE COLOURS—MODE OF SUBMITTING IRON CASTINGS TO PRESSURE WHILE THE METAL IS IN THE LIQUID STATE.

At a recent meeting of the Société d'Encouragement, a description of a new safety lamp for use in coal mines, petroleum warehouses, distilleries, &c., was read. Practically speaking, there is nothing very original in this invention, but the arrangement of the parts is new. Around an ordinary oil lamp an iron crown is fixed by means of a bayonet catch. This crown is pierced with holes to supply the air, the holes being fitted with fine wire gauze. Above this crown is another of thick glass, which allows the light of the flame to pass, and above this again is the chimney or cylinder of fine gauze, the mesh of which is the same as in the Davy lamp. We do not suppose this lamp is more safe than the Davy lamp, but it will give more light, and will not be expensive.

Leaden tobacco boxes, we believe, have nearly disappeared in this country, but we see some occasionally, and we may therefore quote the observation of Dr. Mayer, of Berlin, who states that he has traced six cases of lead colic and paralysis to the use of these utensils. M. Chovallier has also found that tobacco wrapped in lead foil becomes impregnated in the course of time with acetate of lead.

Fuchs describes a method of making of inks with the aniline colours which may be useful to some of our readers. He takes a quarter of an ounce of the colour required—red, blue, or yellow; but as the strength of the colours of commerce varies, a little more or a little less must be used at times to keep up uniformity of shade. The colour is digested for some three hours in two ounces and a-half of strong alcohol. Then a pint and a-half of distilled water is added, and the whole is gently heated, until all the alcohol has been driven off. An ounce of gum arabic dissolved in eight ounces of water is then added, and after standing for a time for any impurities to deposit, the ink is ready for use.

A mode of submitting iron castings to great pressure, while the metal is in the liquid state, has been devised by M. Galy-Cazalet with the idea of giving thereby greater strength to steel cannons. The way of making the mould we need not describe, as it appears to be the same as usual, only using an outer iron casing of greater strength. As soon as the metal has run into the mould, M. Galy-Cazalet fixes firmly on the top a metallic cap, so as to seal the mould hermetically. The cap carries a tube which can be opened by means of a stop-cock. Within the tube, which is closed at the top, a few grammes of a powder composed of charcoal and nitre is put. When the stop-cock is opened this powder falls upon the liquid metal, and developing a quantity of gas at a very high temperature great pressure is necessarily exerted upon the metal. Thus the casting is obtained perfectly solid, and the gun will consequently possess far greater strength than an ordinary casting. This system of casting may perhaps be applied with as much advantage to many other things besides cannons.

THE FORMS AND PROPORTIONS OF IRON-CLADS.

By Mr. E. J. Reed, Chief Constructor of the Navy.

The following is an abstract of a paper read at the Royal Society, on the relation of form and dimensions to weight of material in the construction of iron-clad ships, on Thursday, March 19, 1868. The object of the paper is to show that the proportion of length to breadth in a ship, and the form of her water lines, should be made in a very great degree dependent upon the weight of the material of which her hull is to be constructed—that an armour-plated ship, for example, should be made of very different proportions and form from those of a ship without armour, and that as the extent and thickness of the armour to be carried by a ship are increased, the proportion of length to breadth should be diminished, and the water lines increased in fullness.

It is highly desirable that this subject should receive the attention of men of science, not only because it bears most directly upon both the cost and the efficiency of future iron-clad fleets, but also, because it opens up a theoretical question, which has hitherto, the author believes, received absolutely no consideration from scientific writers upon the forms and resistances of ships, viz., the manner in which the weight of the material composing the hull should influence the form. Prior to the design of the "Bellerophon," the forms of ships were determined in complete disregard of this consideration, and even the most recent works upon the subject incite the naval architect to aim always at approaching the form of least resistance. The investigations given in the paper show, however, that the adoption of a form of least resistance, or of small comparative resistance, may, in fact, lead to a lavish outlay upon our ships, and to a great sacrifice of efficiency; while, on the other hand, the adoption of a form of greater resistance would contribute in certain classes of ships to great economy and to superior efficiency.

In order to indicate clearly, but approximately only, the purpose in view, the author first considers the hypothetical cases of a long and a shorter ship, both of which are prismatic in a vertical sense. The length of the long ship is seven times its breadth, and its horizontal sections consist of two triangles set base to base. The length of the short ship is five times its breadth, the middle portion being parallel for two-fifths of the length, and the ends being wedge-shaped. It is assumed also, that at a speed of fourteen knots, the long ship will give a constant of 600, and the short ship a constant of 500 in the Admiralty formula,

$$\frac{\text{Speed}^3 + \text{Mid. Section}}{\text{Indicated Horse Power.}}$$

The draught of water is in each case 25ft., and the total depth 50ft. It is taken for granted that the form of the long ship has been found satisfactory for a ship of such scantlings that we may consider her built of iron of a uniform thickness of 6in., the top and bottom being weightless. Now let it be required to design a ship of equal speed, draught of water, and depth, but of such increased scantlings (whether of hull proper, or of armour) that the weight shall be equivalent to a uniform thickness of 12in. of iron, the top and bottom being weightless as before. First, the new ship has the proportions of the long ship given to her, and secondly those of the shorter ship. In each case the engines are supposed to develope seven times their nominal horse-power, and to weigh (with boilers, water, &c.), 1 ton per nominal horse-power. The coal supply in each case equals the weight of the engines, so that both ships will steam the same distance at the same speed. But as the equipment of the smaller ship will be less weighty than that of the larger ship, we will require the larger ship to carry 2,000 tons, and the smaller 1,500 tons additional weight.

Assuming the breadth extreme in each case to be the unknown quantity, we can, from the Admiralty formula given above, deduce an expression for the indicated horse-power; thence under the assumed conditions the weights of engines and coals can be found; and these being added to the weights of hull (calculated on the assumption that the sides are of 12-in. iron) and to the weights carried, give an expression for the total displacement, in tons, of each ship. Another expression is found for this displacement by finding the weight of water displaced. The two expressions are equated, and a quadratic equation is formed, from which the breadth extreme is determined, and from it all the other values can be found. The accompanying table shows the results obtained by this method for the two classes of ships:—

	Long Ship.	Shorter Ship.
Length, extreme.....	581 feet	342 feet
Breadth „	83 „	68¼ „
Nominal horse-power.....	1,350H.P.	1,337H.P.
Indicated „	9,450 „	9,359 „
Weight of hull	12,570 tons	7,576 tons
„ of engines	1,350 „	1,337 „
„ of coals	1,350 „	1,337 „
„ carried	2,000 „	1,500 „
Total displacement.....	17,270 tons	11,750 tons

It will, therefore, be seen that by adopting the proportions and form of the shorter ship, a ship of the required scantlings and speed will be obtained, on a length of 342ft., and a breath of 68¼ft.; whereas if the proportions of the long ship are adopted, the ship, although of the same scantlings and speed only, will require to be 581ft. long, and 83ft. broad, the steam power in both cases being as nearly as possible the same. Considerations of this character worked out more fully, led the designer of the "Bellerophon" to depart so considerably from the form and proportions of the "Minotaur."

The next part of the investigation is based upon the official reports of the measured mile trials of the "Minotaur" and "Bellerophon," when fully rigged, and upon calculations made from the drawings of those ships. It is assumed that a prismatic vessel having the same mean draught as each of these ships, and having the same form and dimensions as the mean horizontal section—which equals the mean displacement in cubic feet, divided by the mean draught of water—will give the same constant as the ship herself at the assumed speed of fourteen knots, which, as nearly as possible, equals the speed obtained by both the "Minotaur" and "Bellerophon" on the measured mile. For each ship the weight of the armour and backing is supposed to be uniformly distributed over vertical prismatic sides of the dimensions of the armoured sides, and the weight of hull is similarly distributed over vertical prismatic sides of the dimensions below water of the mean horizontal section, and above water of the armoured side. The actual weights carried by the ships are thus transferred to, what may be termed representative prismatic vessels, having the same constants of performance as the ships. The detailed calculations in the paper show that the weight per square foot of the material in the hulls of the two ships, when distributed over the sides of the representative prismatic vessels, is very nearly the same for both, and the same holds with respect to the weight per square foot of armour and backing. The "Minotaur" is rather heavier in both respects, but for the reasons given in the paper, the means of the values found for the two ships are taken, and are found to be—

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Weight per sq. foot of hull . . = ·152 ton
" " armour and backing = ·11 ton.

The questions next considered are these: presuming it to be necessary to build another ship which shall also steam fourteen knots, carry the same proportionate supply of coal to engine power, and proportionate quantities of stores, but shall have her armour and backing of double the weight of armour and backing of the "Bellerophon" and "Minotaur," then first, what will be the size, engine power, and cost of the new ship of the "Minotaur" type, and having the same mean draught and depth of armour; and second, what will be the size, engine-power, &c., if built on the "Bellerophon" type, and having her mean draught and depth of armour? this condition implying of course that the same constants of performance as before will be realized in each case. On account of the great disproportion in size between the two types of ship it is obvious that the smaller one will require much less weight of equipment. It is assumed therefore that the additional weights of the smaller ship (exclusive of engines, boilers, and coals) amount to 700 tons, and those of the larger ship to 1,000 tons. The developed power of the engines, proportionate supply of coal, and the weight of engines, &c., are taken exactly the same as in the hypothetical case first given.

By proceeding with the investigation for each case in a way similar to that sketched for the hypothetical ships, only treating the breadth extreme of the mean horizontal sections of the new ships as the unknown, the following results are obtained. The new ship of the "Minotaur" type which fulfils the required conditions will be nearly 490ft. long, 72½ft. breadth extreme, and have a total displacement of 14,253 tons; while the new ship of the "Bellerophon" type is 380ft. long, 71ft. breadth extreme, and has a total displacement of 10,950 tons. It thus becomes obvious that a correction is needed in the weight per square foot of hull in the new ship of the "Minotaur" type, as her length has been so greatly increased; it is considered that an increase of at least 10 per cent. is required, and this is the allowance made. On the other hand, the new ship of the "Bellerophon" type is still shorter than the "Minotaur" herself, and the displacement is not much greater than the actual displacement of the "Minotaur," so that no correction is needed in her weight per square foot of hull. When the correction has been made for the new ship of the "Minotaur" type, the final results in round numbers are as follows for the two classes of ship:—

	New Ship of Minotaur type.	New Ship of Bellerophon type.
Length	510 feet	380 feet
Breadth	75 "	71 "
Tonnage	13,770 tons	8,620 tons
Nominal horse-power	1,080 H.P.	1,080 H.P.
Indicated "	7,560 "	7,560 "
Weight of hull	7,100 tons	4,460 tons
" armour and backing	5,190 "	3,630 "
" engines and coals	2,160 "	2,160 "
" stores carried	1,000 "	700 "
Displacement	15,450 tons	10,950 tons

Taking the cost per ton at £55 (which is the average cost per ton of tonnage for the hulls of armour-clad ships), the saving made by adopting the new ship of the "Bellerophon" type would amount to £283,250, or considerably more than a quarter of a million sterling. It must also be considered that the ship of the "Bellerophon" type would cost less for maintenance and repair, and be much handier in action.

The last investigation in the paper is purely theoretical, and consists of a determination of the dimensions which would be required in two ships, of which the horizontal sections are curves of sines, and which are prismatic vertically, if they were built with the same weight per square foot of hull (say ·1 ton) as the "Bellerophon," but carried twice the weight of armour per square foot (say 6·28 ton). In these cases the bottom is taken to have weight as well as the sides, the speed for both is fourteen knots, the draught of water is 25ft., and the depth of the armoured side 24ft. One of the ships is seven times her breadth in length, and the other is five times. Professor Rankine's rule for the calculation of horse-power and speed is employed, and the same conditions of engines, &c., are assumed, as have been indicated previously. The larger ship carries 1,350 tons additional weights, and the smaller 900 tons. The results obtained for these ships are as follows, when expressed in round numbers:—

	Larger Ship.	Smaller Ship.
Length	585 feet	425 feet
Breadth	84 "	85 "
Nominal horse-power	1,267 H.P.	980 H.P.
Indicated "	8,890 "	6,860 "
Weight of hull	7,586 tons	5,540 tons
" armour and backing	6,124 "	4,470 "
" engines and coals	2,540 "	1,960 "
" carried	1,350 "	900 "
Displacement	17,600 tons	12,870 tons

These results are very different in detail from those obtained in the cases based on the actual trials of the "Bellerophon" and "Minotaur," but not greater than might have been anticipated from the adoption of such a different form of ship, and mode of calculating resistance. The 2,000 horse-power which is needed by the larger ship above the power required by the smaller ship, is principally due to the difference between the immersed surfaces of the two ships, and is spent in overcoming friction. The immensed midship sections, it will be remarked, only differ by a very small amount. This last investigation serves to show that the theoretical best form of ship being taken, and the most recent rule being applied in the calculations, the speed of 14 knots can be obtained in the short type of ship at a surprisingly less cost and size than the long type requires, and this result agrees with that of the preceding investigation based on actual trials.

ON THE SHRINKAGE OF CAST IRON.

THE following is the substance of a paper read by Mr. David Walker before the members of the London Association of Foremen Engineers on Saturday, the 4th inst., Mr. Newton in the chair:—Shrinkage is the complement of the property which metals possess in common with nearly all other bodies—that of expanding by heat. It comes into operation more or less at all ranges of temperature, but varies very much in degree. In iron castings it proceeds very rapidly at temperatures high above the smelting point, which was proved by the sinking of the metal in a mould after it had been filled, and the large quantity of metal which was required to keep up the head—technically called "feeding." This would go on in castings of great thickness for a couple of hours or more. When this subsidence was not guarded against by the feeding operation, the castings inevitably became unsound. Exteriorly it would take the form of the mould, but in the centre it would be hollow; the experienced moulder so arranged his feeding head as to supply those parts of the casting which were thicker than the others. (The reader here introduced a piece of cast iron caught, as it were, in the act of crystallization, and which presented an appearance analogous to that of water when freezing.) Mr. Walker then proceeded to say that whereas water expanded during crystallization, iron shrank. A block of metal measuring 1¾ cubic feet took about 7lb., or 26 cubic inches, of metal to feed it; this was equal to 1-10in. to the foot, the usual allowance made for shrinkage in cooling from the smelting point. This appeared to confute the idea of iron expanding in the act of crystallization. It had been said to expand externally; he had never been able to observe any symptoms of this nature. If there were any of that irresistible power which ice exhibits, we should expect it to show itself in the case of a chilled roller, for example. This was not so to any perceptible extent, the chill or iron mould lasting till fairly worn out by heating and cooling. The only argument for the theory of iron expanding in crystallization, held by some scientific men, was that the solid was supported by the fluid, thus showing greater specific gravity.

That the metal shrank while cooling in the fluid state was beyond a doubt, and that the fluid supported its own solid was also quite clear, although how to reconcile the two facts he was at a loss. The contraction, however, was checked during the loss of a great portion of the heat, which was not easy to be accounted for, unless we looked upon the expansion by crystallization, on the one hand, and the contraction by loss of heat, on the other, as two great opposing powers, which, like the centrifugal and centripetal forces in the heavenly bodies, balanced each other for a time, and thus checked the action in either direction. Mr. Walker observed that he had no desire to indulge in theoretical speculations, but would prefer to give the results of his own observations, extending over a considerable time, and sometimes producing rather conflicting ideas. It was admitted, as demonstrated by researches in chemistry, that fluids began to crystallize at certain fixed temperatures, varying according to the properties they possessed. Cast iron, for example, was given at 2,754deg. Fah. by some authorities; at 3,600deg. by others; whilst some authorities went even as high as 17,975deg. by the same thermometer. Copper was less, and the scale descended in silver, gold, zinc, lead, &c., down to mercury, which was 39deg. below zero. Now, leaving out of the question for the present the numerous qualities of cast iron, it would seem safe to assume that two castings from the same charge would crystallize at the same temperature, and if the shrinkage could be calculated with any degree of certainty, our task would be comparatively an easy one. This was, however, by no means the case, for it was influenced by very many conditions—as thickness, position, the nature of the mould (whether of loam or sand) in its various forms, and others, which baffled calculation. He (Mr. Walker) did not expect to succeed in arriving at any definite points as to the results of these conditions, but that even an approximation was important would be admitted by experienced pattern makers, who often found great difficulty in causing the various castings of large pieces of work to come to the required sizes, they having to be produced under the varying conditions alluded to.

The simplest form of casting, and that most easy of observation—the open sand plate—on being poured solidified very quickly, and parted with its heat rapidly. It would naturally be expected that in this case shrinkage would proceed in proportion, but this was by no means so. About ten minutes after it had become set it would be below the smelting point of copper, showing that it had, by the lowest estimate, lost 700deg. of heat, but there was no observable contraction. It would remain at its original size, varying according to thickness, perhaps half an hour, and then it would begin to shrink very slowly indeed till it had cooled to about 1,100deg. or 1,200deg. Here the contraction would cease for a time, and at this peculiar temperature a decided expansion would take place, and this existed until it cooled to about 800deg., when the real work of shrinking began. That slowness of contraction at high temperature he had noticed, in a general way, frequently, but the observations in regard to temperature and the discovery of expansion, at a particular degree of heat, was made upon a plate of cast iron 14ft. long and 1½in. thick, and this was cast at ten minutes to three o'clock in the afternoon, and it set almost immediately. About ten minutes after, it had cooled below the smelting point of copper, and must have lost, according to the lowest estimate of temperature, upwards of 700deg. of heat. This it did without showing the slightest symptom of shrinkage; nor did it do so for quite half an hour, then shrinkage began to show itself very slowly, and continued until it reached the amount of 3-16in. in 14ft. length. Judging from the colour, it had now come to the temperature of about 1,100deg. or 1,200deg. Strangely enough, at this point it began to expand again, and recovered one-eighth of its lost dimension, and thus it remained till it had fallen to about 900deg., when the contraction proper began, namely, about two hours after casting. In one hour it amounted to 5-8in., heat about 700deg. Next hour, 7-8in., heat 600deg. Next hour, 1 1-16in., heat about 550deg. Judging from its effects upon metals of known degrees of heat at the fusing point, next morning, at six o'clock, the heat was 130deg. by the thermometer, the shrinkage 1 11-16in. Finally, the contraction had reached 1¾in., or exactly 1-8in. to the foot. There were some very curious phenomena to be observed upon in this example. It lost nearly 2,000deg. of heat without sustaining any longitudinal or appreciable shrinkage. This might or might not be accounted for by the idea suggested—that of the opposing forces, due to expansive crystallization on the one hand, and shrinkage, by loss of heat, on the other. It was clear that nearly the

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whole of the shrinkage took place within the range of 600deg. The reader of the paper said he had made numerous observations with similar results.

The most important condition, as affecting shrinkage, was, he thought, the relative thickness of castings. Two castings, poured at the same time, would yield very different results in shrinkage when they varied in thickness. It would be easy to adduce examples of this, and one should be mentioned. A bar of cast iron, 1in. thick and 3ft. long, gave 1-10in. per foot of contraction, while a block, cast from the same cupola, and within five minutes of the same time, gave in 2ft. length no shrinkage at all! The latter, indeed, when cold, was exactly of the same dimensions as the mould. The measurements were made with great care in both cases. What seemed more remarkable perhaps was the fact that the same block took in feeding, as nearly as could be estimated, a quantity of metal equal to 1-10in. per foot in its whole mass. These experiments agreed in their main features with the author's general experience, and showed that block castings do not, as a rule, shrink to any sensible extent. Generally, he had found that castings which were fed well had a very limited degree of shrinkage. It would be possible for him to make a sketch of a frame with which he was very familiar (a finely proportioned pattern 2¼in. thick), in which the contraction of the resulting casting varied from 1-17in. to 1-23in. per foot longitudinally, and in depth, which was 24in., gave no shrinkage at all. This was a casting with flanges all round it, so that there was no part of the results due to straining. They were attributable to careful feeding alone. In conclusion, Mr. Walker remarked that this subject naturally divided itself into two parts—First, the nature and condition of shrinkage proper; and, second, the effect of unequal contraction in ill-proportioned castings. The first of these he had hoped to deal with fully that evening, but found that want of time prevented it. At a future period it should be resumed, and then it was to be hoped the whole subject might be more satisfactorily developed.

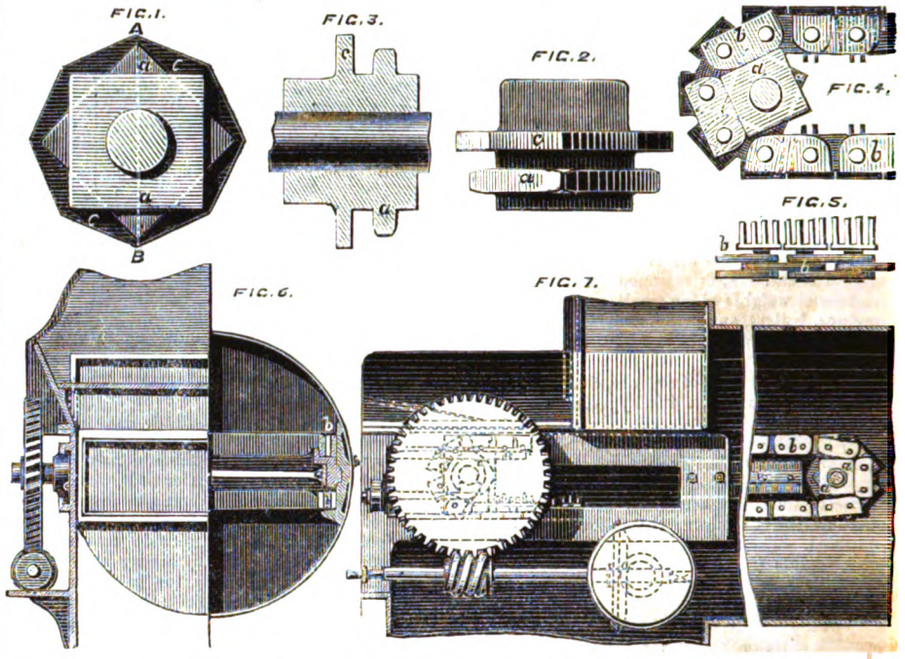
THE STEAM MAN.

THE advent of a steam man in New York has added another to the novelties in that sensational city. The steam man is a new locomotive for common roads, invented at Newark, New Jersey, and is intended to walk or run about as a man would and draw carriages after it. According to the "Times," the particular steam man who is now astonishing New York is a person of commanding presence, 7ft. 9in. high, weighing 500lb., measuring 200in. round the waist, and decidedly stout in general appearance. His legs are made up of iron cranks, screws, springs, and other intricate machinery, and have a motion similar to the human extremities; his stomach is a furnace, his chest a boiler, and the smoke passes up through his head and towering hat. He bears a good-humoured countenance, with a handsome moustache, while in his mouth is fixed a steam-whistle, and a gauge and a safety valve ornament the back of his head. He is the figure head, as it were, of a phæton, capable of accommodating four persons, together with a tank to carry water and a box for coals. The driving machinery is at his back, and within easy grasp of the persons on the phæton, who can start, stop, carve, go fast or go slow at their pleasure. The inventor claims that 20lb. of steam will set him in motion, and 20 cents worth of coal work him a day. He also claims that he can accomplish a mile in two minutes on a level course, and can step over all obstructions not higher than a foot. His engine is 4-horse power, and the man takes 30in. in at each stride. This steam man, however, has not yet exhibited himself in public, though he is promised a race down Broadway when the weather is fit, and meanwhile his owner offers to manufacture steam men at short notice for 300 dollars apiece. Whether they prove of any practical good or not, the one at New York is unquestionably a great curiosity, and when we have said this we think we have said all that can be said.

THE public accounts for the financial year 1866-67 show that from Hyde Park £477 was received in contributions for keys; from Kensington Gardens £140 for grazing rent; from the Green Park 31s. 6d. for keys; from St. James's Park £83 for grazing rent, £220 for rent of ground, and 22s. by sale of unclaimed articles found in the Park—an item that does not appear in the accounts of other parks; from the Regent's Park £349 for keys, £410 for grazing rent, and £336 for rent of ground. £452 was received in fees on warrants for venison supplied from the Royal parks, and proceeds of sale of skins, &c., of deer; and £184 was paid to the keeper of Bushey Park in fees for deer killed in the park.

IMPROVED PULLEY AND CHAIN GEARING.

BY MR. T. WRIGLEY.



IMPROVED PULLEY AND CHAIN GEARING.

WE illustrate in the annexed engraving a novel description of pulley, which is the patented invention of Mr. Thomas Wrigley, of Todmorden. In combination with a chain specially designed it may be applied to many purposes where lifting, pulling, the moving of firebars in furnaces, or the driving of machinery, are effected by means of chains and pulleys; in fact, wherever the pulley is required to take firm hold on the chain to effect its positive and certain action without slipping. The principle consists in constructing the pulley so that the chain shall have several holds on the surface, the number of which may be increased or diminished according to the strength of links or width of chain and the weight to be moved.

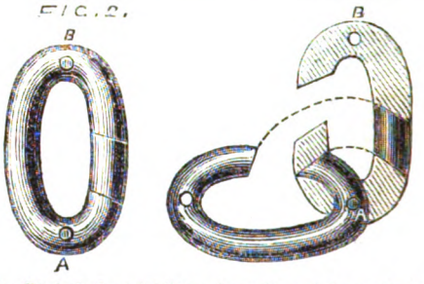
As an example of the invention, we have shown it as applied to the moving of the transverse gratebars of a furnace. Fig. 1 represents an end view of the pulley which contains plates or surfaces of two forms, one set, *a a*, being square for the bearing of the links *b b* (which are dotted as in position), and the end plate *c* being octagonal for the bearing of the bars when applied to the firebars of furnaces, because the width of two bars being equal to the length of one link the bars require more faces to bear upon than the links. Fig. 2 is a plan view, and fig. 3 a vertical section of the pulley taken through the line A B, and fig. 4 is an end elevation showing the application of the pulley and chain to the transverse furnace bars; fig. 5 is a plan view of the same, which in this instance shows the pins or studs on the ends of the bars as forming part of the chain, but in ordinary chains applied to other purposes the links are jointed together by pins as usual.

It will be seen that the plates are so arranged that the points or angles of one plate project above the flat surface of the next, and so on alternately, which is an important portion of the invention, as the projecting points or angles form guides or lateral supports for the links, and the pressure of the chain is dispersed over a greater surface, and presses from several points arranged around and towards the centre shaft instead of the strain being in one line from the outermost point diametrically to the centre, by which improved arrangement the turning of the pulley requires less power, the friction being more evenly distributed. The progress of the chain is effected by the angles of the plates entering the apertures between the joints of the links in combination with the bearing of the links on the flat surfaces of the pulley, and whatever may be connected with such chain will receive motion and power therefrom.

Figs. 6 and 7 show the application of this invention to the firebars in the furnaces, at the Robinwood Mills, Todmorden, owned by Messrs. Fielden Bros., and of which works Mr. Wrigley is the manager. The apparatus has been working for some months with perfect satisfaction. The mechanical details are well carried out, and not one instance of slipping has occurred. The furnace is at once self-feeding and smokeless, and the apparatus requires a remarkably small amount of power to keep it in motion.

LINKS FOR TRACTION AND SUSPENSION CHAINS.

TO unite the two extremities of chains to those of others, in order to constitute an "endless arrangement," and to replace a fractured link, are circumstances of continual occurrence where machinery is employed. Various methods are in use, but it is questionable whether they afford the solidity and strength desirable. Some time ago M. Crauzbaur, of New York, patented a form of link calculated to give the maximum amount of resistance to a change of form, while undergoing a strain, and also presenting a complete security against opening. When once closed they cannot be caused to open so as to allow the neighbouring links to be disunited. The annexed cuts, which we extract from our contemporary



"Le Génie Industriel," nearly suffice of themselves to render their action clear and intelligible. Fig. 1 represents the link open, and fig. 2, when it is closed. It is composed of two parts absolutely identical, whether the link itself be made of round or flat iron. In each part a piece is cut out to receive the corresponding projection upon its neighbour, the "fit" being made with great accuracy and precision. A rivet is inserted at A, upon which the two halves pivot, and when they are closed, as shown in fig. 2, the union is permanently effected by means of a bolt, rivet, or screw inserted at B. It will be seen that the principle can be applied to a link of any form, whether simple or complicated.

NAUTICAL TERMS.

WE lately gave our readers a couple of disquisitions on scientific nomenclature, and thought we had exhausted the subject. The following playful effusion, however, would indicate that we have not. It is from a reefer in the American navy to the Hon. Matthew Walker, and we reproduce it from the United States "Army and Navy Journal." The reefer appears to be considerably bothered as

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to the reason for certain terms and expressions which are generally used on ship-board. Old salts will laugh at the writer's blunders, but landsmen may learn something by reading this effusion. The letter is dated on board ship, February 18, 1868, and, after the usual preliminary greetings, goes on to say:—

To you and Mr. Half-Hitch I am indebted for many useful ideas, which my old grandmother learned from her aunt. And as I have seen service both with the lay and against it, and, besides, knew when I used to sail kites (I was a kite-sailor then) how to tie two strings together, to you two gentlemen I say that I am deeply indebted; and also to other authors on seamanship. All these authors speak of ear-rings and thimbles, hence we must conclude that a ship has ears as well as fingers, but I must confess that I never saw them. The boatswain told me that the topsails had ear-rings, and I asked him if they had any ears; he told me I was a fool, and that was all the satisfaction I could get.

Well, now, there is another curious thing that I would like to mention: this ship has a fore-yard and no back-yard. Then, again, the boatswain calls a great big piece of rope a sheet, although my old grandmother has often told me that a sheet was a piece of muslin, to put over a bed. Again, there is another singular fashion that they have on board ship. I asked the boatswain what some large tarry ropes were called; he answered shrouds. Now, when my old aunt died, they put her in a white night-gown, which my mother called a shroud, and I think that she was right. I asked him the reason for giving them this queer name; he answered, "Don't you see that they go around the dead-eyes?"

Another thing that I never could understand before I went to sea, was that a little stick was called a batten; but understood it when I arrived in Brest; there I unintentionaliy offended a Frenchman, by telling him in excellent French that, "*Votre ami a perdu son vic.*" He did not understand English, or French either, for he flew into a great passion, and said in broken English, "I shall break ze head *avec mon baton.*" And as good as his word he rapped me over the skull with his cane. So I concluded that batten must mean stick or cane. So we should then in propriety give the order to cane or stick down the hatches, which order I have no doubt many of our reefers would be willing to obey in bad weather. It seems to me that this order should never be given to the carpenter, but to the surgeon, purser, marine officer, and others who have the happy faculty of sticking down the hatches whenever bad weather comes on. The chaplain might also be considered a candidate for this honour.

The most curious fellow we have on board is the master. He takes the lead in finding bottom, and he is continually feeling for it. I cannot say much for his manners, for he has always such a stern way on him when he gets it. As for the gunner, I think it doubtful whether he is the most modest or immodest man on board; he is certainly very inconsistent, for his guns have aprons and breeches and locks, and he very often lets down their breeches, takes off their aprons, and adjusts their locks in the most public manner. Should I ever get a chance I will read him a lecture on the breaches of modesty, who is generally represented as a woman in a long gown. I did not say frock, for sailors' frocks are generally short shirts, and I fear that I might be misunderstood, for if modesty should wear a sailor's frock, the artists would certainly have to give her a gunner's apron, which is warranted to be proof.

Whenever I read a book on seamanship I am obliged to consult my dictionary. I find often that they do not agree. For instance, a yeoman, according to the dictionary, is a countryman, a peasant, while, according to all books on seamanship, he takes care of the ship's stores, the rope, tar, nails, &c., &c. The carpenter deals in fishes, and the boatswain deals in cats, fishes, tar, and has but little to do with the boats. The carpenter and boatswain mess together, and such a mess they make of it, with their cats and fishes, I would defy any cannibal to eat them; for, if he should eat the boatswain's cat, he would certainly be bound up; and the carpenter's fish is entirely indigestible; it does not look like a fish at all, and I don't see how any one could call it so. I sent a specimen of one of his fishes to a celebrated *savant*, to be analyzed, and he sent back the following formulæ: C24, H20, O20, K, E. These symbols were examined by the boatswain, and pronounced correct; but a dispute arose atwixt the sailmaker and carpenter about it. The carpenter contended that the *savant* intended to spell chock, and he had made a *lapsis plumæ*. But the sailmaker rejoined that the *savant* had made no mistake at all, but he meant to say that if any one should eat the carpenter's fish, he would choke. But the boatswain settled the difficulty by putting a stop to it, I mean to the symbol, after the H. Thus: C H. OKE. "It is very clear," said he, "that your fish was made out of oak, and the manner of spelling it don't make any difference, for you know that all these chemists are Dutchmen or Frenchmen, and it could not be expected that they should know how to spell." But the carpenter asked him about the meaning of the C, H. The boatswain replied with an oath, "Why, you fool, don't you know that your fishes go under the cat-harpins, and what else can it mean but that?"

The master suggested that it might mean Robar Carolus, out of which the southern cross was made; but they all sneered at him and took the boatswain's explanation as the best. The surgeon offered one, which, were it not for its absurdity, I would not mention it: he said that C24 stood for carbon, 24 atoms; H20 for hydrogen, 20 atoms; O20 for oxygen, 20 atoms; K for kallium, or potassium; E for euphion, or wood-tar. Now the sailmaker was the only well-read man in the mess, for he had red hair and whiskers, and his hands were red also from the constant use of keel, which he stated was the same thing as kallium. So, having obtained an old edition of "Silliman's Chemistry," he pored over it, until he found, on page 445, the symbols, C34, H82, O4, and he was horrified to find that it expressed human fat. The K he found to be potash, on page 414; and he found E to mean tar. He expressed himself astonished, and the conclusion that he arrived at was that the fish of the carpenter (the carpenter was the caterer of the mess) was human fat, and that the potash got into the dish at the galley-fire, and the tar from the boatswain's hands; then, in a furious passion, he pronounced the boatswain and carpenter as bloody-minded cannibals, and then left the mess in disgust, as he said that he was not fond of human flesh; he might eat cats and dogs, but would have nothing to do with their C, H, O, K, E; he wished he might be blessed if he did.

I once heard the boatswain telling the first lieutenant about the main buntlines; he said that they rove through a shoe-block. I asked him if a last had a hole in it. He replied, "What last are you asking about?" I replied, "that he had just told the first lieutenant that the buntlines were rove through a double block at the masthead, then through the shoe-block, and again through the double block, and that the last was split; I suppose that you meant the shoe-block, as it is the last where I came from. But your grammar was bad if you meant the shoe-block, as the last block you mentioned was the double block." His reply showed that his education had not been neglected with respect to shoes, for he said, "Curse your last and sole too; I'm no shoemaker." But his very language betrayed him to be such. The boatswain uses me very disrespectfully; he never calls me by my proper name; he always calls me Bob Stay; he had better keep his tongue.—I remain, respectfully, your obedient servant, ROBERT STAY, Reefer, U.S.N.

THE PORTRAITS OF SIR ISAAC NEWTON.

ABOUT a year and a-half since, Doctor Crompton read a paper before the Literary and Philosophical Society upon the portraits of Sir Isaac Newton. The Doctor recently informed the Society that while preparing his essay for publication, he had opened up fresh sources of information, and became possessed of facts of considerable interest respecting the portraits of Newton. He had examined about twenty portraits of the great philosopher, all of which were considered to be originals, and most of which were undoubtedly painted a long time ago; but he had seen no portrait which, in his opinion, was of equal importance and interest with the Kneller Newton of 1689, to which he last year directed the attention of the Society, as by far the most valuable portrait of the great philosopher in existence, and of which he exhibited an admirable engraving by Mr. Oldham Barlow. His extended inquiries into the subject of the portraits of Newton had led him to the conclusion that there are several (if not many) which pass current as portraits of him which are most decidedly representations of other persons. In the National Portrait Exhibition at Kensington of the present year there were four portraits of Newton, two of which he feels sure have no real claim to be regarded as authentic or genuine. These two are pictures contributed by the Earl of Dartrey and by the Marquis of Exeter. The former purports to be a portrait of Newton when he was a Bachelor of Arts, and to be painted by Lely. It represents a young man with his hand resting on a globe; and there is an engraving of the picture, done many years back, but he had no hesitation in saying that the picture had no right to be considered a portrait of Newton. The features were not Newton's, and it was most improbable that the poor Trinity College Sizar would, when a Bachelor of Arts (that is, between January, 1665, and July 7, 1668), have cared, or, if he had cared, could have had the means to obtain a portrait of himself. He apprehended that because the portrait represented a young man with his hand on a globe, some imaginative person had supposed that it must be a representation of the great philosopher who had explained the system of the universe. But this portrait represents one of the poorest specimens of humanity; and certainly not a Newton, but rather a Simple Simon.

The Marquis of Exeter's picture has hardly any greater claim to be regarded as a Newton. It represented a man with a bald head, but there was the clearest evidence that Newton was not bald.* The two Vanderbank portraits representing him the year before his death without his wig, show that he had a beautiful head of silver white hair. There is another portrait of Newton by Thornhill, taken at an earlier period, which represents him without his wig, but with short white hair and no trace of baldness. The Portsmouth Kneller of 1689, which represents him when he was forty-seven years old, shows him without a wig and with abundant grey hair. This is a sufficient ground for rejecting this picture; but no one who has studied the portraits of Newton could be brought to believe that this is a representation of the great philosopher. Last year, when reading his paper, Doctor Crompton remarked that he had been unable to discover where the original Kneller of Newton, engraved by Houbraken, was to be found. He then pointed out that in some impressions of the Houbraken print it was stated to be in the possession of Mr. Conduit. Dr. Crompton went to the Earl of Portsmouth's seat at Hurstbourne Park, and there found the original picture. It is dated 1702, and signed by Kneller. The Earl of Portsmouth, Newton's collateral descendant, therefore possesses the two most important portraits of Newton. This portrait of Newton was engraved also by Smith, about 1712.

A replica, if not an early copy, without any name of an artist upon it, is in possession of the Duke of Devonshire, at Holkar. His grace informed the Doctor that he could not positively trace its coming into the possession of his family, but he conjectured that it might have been at Holkar before the marriage of one of the Lowthers with Lady Mary Cavendish, through whom this Holkar property passed to the Cavendishes. There is an exact replica or early copy of the Portsmouth Kneller of 1689 at Lord Galway's, except in not having the name of Newton or of Kneller upon it, which Dr. Crompton has examined, and which, in an old catalogue of the pictures, is said to be painted by Bond. Dr. Crompton said that he had examined the three oil paintings of Newton in the Royal Society's collection; also the Kneller at Hampton Court, which is dated 1689, and differs from the Portsmouth Kneller of 1689 only in the position of the hands; also all the portraits of Newton belonging to Trinity College, Cambridge; the Indian ink drawing of Newton in the Pepysian Library at Magdalen College; and a portrait at Mrs. Miles', at Firbeck Hall, Yorkshire, which resembles very much the Egremont Newton by Kneller, engraved as a frontispiece to Sir David Brewster's first "Life of Newton," published in the "Family Library." Dr. Crompton exhibited this edition of Brewster's life, as well as the larger one in two vols. In the text of both the engravings, which differ very greatly from each other, are said to be from a picture in the possession of Lord Egremont. Sir David Brewster was unable to explain how it was that two engravings from distinct and different portraits should thus happen to be spoken of in the text, except that his publisher must have selected the second portrait and got it engraved. It is, the Doctor thinks, unmistakably taken from Smith's print of 1712 or an early impression of Houbraken's engraving. The portrait prefixed to the small "Life of Newton" is the same as that engraved in Lodge's portraits. At present, Dr. Crompton is unacquainted with the historical evidence regarding the genuineness of this portrait. It is signed by Knoller, and dated 1716; but Dr. Crompton has not yet seen it, nor one in the possession of Mr. Turner, of Stoke Ashford, near Grantham.

In Lord Portsmouth's collection at Hurstbourne, besides three genuine and authentic portraits of Newton, there is a fourth picture with the name of Newton painted upon it. It was described to Dr. Crompton by a gentleman who had had an opportunity of a very close examination of it, as the earliest and most important portrait of the great philosopher. But Dr. Crompton found neither date nor artist's name upon it, and the picture, which is mounted upon panel, has a crest in red wax behind it, which is not the crest of the Ports-

* Mr. Conduit, Newton's nephew by marriage, when describing Newton's personal appearance, says, "With a fine head of hair as white as silver, without any baldness, and when his peruke was off, was a venerable sight."—Brewster's "Life of Newton," 1855, vol. ii., p. 413.

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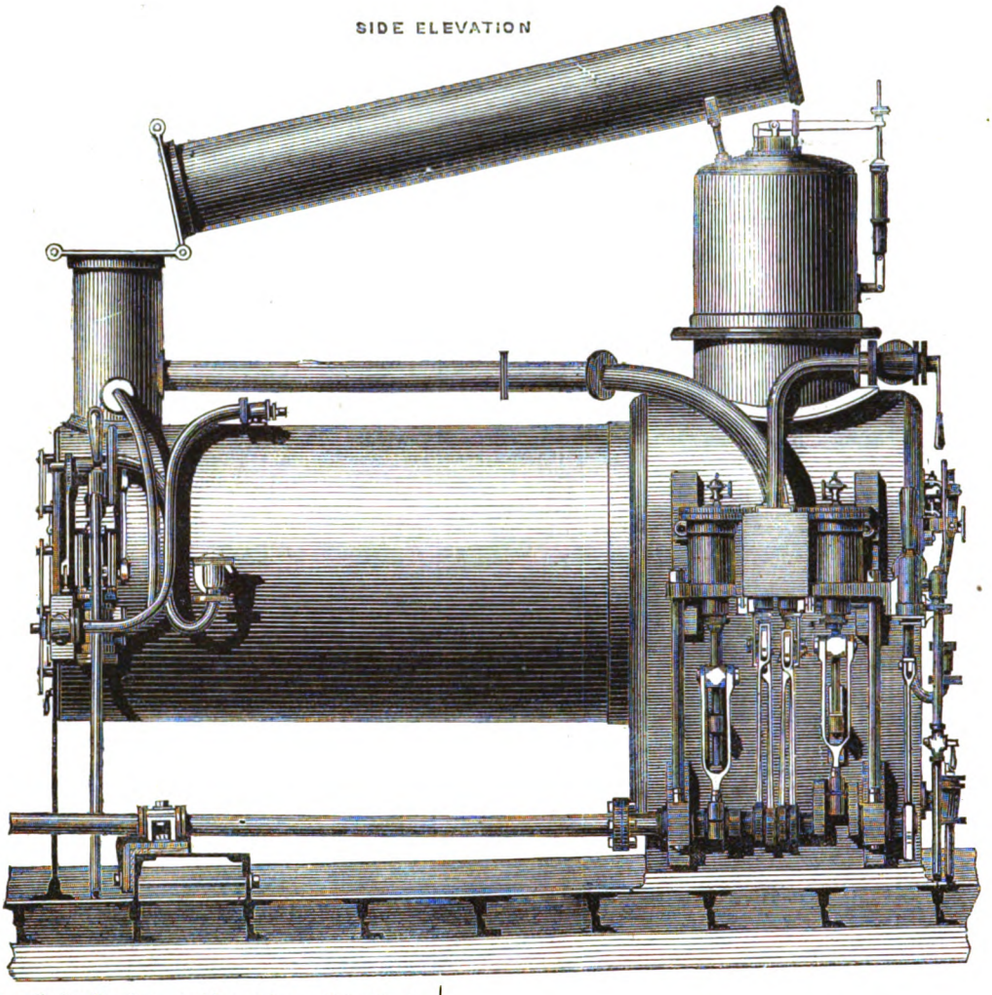
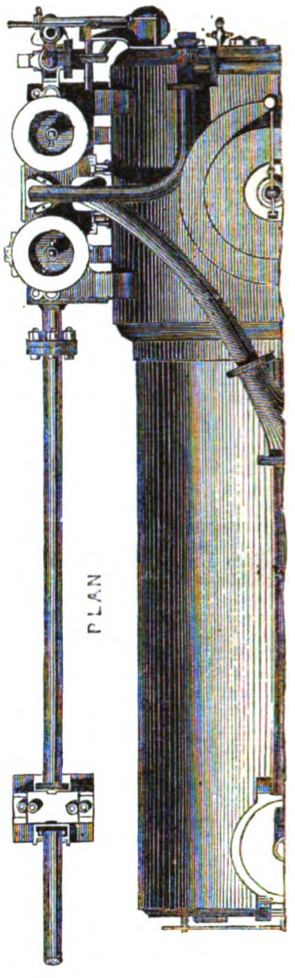
ENGINES OF THE "GREAT EASTERN'S" STEAM LAUNCH.

BY MESSRS. FORRESTER AND CO.

SIDE ELEVATION



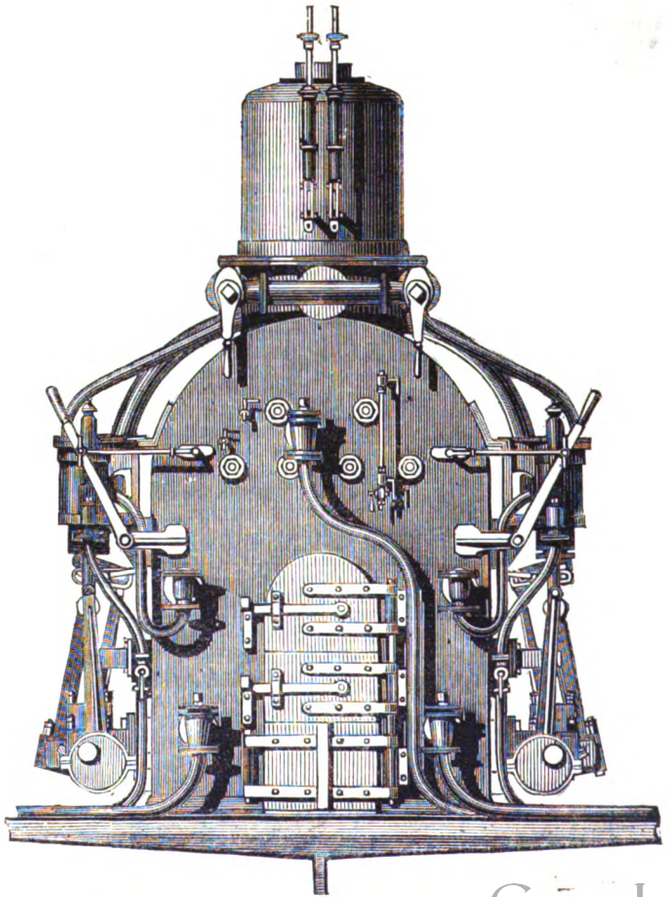


mouth family, but could not be sufficiently determined what it was for want of a magnifying glass. The history of this picture will be investigated further; though it is certain that it cannot be a portrait of Newton, for the features are not his, and the eyes are brown, while Newton's were bluish grey. It is most earnestly to be desired that all the portraits of Newton might be collected together at Kensington for comparison with each other, and that the portraits of other great men (where there are several) should be thus exhibited in juxtaposition. It would probably then be evident that there exist many spurious ones, and an opportunity would be thus afforded of determining which are the best as well as the true.

ENGINES OF THE "GREAT EASTERN'S" STEAM LAUNCH.

THE above illustrations represent the engines of the steel steam launch which was built and engined for the "Great Eastern" by Messrs. Forrester and Co., of Liverpool. The boiler is of the locomotive type, the barrel being 2ft. 6in. in diameter and 5ft. long, including the smokebox. The front of the boiler is fitted with two firedoors, for the purpose of insuring the least amount of air passing into the firebox during the operation of stoking; the door below admits air to the grate. The bottom blow-out cocks and pipes are at each side of the doors, and the surface blow-off cock directly over the upper door, and on each side of the cock are the gauge cocks and glasses. The boiler, it will be noticed, is stayed longitudinally by six stays suitably disposed. The firebox is fitted with a dome 16in. in diameter and 2ft. high, and contains a trap to prevent the water, when priming occurs, from entering the steam pipes leading to the cylinders. Two safety valves are attached to the dome, each being compressed by a spring to a maximum pressure of 60lb. on the square inch. The length of the firegrate is 2ft., and the width 2ft. 6in.; the tubes are fifty-one in number, each being 4ft. long and $1\frac{3}{4}$in. external

END ELEVATION



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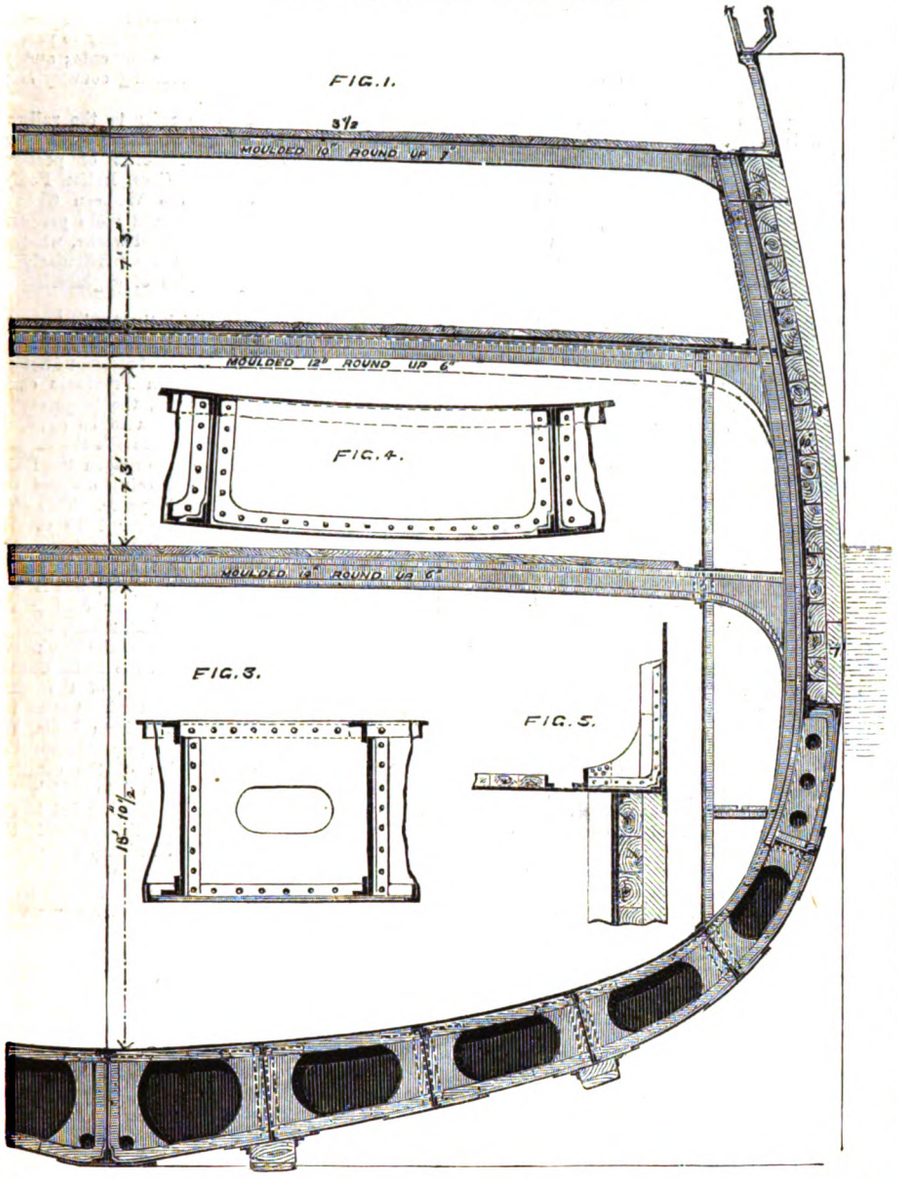
THE IRON CLAD FRIGATE "WILHELM I."

DESIGNED BY MR. E. J. REED.



diameter. The proportions of the heating surfaces are—grate, 5 square feet; firebox, 20 square feet; and the tubes, 93 square feet. The diameter of the chimney is 9in., and the height from the smokebox 7ft.

The engines are of the direct-acting type. The cylinders, each 5in. in diameter, with a 6-inch stroke of piston, are secured to the boiler at the firebox end by wrought-iron brackets, the latter being placed there after being riveted to the boilers. The slide valves are single ported, having a lap of 5-16in., and the width of the opening attained in the cylinder ports for the admission of the steam is ¼in., the width of the supply ports being 7-16in. The steam cocks are attached to the dome, and the starting gear is at the boiler front. The connecting rods, each 15¼in. between centres, are forked, the piston rods being 1in. in diameter, and guided by eye brackets below the connecting pin. The slide valves are between the cylinders; the link motion and eccentrics are, therefore, between the inner cranks. The crank shaft is supported beyond each outer crank by the capped ends of the wrought-iron columns, the upper ends of which are fixed to the cylinders, and the lower ends bolted to the firebox. Near the smokebox end of the boiler is the thrust block, of the ordinary kind, secured by bolts, nuts, and caps. The thrust of the screw is resisted by the foot of the block being secured at right angles to the line of strain. Each pair of engines is fitted with a feed pump, worked by an eccentric on the extremity of the shaft, the stroke of the plunger being 2¾in., and the diameter 1⅜in. A donkey engine is also supplied, fixed to the side of the smokebox. The steam cylinder is 3in. in diameter, and the plunger of the pump 1½in.; the length of the stroke being 3in.; the donkey can also be worked by hand. The screw propellers are four-bladed, 3ft. diameter; pitch, 3ft. 6in. The propeller, shafts, and tubes are of gun-metal, and gun-metal bosses are riveted in with the plates of the launch for supporting the inner ends of the stern tubes, the outer ends being supported by wrought-iron brackets close to the bosses of the screws. The hull and frames are built entirely of steel; the length is 50ft., with a beam of 10ft. In the above engines Messrs. Forrester have supplied a good example of marine engineering on a small scale.

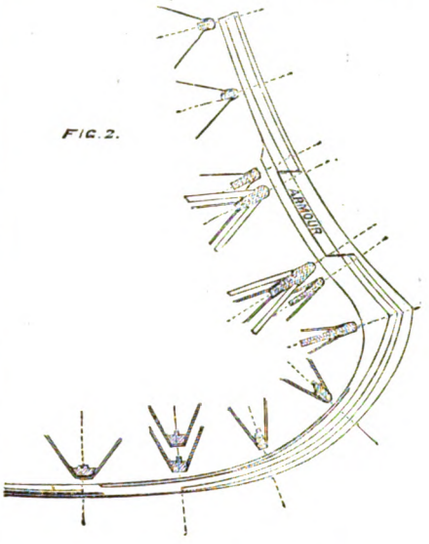
THE IRON-CLAD FRIGATE "WILHELM I."

IN our issue of the 31st of January last we promised our readers a detailed description of the iron-clad frigate "Wilhelm I.," now building by the Thames Ironworks Company for the Prussian Government, and we now fulfil that promise. The ship was originally designed for the Turkish Government, at the request of the Sultan, and with the sanction of the Lords of the Admiralty, by Mr. E. J. Reed, Chief Constructor of the Navy. She was, however, as we previously stated, subsequently purchased by the Prussian Government. The construction of the ship will be clearly understood by the following description, with the aid of the accompanying engravings. The principal dimensions of this fine frigate are as follows:—

	Feet	in.
Length between perpendiculars ...	355	10
„ of keel for tonnage	310	1⅛
Breadth, extreme	60	0
„ for tonnage.....	60	0
Depth in hold	18	10½

Burthen in tons, O.M., 5,938 71-94ths.

The vessel is built of iron, with a ram bow, and a protected battery extending for a length of 232ft. on the main deck, in which she can fight 28 7-ton guns, with the port sills 10ft. above the water. At the stern on the main deck she has a 7-ton gun protected by armour, and which can fire right astern in a line with the keel. There is an armour-plated bulkhead at the fore end of the battery extending right across the ship, and from the lower deck through the upper deck to the forecastle, protecting two 7-ton guns on the upper deck. Each of these guns can be worked at two ports, so as to fire right ahead and 20deg. abaft the beam. The armour-plated bulkhead at the after end of the battery is cut off by the upper deck, but two half towers, one on each side of the ship, are built for protecting two 7-ton guns; each of these guns work at two ports, from one of which the guns can be fired at an angle of 15deg. with the keel, and from the other at 30deg. forward training. The half towers project beyond the ship's side about 4ft., which does away with the necessity of "hancing" the ship's side. The guns forward fire over the upper deck, there being no topsides above it to interfere with them. The hull of the ship is protected by the armour, &c., on the sides of the battery, the armour extending from 6ft. 8in. below the water up to the upper



deck, the lower strake being 7in., and all the others 8in. thick, tapering to 5in. and 6in. at the extremities of the ship. The armour forward of the battery only extends to the lower deck, which is about 2ft. above the water, very strongly built, and plated over with 2in. iron; abaft the battery the armour extends to the main deck and right aft up to the upper deck to protect the gun. The ship has a single screw and balanced rudder, which is well protected at its head by the armour on the stern. The draught of water forward is 24ft. 6in. and 26ft. 6in. aft. The engines, which are being constructed by Messrs. Maudslay, Sons, and Field, are of 1,150 nominal horse-power, and capable of working up to six times that power, and calculated to drive the vessel at a speed of from 14½ to 15 knots per hour. She is to be ship rigged, and fitted with three iron lower masts, with steel topmasts and yards, and her bowsprit is fitted for running in when used as a ram. The men will be berthed on the main deck inside the battery, and the officers on the same deck, but abaft, in the unprotected part of the vessel.

She is constructed with an inner skin extending about two-thirds the length of the ship, and up to the main deck on each side. The space between the two skins is divided longitudinally by the vertical watertight keel, and by two watertight longitudinal frames, one on each side at the foot of the wing passage bulkhead, and transversely about every 20ft., giving great safety in case of the outer skin being pierced, as the water could only fill the compartment injured. Before and abaft this inner bottom the ship is formed into sections by horizontal watertight iron flats and transverse frames, with watertight trunks extending up to

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the main deck, conducing greatly to the safety of the ship. The method of construction is shown in fig. 1. The keel is formed of two flat keel plates, the inner one 1in. and the outer one 1¼in. thick, of a vertical keel plate 54in. deep and ⅞in. thick, extending from the stem to the sternpost, and firmly secured to them; it is connected to the flat keel plates by double continuous angle irons 6in. × 6in. × 1in., and on its upper edge short angle irons are worked between the frames, the whole well caulked and making a watertight longitudinal division through the double bottom. The stem and sternpost are solid forgings, to which the vertical flat keel plates and continuous angle irons are scarphed. The construction of the stem will be clearly seen from the profile view and sections given in fig. 2; it is a solid forging sufficiently large for the armour, backing, plating behind armour, and the two thicknesses of outside plating forward to rabbet into and fasten to it. All these plates being butted square in the stem form strong supports to it in case of the vessel being used as a ram.

The longitudinal frames, of which there are six on each side of the keel, in this ship extend right forward to the stem; they are formed of plates varying in depth from 22in. to 46in., of continuous angle irons on their outer edges, and short angle irons on their inner edges; before and abaft the double bottom the longitudinals are reduced in depth, and the angle irons on their inner edges are also continuous; the three longitudinals out from the keel are tightened by holes taken out of them (see fig. 4) so as not to reduce their sectional strength. No. 3 longitudinal, forming the foot of the wing passage bulkhead, is made watertight throughout the double bottom; the upper or No. 1 longitudinal forms the recess for armour and backing; the longitudinals and the continuous angle irons are well butt strapped, and they are worked on outside strakes of plating, care being taken that they shall not cross the joint, and their surfaces are twisted so as to always stand square to the section of the ship. The transverse frames in double bottom are 4ft. apart, and are composed, as shown in fig. 1, of continuous angle irons on the inner edges, which extend across the keel, and are scarphed to the frames behind the armour of short angle irons on their outer edges to which the outside plating is riveted, and of bracket plates which, with short angle irons on the longitudinals, are all riveted together. At every 20ft. solid plates are substituted for the bracket plates, made watertight with staple angle iron (see fig. 4) and with the keel, and No. 3 longitudinal, dividing the double bottom into watertight compartments; before and abaft the double bottom the transverse frames are made of plates, tightened, instead of bracket plates. Between the recess plate and No. 2 longitudinal, plates with holes to tighten them are worked, the better to sustain the immense weight of armour. The transverse frames behind the armour are 2ft. apart, formed of angle iron 10in. × 3½in. × ½in., with double angle irons on its outer edge 3½in. × 3½in. × ⅝in.; of these frames every alternate one is scarphed at each side of the longitudinal at the foot of the wing passage, to the continuous angle irons before alluded to, the intermediate ones being ended at this longitudinal. The framing above the armour is formed of plates 7in. × 7-16in. with a single angle iron on the outer edge 4in. × 3½in. × 9-16in.; these frames are worked directly over the alternate frames behind the armour, being 4ft. apart, and formed, as shown in fig. 5; between these intermediate frames, with feet riveted to the deck plating, are worked.

The outside bottom plating is worked, as shown in fig. 1, with alternate raised and sunken strakes; the edges are double, and the butts treble chain riveted. The plating varies from 1in. to ¾in. Forward it is doubled and rabbeted into the stem, and aft the plates are 1in. thick and chased into each other, forming a flush surface. The plating above the armour is ½in. thick, flush jointed, with edge strips and butt straps on the inside. Behind the armour two thicknesses of plating, each ¾in. thick, are worked, the inner having butt straps, and the outer edge strips. The joints of the outer thickness are arranged to take the fastenings of the longitudinals, of which there are two to each strake of armour. Thus the target forming the ship's side is made up of armour 8in. thick, 10in. teak backing, longitudinal girders, two thicknesses of ¾in. plating, and frames 2ft. apart, composed of an angle iron, 10in. × 3½in. × ½in, and two of 3½in. × 3½in. × ⅝in. The upper deck is formed of Butterly beams 10in. deep, spaced 4ft. apart, entirely covered with ½in. steel plates for the length of the battery, before and abaft it with steel plates ½in. thick, the whole being covered with 3½in. Dantzic deals. The main deck is formed of Butterly beams 12in. deep, one at each frame. The entire surface abaft the battery, the deck within the battery from about 7ft. out of the middle line to the sides, and before the battery, is covered with ½in. iron, worked as well as on the upper deck, to the outside plating, and secured with staple angle irons, the whole being covered with 4in. Dantzic oak.

The lower deck, the foreside of the battery, in consequence of the armour not running above it, and being very near the water, is very strongly built. It is formed of beams 10in. deep, filled in solid between with teak, and covered with plating 2in. thick. From the foremost bulkhead of the battery to the stern the beams are 14in. deep, formed of plates and angle irons, upon which is worked a stringer plate running through the wing passage bulkhead, and forming the lower side of a gutter. Forward it is scarphed to the 2in. plating, and the whole is covered with Dantzic deals 3½in. thick. The decks are firmly supported by hollow pillars, with solid heads and heels, those in the hold being 7in. diameter and ½in. thick. There are nine transverse watertight bulkheads, enclosing engine and boiler rooms, magazines, double bottom, &c., built of ½in. plates, with angle and T-iron stiffeners. The ship is well ventilated, drained, and fitted with sluice valves to all watertight compartments. The vessel is now fast approaching completion, and will be a most formidable ship of war.

SOCIETY OF ENGINEERS.

(Continued from page 221).

THE general substitutes for piles in India are well or block foundations, which have been in use for very many years; they are peculiarly adapted to the deep sandy beds of Indian rivers, and are extensively used, both for bridges and buildings. A foundation may consist of a number of wells, sunk close together, and connected together afterwards; or, what is better, of a block or blocks of masonry made to the required shape, and having holes left of the same size as the wells; the latter, however, requires experienced workmen, and circular wells are, therefore, generally used. In both cases the method employed is the same. A wooden curb of hard wood, and of a thickness varying from 6in. to 18in., is made of the size of the well or block, and fixed in position on the river bed. On this about 4ft. in height of masonry is built; and, when dry, the sand inside is scooped out, so that the curb and masonry descend. Another 4ft. is then built, and again the same process is resorted to, and the curb again made to descend until any required depth is attained.

As long as the water in the interior can be kept out by pumping or lifting, the work proceeds quickly; but when the work has to proceed under water, it is very slow. A machine called a jham is used. This is, in fact, a huge hoe, with a straight socket cast on to it, to receive a pole, by which the jham, when lowered into the water, can be worked into the sand from a stage above. The pole is then withdrawn, and, by means of a windlass and rope, the jham, with its load of sand, is dragged up, emptied, and again sent down. In some parts of the country the well-sinkers dive every time, and work the jham into the sand by their hands; and divers have generally to be employed in case of any obstruction to the regular descent of the well. The wells or blocks are either driven down to the solid clay or rock, or they may be suspended, as it were, in the sand by mere friction. In Madras, when the wells are used to carry bridge piers, it is usual only to sink them about 6ft. in the sand, the piers being connected together both at their up and down stream ends by a line of wells, acting as curtain walls, to prevent a scour; a flooring of masonry or concrete is also added between the piers. The wells being finished, may be filled in with loose brick or kunkur, arched over, and connected together by arches, on the top of which the superstructure is built, or they may be filled with concrete from the bottom, thus forming a series of solid cylinders.

Since the establishment of roads, river communications have, in some sense, diminished in their importance, and the number of native boats is not so numerous as formerly. But with the introduction of steamers many rivers have required improvement, in order to render their channels free from obstructions. For this purpose river conservancy establishments are maintained, whose duties are to keep the river channels clear from sunken boats, and from trunks of trees which are often brought down by the monsoon rains, and fixing themselves in the bed of the river, obstruct navigation. In other rivers natural obstacles have to be overcome, as in the Godavery, in the course of which river three extensive barriers of rock obstruct the navigation in different parts of its course. In some cases it is necessary to protect the banks from the action of the currents; and in others to protect the surrounding country from inundations during freshes.

It is not intended here to refer to the railway system of India, on several of whose lines there are, however, to be found works of peculiar interest, especially where the Great Indian Peninsula Railway passes over the Western Ghauts. These, and such like works, would more properly come under the heading of special works, whereas the object of this paper is more particularly to describe the general principles of engineering in India.

Following the order in which the ancient works of native origin have been dealt with, the irrigation works of modern construction next command notice.

Soon after the North-Western Provinces came under the British Government, the propriety of restoring the Mogul canals began to be agitated. Attention, it is said, was first drawn to the subject by the offer of a Mr. Mercer to reopen the Delhi Canal at his own expense, on being secured the whole proceeds of it for twenty years. This offer was declined; and about the year 1810 several officers were deputed to survey and report upon the lines both east and west of the Jumna. The subject was, however, soon dropped; but it was resumed with characteristic vigour during the administration of the Marquis of Hastings, who, in 1817, appointed Lieutenant Blane, of the Engineers, to superintend the restoration of the Delhi Canal; and, in 1822, Lieutenant Debude, of the same corps, was ordered to survey and report upon the Doab Canal. Similarly, in Southern India, the works of the natives were followed up and improved upon soon after the acquisition of the country. The hopeless state of confusion into which the Tanjore Government had fallen having led to the cession of the country to the English, in 1801, the maintenance of the works of irrigation of course developed upon them from that time forward; and it was not long before certain defects, inherent to the system, began to exhibit themselves in a very clear and unpleasant manner.

The earlier works of this character, undertaken by the British in India, were, almost without exception, the restoration of ancient native works, and the defects originally existing in their construction were too often followed and imitated. On the Ganges Canal, for the first time, there was new ground to work upon, and Sir Proby Cautley and his able assistants successfully overcame the difficulties attending that vast project.

There are two distinct systems of canal irrigation carried out in India; that in the north differing in many respects from the plan pursued in the south, in consequence of the physical peculiarities of the two parts of the country. The southern, or Madras, system, which is confined chiefly to the deltas of the great rivers, such as the Godavery, Kistnah, &c., consists in throwing a dam, or anicut, across the bed of the river, to raise the surface level of the water, which is then conducted along canals, whose mouths are above the dams, to the lands requiring it. This system is necessarily confined to alluvial tracts which have been formed by deposits from rivers in a state of flood.

In the rivers of Northern India, although there is a certain width of low alluvial land on either side, it is only a narrow strip. The greater portion of the country consists of a high table land, occupying nearly the whole extent of the Doab, and in general rising very abruptly from the khadir, or low-lying land. In this case it is necessary to go back to a point high up in the river's course, whence the water can be brought on to the high land by excavation of a moderate depth, and by which sufficient command of level may be obtained to overflow the surface. For this purpose the water is generally, in Upper India, taken from the rivers, where they emerge from the mountains.

The simplest kinds of canals used in Upper India are those which are generally known as inundation canals, of which there are many existing along the borders of the Punjab rivers, by which the khadir, or low land, is irrigated. Cuts are made from the river inland, for a certain distance, and are then carried in a direction generally parallel to the fall of the country, or the course of the river. By these, when the latter is in flood, the autumn crop is watered; but in the cold season, when the river is low, the canals run dry, and

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the spring crop thus derives no benefit from them. During that time of year, therefore, labourers are employed to clear the canals of the silt which was left by the waters in their beds, or heaped up at their mouths. There are no works at the head of such canals to control the supply of water, for the course of the river is so uncertain, that it may completely desert the head, and the water may have to be brought in by a new mouth excavated for that season, which again may be useless in the next.

It would be impossible, without exceeding the limits to which a single paper should extend, to enter into the many details of construction of each class of work to which allusion has here been made. It is proposed, therefore, to conclude the present paper with a short statement of the expenditure incurred in India for public works, and the establishment by means of which such works are undertaken.

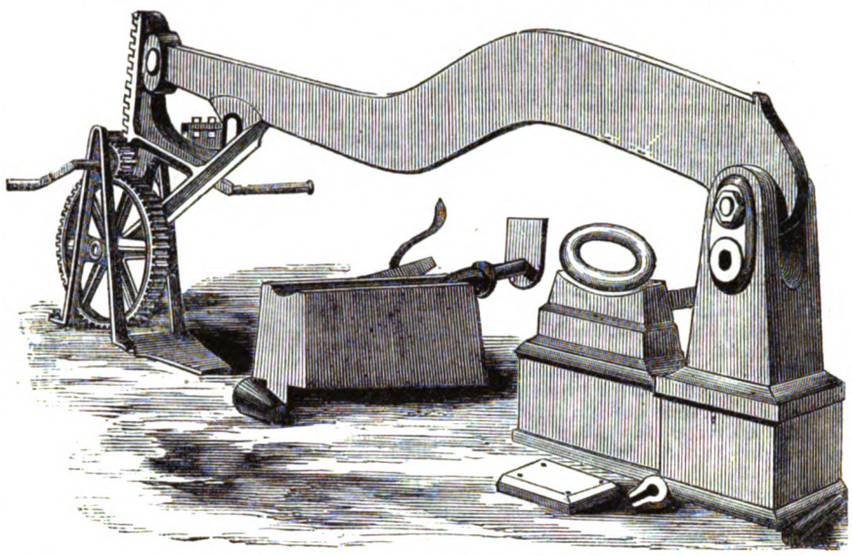
Notwithstanding what has been stated relative to the construction of a certain class of public works by the native rulers in former ages, it does not appear that any spirit of enterprise exists amongst the natives of the present day, and consequently the construction of remunerative works is but to a very limited extent promoted by means of private speculation: and with very few exceptions, the public works of the country are carried out through Government agency. The funds for this purpose are provided from the surplus revenues of the State, and the receipts from remunerative works are credited to the same account. Prior to the year 1853-54, the construction of public works devolved upon different departments, according to the character of the works executed, and, on this account it would be somewhat difficult to state with any degree of accuracy the precise sums so expended. In 1853-54, the total expenditure amounted to £2,586,531, and with the exception of the period during which the Indian mutiny almost put a stop to all public works, the annual expenditure on their account has gone on gradually increasing. In 1863-64 the sum expended was £4,459,264, and the estimated expenditure for 1867-68 was £6,637,500. With the increase of total expenditure, the item of establishment has, as might naturally be expected, also increased. Thus in 1853-54 the the sum entered under that head was £405,506, whilst in the estimate for 1867-68 it has been set down at £1,027,700, being 15·15 per cent. on the total estimated expenditure for the whole empire.

Prior to the constitution of a regular Public Works Department, the duties of superintending public works were entrusted to agencies, varying in the different presidencies. Thus in the Bengal Presidency the Military Board had the control of all public works, but it was also responsible for the Army Commissariat and Government Studs Departments, and for the Department of Ordnance, including the foundry, the gun-carriage agency, the powder mills, the arsenals, and the military equipments of the army, with the exception of clothing. In the Madras Presidency, public works were carried on under three distinct and independent departments. 1st. The Public Works Department of the Board of Revenue, which had the control of all irrigation works, of all civil buildings in the provinces, and all roads and bridges (not included in the "Trunk Roads" or in military cantonments), and all canals, &c. 2nd. The superintendent of roads, who had the sole superintendence of the great lines of communication classed under the term "Trunk Roads." It was his duty to propose all new roads on these lines, as well as all repairs and improvements, and he and his subordinates executed the greater part of the work. And, 3rd. The Military Board, to whom was entrusted the construction and repair of fortifications; of all public buildings, both military and civil, at the presidency; the Government roads, and all bridges at the presidency; all military buildings and forts in the provinces; and roads, and bridges, &c., in military cantonments, as well as the roads, bridges, and civil buildings and works in the Saugor division. Besides, which, the work at the Paumbum Channel was under the sole superintendence of the chief engineer. And in the Bombay Presidency the control of works was vested in the Military Board and the Road and Trunk Department.

(To be continued).

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending March 21, was 3,720; total number since the opening of the museum, free daily (May 12, 1858), 1,264,042.

MACHINE USED IN IRON CABLE MANUFACTURE AT GUERIGNY.



MANUFACTURE OF IRON CABLES AT GUERIGNY.

IT has often been adduced as a proof of the different *regime* existing in our own country and that of France that the majority of the large manufactories and engineering works are in the hands and under the authority of the Government. Until very recently this was unquestionably the fact, but lately private enterprise and private capital have found there that scope previously either denied them or of which they failed to avail themselves. If we look, however, into the early history of many of the imperial establishments, as they are termed, we shall find that, as a rule, they were all founded by the energy and capital of private individuals. So long as the particular branch of industry carried on did not develope itself beyond certain limits the Government took but little notice of it; but no sooner had it arrived at a sufficient degree of importance to attract the attention, and probably the jealousy, of the State than it was at once annexed by the latter power. In modern times the desired acquisition was achieved by purchase; but the Government was not always so particular and considerate in its mode of proceeding. The present imperial establishment at Ruelle was seized, barely a hundred years ago, from the original proprietor, M. Montalembert, who for sixteen years afterwards received not the slightest compensation for the unwarrantable injury inflicted on him, and at the expiration of that term his just claims were but very reluctantly recognized and very incompletely satisfied. M. de la Chaussade, the original proprietor of the premises at Guérigny, met with better treatment than the former gentleman, for about the year 1780 the French Government bought the whole concern from him at a fair valuation for £120,000, and he retired into private life at Paris, where he died some years afterwards. We shall not follow the further development of these works, or the various ways in which they were submitted successively to the control of different departments of the State, for although the history is in itself interesting, yet the actual production of the workshops is that with which we are more immediately concerned. It was not until the year 1828, according to "Les Grandes Usines," that hempen cables gave way to those of iron, and necessitated in consequence the erection at Guérigny of premises specially adapted for their construction. They were built, and the manufacture of iron cables has been conducted ever since on an increasing scale. They are capable of turning out over thirty miles of chain cable in a year, and during the continuance of the Crimean war their production was upwards of fifty miles. About twenty-five years ago the imperial cables were tested competitively with those manufactured by private firms, and evinced so decided a superiority in strength and quality that the large mercantile companies petitioned the Minister for the Navy, in whose hands the works were then, to allow them to obtain their cables from the imperial establishment. An assent to this request entailed so heavy a tax upon the resources of the works that considerable enlargements and improvements had to be carried out to meet the new demand, and at present the workshops are furnished with all the modern machinery and mechanical appliances that science can devise and money procure.

Before passing on to the description of the manufacture of the cables, we will take a glance at that of the anchors, of which it appears there are no less than ninety-six different sizes, varying in weight from 12lb. to 5 tons, and suitable for the smallest craft as well as the most powerful armour-plate afloat. Since 1835 the anchors have been forged upon what is known as the Swedish plan, by welding the arms upon the shank, thus virtually making them consist of three distinct pieces—the two arms and the common shank. One advantage of this plan has been found to be in causing the iron to act more in the direction of the fibres, and also a fewer number of heatings is required than in the processes formerly employed, and the result of too many heatings is a deterioration in the quality of the material. The method of forming the arms, together with the flukes, is deserving of attention. A large fagot of bars, of uniform thickness but of different lengths, in order to cause a break in the joints, is welded together by a 12-ton steam hammer. It is afterwards worked into the shape of a triangle, with a projecting rib in the central portion, heated to a white heat, and submitted to the action of a die having the form of the arm required to be made. A few blows with the steam hammer and the thing is done. It only remains to weld on the shank and the anchor is complete. If the employment of a first-class description of iron is of paramount importance in the production of an anchor, it is not the less indispensable to that of the cable. That in use is procured from various firms, but for some years past the works at La Haute Marne have enjoyed almost a monopoly of the supply. Any iron that may be sent to the establishment is tested gratuitously, and the sender may compete for contract, provided it stands the test satisfactorily. In the first place it must have been produced from pigs made with charcoal, and every bar must be marked with the distinguishing mark of the firm producing it. Each separate bar is subjected to a searching scrutiny before it is permitted to undergo any actual testing operation, and if a flaw is discovered it is at once rejected. Again, a certain number of bars are selected and cut half through and the appearance of the section carefully examined. To test whether the iron is sufficiently soft and calculated to resist a shock it is submitted to a series of blows from a 25lb. hammer, and its elasticity is determined as follows:—The bar is put under a powerful hydraulic press and at the moment of fracture it should exhibit an elongation of 1-1800th of its original length, and the tensile strength must not be less than twenty tons to the square inch. These are termed the cold tests, and supposing them to be successfully undergone, the hot tests are commenced, and are thus conducted:—A right-angled bend is made in the bar, it is then straightened, bent again, re-straightened, and bent a third time, and the bar must not break until the operation is repeated a fourth time. Holes having a diameter equal to three-quarters of that of the

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bar are punched in it, while at a dull red heat, and no flaws or cracks must appear. To ascertain whether the iron possesses good welding properties, and that the grain suffers no injury, or the elasticity any diminution from the action of heat, a welded bar is tested by the hydraulic press, and it must give the same results as on the previous trial, When the bars have passed both the cold and fiery ordeal they are further subjected to the various processes they will have to encounter in the actual manufacture of the cables. They are tested in the shape of links, and four defective examples out of a hundred are sufficient to cause the iron to be rejected. Considering the severity of these tests it is not surprising that the iron supplied to the imperial premises costs £18 per ton.

The diameters of the cables increase by a regular difference of one-twelfth of an inch, from ¼in. to 2⅜in.; sometimes, but rarely, they reach the dimensions of 2⅞in. Bar and rod iron are both used in making the cables. They are first heated to nearly a white heat, then bent, re-heated, and cut by a blow of a hammer upon an anvil in a manner so that the two ends are bevelled off. The welding is performed by hand labour, and the workmen have a certain amount of work to get through daily. In welding the cables a small cylinder of iron called a stud is set in the link to prevent it from becoming flattened when under tension. By means of the lever represented in the cut the ring dilated by heat is compressed, and in contracting when cold it seizes the stud and fixes it immovably. It is then passed through a link previously made and the two ends welded together under the hammer. Each chain or separate portion of a cable is 100ft. in length, and is tested up to 20 tons per square inch of sectional area. After being examined link by link with respect to both their lengths and diameters, the chain is passed, and the year of its manufacture and its proper number marked on the two extreme links. A register is kept of these particulars, and also of the name of the foreman who superintended the welding, and who is still held responsible for any defect that may hereafter occur, and were it brought home to him, would lose both his place and his right to a pension.

MR. SEELEY'S PIGS.

WERE the Bank of England to announce that from this date, they would only part with the gold in their cellars at £5 per oz., the ordinary trade value being a fraction under £4, the buyers of gold would at once withdraw their custom, and the gold would remain unsold. But the true value of the gold itself would not be lessened thereby, the loss on interest falling on the Bank directors. Now such is the exact position of "Seeley's Pigs" with the Admiralty Departments at present. Their value—which has been proved—remains the same. The public property in the hands of the Storekeeper General, or rather under his feet, has been increased by Mr. Seeley's bringing them to light, and the gratitude due to him from the public should be none the less because his service is not represented by actual money. Why, asks the "Iron Trade Circular," is it not so? Why have not these pigs been sold, and who has stopped the way? Not the Lords of the Admiralty, for by them and by their Secretary every facility was afforded. Their intention was direct and honest, and they honestly carried it out to the extent of their power. Did the fault lie with Messrs. George Ryland and Co.? Certainly not. The letter of Messrs. W. Bird and Co. is a sufficient answer on that score. But it happened, unfortunately, that when the question of starting at a price arose, "My Lords" had to consult, and were bound officially to be instructed by the Storekeeper General's Department, the very office mainly responsible in the first instance for the disposal of the pigs as paving stones. This department, then, felt it their duty to put the highest value on the pigs (previously estimated by them in a minute of "My Lords" at £1 per ton, and so charged by thousands of tons to the Engineering Department), and their Lordships were informed that the pigs could not be sold under £4 per ton short weight at the dockyards. Whereupon "My Lords" insisted on the sales already effected at £3 being cancelled, and started the pigs at a fixed minimum price of £4. It was vain to show that a market had to be made. Their Lordships' reply to this was the grand flourish that the Admiralty could not speculate; that the pigs were said to be worth £5 a ton (it was useless to talk of long weight and expense of delivery), so Messrs. Ryland had no option left them in selling, but the trade had the option of not buying, and they did not buy, and so the pigs were not sold. Nothing then remained but to show to the Admiralty, if they would not sell the pigs, the advantage of keeping them for their own use This was done with infinite trouble—occasioned, however, it is but just to say, only by the obstruction and delays arising in all cases from the ordinary official forms, and the difficulty of bringing different departments into communication. However, the iron was tested at Sheerness and proved to be of very high quality and adapted for many purposes, and so reported upon. Next it had to be tried for Palliser shot, for which purpose we considered it to be as good as iron the Woolwich Arsenal Department were purchasing at from £5 to £6 per ton. As the iron would have to be proved at the arsenal by an officer, who had already, under other circumstances, reported against it, it was asked—so as to avoid placing that gentleman in an invidious position—that Messrs. Ryland might be present at the trial. This request was made three months ago, and repeated to the War Office by another application a month since, and there the matter rests after six months' attention. The merits of the navy ballast iron are unquestionable—except to the wilfully ignorant. It has been tried by the most eminent firm in Sheffield, and we doubt not, even yet, in spite of the Duke of Somerset, to see it in the armour plates of some future "Hercules," or on a Gibraltar target, stoutly resisting the indent of Palliser shot, also of its own formation. We hold the same opinion as we first expressed; the navy ballast iron in her Majesty's dockyards, laid down as flooring, used instead of paving stones, stuck up as side walls (and none the worse for it, be it said), is of the best quality of iron now to be had in England, fit, with judicious admixture (as required by other pig iron), for all naval and engineering purposes, and capable of being converted, at small expense, into the best steel. On a rough estimate we should say there is full £200,000 worth of it lying about, and this amount, or something approaching to it, ought to be carried to the credit of "Stores," and so be gradually run off into use, and the interest on so large a sum saved to the nation.

A NOVEL GUNBOAT.

A GUNBOAT named the "Staunch," built for the Admiralty upon the proposition and plans of Mr. George Rendel, of the firm of Sir William Armstrong and Company, has just been completed, and tried at sea off the mouth of the Tyne, with the Admiralty inspectors and a numerous party of officers on board, including some members of the Ordnance Select Committee. A correspondent of the "Pall Mall Gazette" gives the following account of the boat:—This vessel, though wholly insignificant in appearance and cost, represents some very novel principles. She is only 79ft. long and 25ft. beam; her draught of water when loaded 6ft., and her displacement 150 tons. She has twin screws driven by two pairs of condensing engines of 25-horse power (nominal) combined, giving her a mean speed of seven and a-half knots. She carries as heavy a rifled gun as any in the navy, and to all appearance carries it most efficiently. The gun, a 12½-ton 9-inch Armstrong, is mounted in the fore part of the boat in a line with the keel, and fires through a bulwark or screen over the bow, which is cut down and plated something like that of a Monitor. Thus placed, it is easily worked in a rolling sea, and its change of position by recoil does not appreciably affect the trim of the vessel. At the same time, to provide for heavy weather, it is made capable of being lowered into the hold, so as to relieve the little vessel of its deck load, and enable it to carry the weight as cargo. Machinery is also employed for the purpose of working the gun, by which means more than half of the ordinary gun's crew can be dispensed with. The operation of lifting and lowering is performed by simple but powerful machinery. During the recent trials, the gun, with its carriage and slide, and the platform carrying them—weighing in all twenty-two tons—was raised and lowered in a rough sea, with the boat rolling 11deg. each way, in from six to eight minutes. When the gun is lowered the gun-well is closed and the deck left perfectly clear, but in a few minutes the gun can be again brought up ready for action. For working the gun small capstan heads on deck are used. These are turned by machinery from below, and instead of the gun tackles being hauled by a large gun detachment, one man on each side has merely to take a turn with his rope round the nearest of the revolving capstan heads. The capstan, upon his tightening his end of the rope, draws the rope for him, and on his slackening his end frees it. Thus the gun is run in or out, or trained right or left, with great ease and precision. In the same way shells are run up out of the shell room, and other analogous services performed. This simple method of economizing manual labour has been already applied in many ways, such as for drawing trucks and moving heavy weights in railway goods stations, in conjunction with hydraulic machinery. With such assistance, during the trials of the "Staunch," the 12½-ton gun was easily handled by six men, instead of sixteen, and fired with extra charges of 56½lb. of powder, and 285lb. shot. It must be observed that very little, if any, training is requisite with the gun of the "Staunch." The vessel is so small as to be a sort of floating gun carriage. Her twin screws enable her to turn rapidly in her own length. Her helmsman is placed just behind the gun. The gun, therefore, can be laid by rudder right or left with far more ease and speed than any gun of similar weight otherwise mounted. During the recent trials with the engines driving reverse ways, the vessel made the full circle in her own length in 2¾min. With both engines going full ahead, she made by the helm a complete circle of seventy-five yards diameter in 2½min. The "Staunch" is wholly unarmoured. Her strength and security lie in her great gun and her diminutiveness. And she must be considered as one of a flotilla of similar vessels. Sixty such could be built at the price of a single armour-clad frigate, and ten of them, acting from different points, doubling in their own length, escaping into shallows, sheltering under forts, would drive off, or render a good account of any hostile vessel venturing to attack our harbours. Primarily they are intended for harbour defence; but the power of lowering the gun and carrying it as cargo would afford great security for these vessels at sea, and enable them to be sent from harbour to harbour with safety. The "Staunch" is now to be sent round to Portsmouth, where she is to be attached as experimental gunboat to the gunnery ship "Excellent."

CAST-STEEL BOILERS.

THE use of steel in the manufacture of steam boilers is of comparatively recent date, and the relative advantages, if any, over ordinary iron boilers, except on the score of their less weight, has hardly yet been satisfactorily determined. We, "Scientific American," have before us perhaps the latest information bearing on this subject, being the results of an important series of experiments made recently at the rolling mills of Messrs. Funk and Elbers, of Hagan, Prussia, for the purpose of ascertaining the respective evaporating power of the new compared with the old style of boiler.

The two boilers experimented with were each 5ft. in diameter, and 34ft. long, constructed to stand five atmospheres "over" pressure. One was made of wrought iron, and the other of soft cast steel. The thickness of the sides in the cylindrical portions of the iron boiler was 0·50 of an inch, and of the cast-steel boiler 0·33 of an inch. Each boiler had a heating surface of 293 square feet, and 12 square feet of surface. Both were new, and had never been before heated. They were set alike in brickwork, one above the other, but entirely separated by masonry; the gaseous products of combustion passed through a single flue underneath each boiler, and passed directly into the same chimney. At first both boilers were filled, and fires were kept under them for several days in order to dry the brickwork, after which the fires were extinguished and the boilers emptied and cleaned. Each boiler then received exactly 712 cubic feet of water at 95deg. Fah. temperature; the man-holes were closed, and the water was heated to the boiling point; again the fires were put out, and all the ashes and coals taken away. From this point the boilers were fired afresh, and fed with weighed fuel; the man-holes, hitherto kept closed, were now opened to let the steam escape; and the firing was so well regulated, by means of dampers, that the velocity of the escaping steam—measured by List's velocimeter—was the same in each boiler. The temperature of the gases from the fire was measured, at a point 6ft. from the rear end of each boiler, by Gauntlett's pyrometer, and found to vary from 644deg. to 734deg. Fah.

After consuming on each grate 3,150lb. of coal of the same quality, the cinders of which were burned over and over again, the fires were put out, and the man-holes closed. On the following day the remaining water of the boilers, showing a temperature of 95deg., was let out through the emptying tube, situated at the lowest part of the boiler, and measured by means of a hydrometer adapted to the tube. The iron boiler showed 387 cubic feet, and the steel boiler 331 cubic feet of the remaining feed water. Therefore the water evaporated in the iron boiler was 712—387—325 cubic feet, or 20,065lb.; and that evaporated in the steel boiler was 712—331—381 cubic feet, or 23,523lb. Hence the evaporating capacity was proved to be 17·20 per cent. in favour of the steel boiler. 1lb. of coal evaporated in the iron boiler 6,350lb. of water, and the steel boiler 7,367lb. of water at 212deg. Fah.

At the next trial the whole operation was performed in the same manner, only the velocity of the escaping steam was less. It resulted in showing 19·62 per cent. in favour of the steel boiler. 1lb. of coal evaporated in the iron boiler 5.809lb., and in the steel boiler 7,008lb. of water. These two experiments were verified in the following manner: To an equal quantity of feed water in each boiler an equal volume of a strong solution of salt was added. After stirring the water for some time, by means of long poles, and boiling it with closed man-holes, samples were taken out for future analysis. In completing this experiment, in which equal quantities of fuel and water were used, further samples were taken out. The analysis of the samples by Dr. List, of Hagan, showed that in the iron boiler one quart of water contained before evaporation 4,629 grammes of

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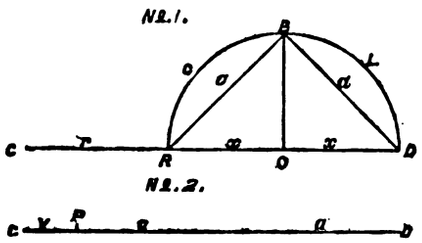
chloride of sodium, and after, 5,985; in the steel boiler one quart contained 4,871 grammes before, and 7,885 grammes of salt after evaporation; the iron boiler lost 33·76 quarts, and the steel boiler 40·81 quarts of water, showing 20·85 per cent. in favour of the latter. The average per centage of these three experiments is 19·24 per cent. in favour of the steel boiler, which, it will be noted, had a shell 33 per cent. thinner than that of the wrought-iron boiler.

Correspondence.

SQUARING THE CIRCLE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Will you allow one, who is not the least a mathematician, to submit to the many readers of the MECHANICS MAGAZINE a definite expression for the relation of the circumference to the diameter of the circle? If the diameter be 1, I have found the circumference to be precisely $\frac{20\sqrt{2}}{9}$. This result I have obtained in the following manner:—Let the



line C D (No. 1) be supposed to be equal in length to the semicircle described on R D. On the diameter of the semicircle construct the triangle R B D. Drop B O perpendicular on R D, then B O is equal to R O and to O D. Let each side of the triangle R B D be represented by a, and R O and O D each by an x. Let the line produced from D R to C be represented by r. On another line equal to C D (No. 2), let P D be equal to R B, and B D = $2a$, and the remainder of the line by v. Finally, let C D be equal to 10, and the semicircle R G L D also is equal to 10. From this it can be shown that v is equal to 1, and that $2x$—the diameter of the circle—is equal to $\frac{9}{\sqrt{2}}$, the exact diameter of a circle whose circumference is 20. This makes the measure of a circle, whose diameter is 1, to be $\frac{20\sqrt{2}}{9}$, or 3·1423611, &c.; the figure 1 continually recurring. This is a little in excess of the recognized measure, and very nearly that adopted by Archimedes.—I am, Sir, yours, &c., J. STAPLETON.

George-street, Plymouth.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—J. H.—G. L.—R. S.—G. G.—H. N.—W. T. R.—J. H.—W. J. M.—H. P. S.—J. S.—L. P.—T. H. S.—T. C.—Messrs. M. R. and Co.—F. N. S.—R. I.—G. W. H.—T. B. J.—S. M.—H. S.—J. H.—A. W.—T. H.—J. N.—W. J. M.—T. B.—H. D. R.—G. W. H.—B. B.—J. F.—W. H. H.

Meetings for the Week.

MON.—Royal United Service Institution.—1st. Mr. James D. Dougall on "Schultze's Granulated Wood Gunpowder;" 2nd. Mr. George Read, R.N., "Will Explain a Model of his Helm Indicator," at 8.30 p.m.

Society of Engineers.—Special General Meeting for Consideration of Proposed Alterations in, and Additions to, the Rules and Bye Laws of the Society, at 7.30 p.m.

TUES.—The Institution of Civil Engineers.—Mr. John Wolfe Barry, M.I.C.E., on "The City Terminus Extension of the Charing Cross Railway," at 8 p.m.

Royal Institution.—Dr. M. Foster on "The Development of Animals," at 3 p.m.

WED.—Society of Arts.—Mr. Raphael Brandon on "How to Make Railways Remunerative to the Shareholders, Beneficial to the Public, and Profitable to the State," at 8 p.m.

THURS. — Royal Institution.—Dr. M. Foster on "The Development of Animals," at 3 p.m.

FRI.—Royal Institution.—Professor Frankland on "The Proposed Water Supply for the Metropolis," at 8 p.m.

SAT.—Royal Institution.—Professor Roscoe on "The Non-Metallic Elements," at 3 p.m.

Naval, Military, and Gunnery Items.

THE total number of vessels at present composing the navy of the United States is stated to be 230, with an aggregate of 140,746 tons burden, and 1,915 guns.

FROM Prussia we learn that Herr Pauer, the well-known but hitherto unsuccessful inventor of submarine ships, has constructed a new model, which looks promising enough to have obtained the honour of a special federal commission to test its merits.

A SERIOUSLY destructive fire recently broke out in the Chassepot rifle manufactory belonging to Messrs. Reeves, George-street, Birmingham. The premises, which were very compact, were partially burned down, and the damage done to machinery and stock is estimated at £5,000.

AN order has been received at the Royal Engineer establishment, Chatham, directing a party of non-commissioned officers to proceed to Persia to join the detachment of sappers of the Royal Engineers engaged in laying down the telegraph overland to India, under the superintendence of Major Smith.

IN addition to the "Sultan," the new iron-clad of the "Hercules" class ordered to be laid down at Chatham dockyard, a powerful turret armour-clad ship, to be named the "Triumph," is directed by an Admiralty order, just received, to be constructed at that establishment, the designs for both vessels having been prepared at the Admiralty, where the drawings and plans are now being made.

THE "Ringdove," first-class gun vessel, 666 tons, 160-horse power, has just made an official trial of her speed at the measured mile, Stokes Bay. Six runs were made at full boiler power, the result being a mean speed of 10·632. Four runs were made at half-boiler power, the mean speed being 8·145. The engines worked well, indicating a maximum of about 900-horse power. The speed attained cannot be regarded as very satisfactory. The "Ringdove" was designed by Mr. E. J. Reed, and built at Portsmouth.

IT is stated that the camp of Chalons this year will be composed as follows:—First division of infantry, 1st brigade, 3rd battalion of Foot Chasseurs, and 5th and 8th of the Line; 2nd, the 13th and 18th of the same arm. Second division, 1st brigade, 9th battalion of Foot Chasseurs, 29th and 67th of the Line; 2nd, the 44th and 78th regiments. Third division, 1st brigade, the 18th Foot Chasseurs, 65th and 67th of the Line; 2nd, the 81st and 92nd of the same. Cavalry division, 1st brigade, 5th and 6th Lancers; 2nd, the 3rd and 9th regiments of Dragoons.

THE attention of shipbuilders, engineers, and others interested in the shipping trade is called to the fact that the time for applying for space in the Havre Maritime International Exhibition is drawing to a close. As the Board of Trade, Admiralty, and other public departments have set the example, it is hoped that a good display will be made of all that relates to the great maritime interests of the country. The concessionnaires, Messrs. J. M. Johnson and Sons, of Castle-street, Holborn, are prepared to receive applications for space until the 15th proximo.

THE shipping employed in our coasting trade in 1867, the total of entries inwards and clearances outwards with cargoes, amounted to 285,918 vessels of 36,854,343 tons. Only 1,090 vessels of 194,168 tons were foreign. The number of vessels decreases, but the tonnage (except in 1867) increases. The total tonnage was 35,009,528 in 1864, 36,325,219 in 1865, 37,005,575 in 1866. The decrease in 1867 is in that part of our coasting trade which does not consist in intercourse with Ireland; in the intercourse with Ireland the number of vessels engaged and the amount of tonnage increase year by year, without exception.

Miscellanea.

AN avalanche five or six miles in extent occurred near the town of Cisco, California, on the Pacific Railroad recently. Six Chinamen were killed and seven locomotives were injured.

IT is announced that the Prince of Wales has signified to the committee of the National Exhibition of Works of Art, at Leeds, that he will open the Exhibition in the week commencing Monday, the 18th of May.

A COMPLAINT in Chancery has been lodged against the Anglo-American Telegraph Company by Mr. W. P. Piggott and others, for a suspected infringement of Mr. Piggott's patent for improvements in the mode of generating electric currents.

A PAMPHLET about to be published by M. Horn states that the expenses of the French Empire from 1852 to 1866 (both inclusive), amounted to the terrific sum of 31 milliards of francs, or £1,240,000,000 sterling.

THE Right Hon. W. E. Gladstone, M.P., has consented to preside over the Statistical Section at the approaching meeting of the British Association for the Advancement of Science. The meeting will be held at Norwich, in August next.

LIVERPOOL is making every exertion to induce the Royal Agricultural Society to hold its annual gathering for 1868 in that town. A meeting was lately held in the Mayor's parlour, and a committee was elected to form a guarantee fund of £3,000.

WE understand that the Benchers of the Honourable Society of the Middle Temple are preparing for publication a "History of the Temple," with a succinct account of the most eminent of its *alumni*. The record will extend over a period of between three and four centuries.

THE "Siecle" tells us that the Director-in-Chief of the French Telegraphs has decided that each of his servants shall wear a uniform—which is quite necessary—and also carry a sword, with a brass pommel and scabbard. "All the world," adds the "Siecle," "is asking what they have to do with that weapon."

THE vast area of the metal portion of the roof of the New-street Railway Station, at Birmingham, is now being recovered with Vieille Montagne zinc. The zinc used is 16-gauge, and more than 100,000 square feet will be required to complete the work. The old roof of corrugated galvanized iron has been thoroughly worn out during thirteen years.

WE are happy to state that the honorary office of president of the Horological Institute of Great Britain, rendered vacant by the death of Mr. Valentine Knight, J.P., has been accepted by Mr. E. B. Denison, Q.C. We congratulate the members of the Institute on the acquirement of a president so distinguished as a horologist and as a man of science.

AT the South Kensington Museum the visitors during the week ending March 21, were:—On Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 10,968; on Wednesday, Thurday, and Friday (admission 6d.), from 10 a.m. till 5 p.m., 1,697; total, 12,665. Average of corresponding week in former years, 10,773. Total from the opening of the museum, 7,255,358.

WE have much pleasure in announcing that Sir Roderick Murchison has been elected by the Academy of Sciences in Paris Foreign Member, in place of the late Professor Faraday. There are only eight such members, and the honour is regarded by men of science as the highest which a man of science can receive. As a matter of form the decision has to be submitted to the Emperor for his confirmation.

IN the competitive trials for drawing, conducted by the Science and Art Department, South Kensington, 588 schools contended. When the awards were made the greatest number appeared for the Orphan Working School, Haverstock-hill. This establishment entered the lists for the first time, and sent up 161 boys, 71 of whom had their drawings marked excellent, 39 were adjudged proficient, 39 were considered fair, and 12 passed over.

IN connection with the construction of railways in Russia, it is important to note that the lines opened for traffic realized last year a notable progress in their receipts as compared with 1866. In the case of the Moscow and Riazan this progress was 51 per cent., in the case of the Volga and Don 39 per cent., and in the case of the Riga and Dunaburg 30 per cent. The last enterprise, it will be remembered, was to some extent an English work.

A COMPANY has just been formed at Naples for coal mining in the Neapolitan provinces, and, in consequence of experiments that have been made at the naval arsenal, the Government has ordered 50 tons, which are to be supplied from the mines of Giffoni, Valle Piana, in the Principato Citeriore. The experiments that have been made with this coal at Naples, prove that it is of excellent quality, and most suitable for gas manufacture.

IT appears, by the "Journal de Frankfort," that a statue of Napolean the First, by Canova, which stood in the Salle des Etats in the time of Jerome, king of Westphalia, has been found hidden in a barn in the garrison of Cassel. Unfortunately, at the time of the retreat from Moscow, the statue was removed and mutilated, the arms, it is said, having been sawn off. The French consul has applied to the Prussian authorities for the statue in question.

A DEPUTATION from the British Association for the Advancement of Science lately had an interview with the Premier, to urge upon her Majesty's Government that, in the event of the Natural History Collections in the British Museum being moved from their present site in Great Russell-street, the administration of these collections should be intrusted to a director immediately responsible to some Minister of the Crown, and that the authority of the present trustees over them should cease.

THE value of the telegraphic wire and apparatus exported from the United Kingdom last year was £209,688 as compared with £312,288 in 1866, and £148,679 in 1865. In the ten years ending 1867 inclusive, the value of this branch of our exports will be seen to have been very considerable, viz., in 1858, £224,708; in 1859, £742,806;

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in 1860, £251,712; in 1861, £214,441; in 1862; £320,897; in 1863, £317,214; in 1864, £218,464; in 1865, £148,679; in 1866, £312,288; and in 1867, £209,688.

THE steam force of the Metropolitan Fire Brigade has just been increased by three new steam fire-engines of Messrs. Merryweather and Sons, long-stroke single-cylinder pattern. The success of these makers at the Paris Exhibition has caused the Metropolitan Board of Works to choose these engines. One of them is the engine "Le Prince Imperial," which gained the gold medal at Paris. They have steam cylinders, each 6½in. diameter, and double-acting pumps each 5½in. diameter, with 18in. stroke of pistons.

THE arrangement of the third and final collection of national portraits is now making good progress at South Kensington. There is no want of portraits; indeed, the great difficulty is to find space for those already received. The exhibition will consist of portraits of eminent persons who have lived during the present century, and of many distinguished people who flourished prior to that time, forming a supplement to the whole series. In all, there will be about 900 portraits, and efforts are being made to open the exhibition on Easter Monday.

THE yield of gold from the mines of Victoria for the year 1867 was 1,493,831 ounces. The average number of miners employed was 65,857, and the average earnings 35s. per week. The gold mining companies in the colonies paid in the year 1867 dividends amounting to more than £820,000, being a much larger number of pounds sterling than the number of the entire population—men, women, and children. The amount would be very largely increased if there were added the profits of private mining undertakings, and of companies which do not make public their yield and dividends.

STEPS are being taken for the formation of an Archæological Society for Birmingham and the neighbourhood, in connection with the Birmingham and Midland Institute, for the examination, study, and preservation of local antiquities. A committee has been formed to make the necessary arrangements with the council of the institute for carrying out the project. Members of the institute, on paying 5s. a year, are to become members of the archæological section. Donations are to be requested towards a copying fund for providing drawings and photographs of old documents and old buildings, and for preserving old relics of the history of Birmingham and its neighbourhood.

DURING the last week three stone axes, which have been found by drainers in the alluvial clays of the Derwent and the Rye, have been purchased by Mr. C. Monkman, of Malton. Mr. C. Hartley has also purchased one found in a similar way. The axes are met with at depths varying from 2ft. to 3ft. 6in. A pierced stone hammer was found a few days ago, and, with the flint axe found at Norton a few weeks ago, make up six weapons which have been discovered during the winter months, all of which, except that above-named, have passed into Mr. Monkman's hands. Three out of the six are very good specimens. From the same beds the Rev. J. Robertson, of Appleton, has obtained some very fine flint arrow heads and implements during the past draining season. It is believed that many stone antiquities have been destroyed in the Ryedale district, simply from ignorance of their value by the workmen.

IT has long been a contested point with collectors as to what kind of china really was made at the first manufactory of this ware in England, which is known to have been established at Bow in 1744, and what mark served to distinguish it from that of other manufactories. In trenching for a drain at the lucifer-match works of Messrs. Bell and Black, at Bow, an important piece of evidence has fortunately been turned up. The cutting has intersected a waste heap, and many fragments have been found, consisting of knife handles, cups, and plaster moulds for casting the ornaments in relief. The curator of the Geological Museum in Jermyn-street has thus been enabled to identify as of Bow manufacture two perfect specimens in the ceramic collection of that museum, and Mr. Bell has liberally given several of the fragments to the museum. It should be added that no distinguishing mark has as yet been found on any of the specimens.

MR. BARKER, organ builder, Paris (inventor of the pneumatic lever), has just patented in France and England a complete system for applying electricity to supersede the ordinary mechanical key and draw-stop action in large organs. The patentee has already built a grand electric organ of forty-two sounding stops and eight couplers for St. Augustin's, Paris, and another for Salon, near Marseilles. As the largest organs may now be played through a cable of insulated wires, positions hitherto wholly impracticable can be turned to account. The organist, with his various claviers, can be placed in any direction, and at any distance away from the organ, the touch being equally delicate and rapid on every manual, whether used separately or coupled. Bryceson Brothers and Co. have the concession for working this patent in Great Britain, either as regards new organs, or applying the electric action to existing instruments.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—2425, 2430, 2472
BUILDINGS AND BUILDING MATERIALS—2481, 2486
CHEMISTRY AND PHOTOGRAPHY—2437, 2449, 2458, 2501
CULTIVATION OF THE SOIL, including agricultural implements and machines—2427, 2462
ELECTRICAL APPARATUS—2480
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2439, 2442, 2445, 2446, 2448, 2460, 2490
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—2455, 2496
GENERAL MACHINERY—2428, 2432, 2433, 2441, 2451, 2454, 2468, 2470, 2487, 2493, 2497, 2498, 2500
LIGHTING, HEATING, AND VENTILATING—2435, 2461, 2491
METALS, including apparatus for their manufacture—2438, 2463, 2484
MISCELLANEOUS—2429, 2436, 2444, 2447, 2450, 2452, 2453, 2457, 2459, 2464, 2466, 2471, 2474, 2475, 2478, 2479, 2489, 2492, 2494, 2495
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2434, 2465, 2482, 2483, 2485, 2499.
SHIPS AND BOATS, including their fittings—2440, 2443, 2467, 2469, 2473, 2476
STEAM ENGINES—2456
WARFARE—2431, 2477, 2488

2425 A. and E. WIGZELL. *Improvements in, or applicable to Juckes' furnace.* Dated August 24, 1867.

The patentee claims, first, the application to Juckes' furnaces of tumbling gratebars, or bars hinged at one end only, on portable rods supported and carried by endless chains. Second, the general arrangement and combination of parts of apparatus, substantially as described and illustrated in the drawings.—Patent completed.

2426 J. P. SMITH. *An improved mode of, and apparatus for, hauling, draining, and other agricultural implements in the field by steam power, and also an improved truck for mounting and carrying such implements from place to place.* Dated August 24, 1867.

According to this invention the implement is to be attached to a block carrying a pulley round which the rope passes, the other end of the said rope being brought back again and fastened to the wheel or other stationary part of the engine, or to any other firm anchorage. The object of this contrivance is to reduce by one-half the speed at which the implement travels, and hence to gain an equivalent increase in the power. The block to which the pulley is attached is mounted upon a cranked or other axle carried by two wheels or rollers, so as to allow it to accommodate the angle of the flanges of the pulley to the direction in which the rope pulls. The improved truck consists of a body or framework composed of wrought iron, or other suitable material, with the bottom about the same distance from the ground as the lowest part of the traction engine, and having two running wheels either mounted on cranked axles passing under the body, or on short axles affixed to the sides of the truck. The lower part or front of the truck is cut away to admit of a steering wheel, the shelf thus formed in the inside of the truck serving to carry a vice and a portable forge, and the back of the truck, or the lower part thereof, is made to fall down on hinges so as to form an inclined plane up which the implements are easily moved into the truck. The inside of the body of the truck is furnished with two longitudinal angle irons or projections about midway of its height to receive the ends of boards for forming a second flooring if required. The front of the truck is provided with a draw bar and shackle for attaching the traction engine thereto.—Patent abandoned.

2428 M. SAMUELSON. *Improvements in sewing machines.* Dated August 24, 1867.

This invention relates to the general construction and arrangement of what are known as shuttle or lock stitch sewing machines, and consists of the following arrangement:—The cloth plate is screwed on to brackets cast on a bed plate, which brackets carry a transverse driving shaft provided with a small hand pulley, and with a duplex cam for imparting a to and fro and up and down motion to a serrated feeder, the feeder being of the description known as the under "four motion feed." To one extremity of this driving shaft there is keyed a disc provided with a crank pin which works in a differential slot in the end of a vibrating lever working beneath the cloth plate, and secured to a rocking shaft working between adjustable screw centres in brackets cast on the bed plate at the back end thereof. To the opposite end of the driving shaft there is keyed another disc carrying a crank pin for the purpose of driving the shuttle, as hereinafter explained. The rocking shaft above referred to derives its motion from the first-mentioned crank pin and differential slot in the lever arm attached to such shaft, and this vibrating motion is imparted to the needle arm, which is also secured to the rocking shaft, the needle being curved and attached by a pinching screw, or otherwise, direct to the end of the lever. The shuttle is carried in a box or chamber formed on the upper end of a vertical lever situate below the cloth plate, and in place of reciprocating in a straight guiding groove or race, as in most of the reciprocating shuttle machines heretofore constructed, it describes an oval or elliptical course in front of a smooth face plate. The shuttle lever is attached at its lower end to a sliding block working between vertical guides secured to or cast on the end plate, and at an intermediate point between the sliding block and the shuttle box the shuttle lever is connected by a crank pin with the disc hereinbefore referred to for actuating the shuttle. As this pin revolves, it imparts not only a vertical but also a lateral movement to the shuttle lever, the combination of which two movements produces the elliptical or oval course of the shuttle. A small catch is fitted to one end of the shuttle box for affording facility for the introduction and removal of the shuttle. The presser foot is carried in the end of a fixed overhanging bracket arm, and is held down by a spring and elevated by a cam lever attached to the end of the arm, such cam acting upon the enlarged head of the stem of the presser foot.—Patent abandoned.

2429 W. E. NEWTON. *An improved fastening for paper bags and paper parcels.* (A communication.) Dated August 24, 1867.

This invention consists in applying to the open or mouth ends of paper bags, and also to sheets of paper designed for wrapping purposes, a thin sheet metal strip, over which the edge of the paper is secured, so that the filled bag, or the sheet after being rolled or folded, will enclose the article within it, and may, by bending over the metal band, be securely fastened without the aid of strings or tapes, or any mucilage or adhesive substance whatever.—Patent completed.

2430 H. DAVEY and D. DAVY. *Improvements in apparatus for supplying or feeding water to steam boilers and other vessels.* Dated August 24, 1867.

Here the inventors mount a wheel with recesses on its circumference, or openings in its side, on centres or spindles in a casing, so as to turn freely. This casing is provided with two openings, one communicating with the boiler below the water level, and the other with the steam space. It is further provided with one or more openings for receiving the water from a tank or other supply. These openings are arranged on the circumference at the sides, so that as the wheel revolves, the recesses or openings being previously filled, the steam becomes filled with water on passing the supply openings from the tank (the steam being condensed), and thence pass round to the openings communicating with the boiler, where they are emptied of water and again filled with steam. The apparatus is made self-acting by arranging the inlets for the water, so that it impinges in an inclined direction on the wheel cavities, causing it to start in the required direction, the motion being further maintained by the weight of water being on one side of the wheel only.—Patent abandoned.

2431 W. R. LAKE. *Improvements in cartridges for breech-loading firearms.* (A communication.) Dated August 24, 1867.

This invention relates to means for holding the priming or fulminate in the proper position to be ignited by a blow received on the base of the cartridge shell or case, and also to the means for strengthening the said base and preventing the access of gas to the rim. The improvements consist, chiefly, in the employment of a metal cup of peculiar formation which is placed in the rear of the cartridge shell; also in the novel construction of the base of the shell, and in the combination of the same with the metallic cup. The base of this cup is placed in contact with the interior of the base of the cartridge shell, its sides or circular portion being made to fit closely to the interior surface of the cylindrical portion of the shell. The base of the cup is formed with a recess to receive the priming or fulminate, and the recess communicates through a small hole or perforation with the charge in the body of the shell. The base of the shell is formed with a projection which fits the recess or chamber in the base of the cup, and which is forced into contact with the priming, to ignite the same when the exterior of the cartridge case is struck by the firing pin or other striking device of a fire-arm.—Patent completed.

2432 P. KNIAGHININSKY, P. GALAHOFF, and N. OSSIPOFF. *Improvements in machinery for setting up and distributing printing types.* Dated August 24, 1867.

Here the patentees arrange the types to be set up in two cases or trays having longitudinal grooves in them. The types are placed in these grooves, each letter or sort of type in its own groove. The trays are inclined so that the types slip down to the front ends of their grooves, where they are retained by pincers or lips at the mouths of the grooves. Extending along the front of these cases or trays is a plate which receives a rapid oscillating movement to and from the cases or trays. Along this plate an instrument, which they call the "collector," is able to slide; it has a nut upon it with which a screw of rapid pitch works. By turning the screw one way or the other the collector can be traversed in either direction along the oscillating plate, and so it may be brought in front of any type groove from which it is desired to take a type. The collector has a projecting beak, and when the collector is brought forward up to the type cases or trays by the oscillation of the plate which carries it, the beak seizes a type in the groove opposite to it, and removes it as the collector recedes. When the screw is next turned, the collector is brought opposite the composing stick. The composing stick is double, and has two grooves in it to take alternate lines of type; each is fitted at its mouth with pincers somewhat different from those at the ends of the type cases or trays; they are so formed that, when the beak of the collector moves up to them, they take from it the type it carries. The composing stick is between the two type cases or trays. By the repetition of these movements the types are rapidly taken from the cases or trays in the order required, and are deposited in the composing stick. The screw is driven by two electro-magnetic coils, one at each end of it, which, by driving bands, are kept constantly rotating in opposite directions. There are armatures on the ends of the screw, and when electricity is passing in either of the revolving coils, it seizes the screw and carries it round with it. So, by connecting one or other of the coils with a battery, the screw may be driven either way, and it remains stationary when no current is passing in either coil. The due regulation of the electricity to these coils will thus cause the types to be collected and arranged in the order required.—Patent completed.

2433 F. J. CLEAVER. *Improvements in screw presses and apparatus for pressing and moulding soap, or for pressing, moulding, packing, or stamping other materials.* Dated August 24, 1867.

Here the patentee connects the upper end of the axis of the screw of a press by a joint to the lower end of a piston rod, the piston of which works in a cylinder

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mounted upon the framing, the piston being actuated either by steam, compressed air, or other elastic fluid. A cross head upon the piston rod gives motion to a slide valve so arranged that the length of stroke of the piston may be readily adjusted from time to time by a screw or otherwise, as required. Another slide valve is also arranged capable of adjustment, so as to cut off the steam or other motor during the up-stroke of the piston when the press is used for pressing and moulding soap, &c., where the rebound is sufficient to effect the upward movement of the piston. A flywheel is mounted upon the axis of the screw, a portion of its length being formed square, and so as to move up and down freely through a square opening in the boss or centre of the flywheel, which is retained in position by a grooved collar or otherwise. Below the plunger of the press a rotating table is arranged, upon which the moulds or dies are mounted for receivfng the soap, &c., to be pressed or moulded. A step-by-step movement is communicated to the rotating table so as to bring each mould in succession as the table rotates correctly under the plunger each time it descends. —Patent completed.

2434 W. BERRY. *Improvements in removing mud, drift, or other rubbish from streets and other places.* Dated August 24, 1867.

This invention consists, first, in using an inclined plane and receiver mounted on a frame on one or more wheels, slides, or other means; the lower end of the inclined plane is to be near the ground, so that mud, drift, dust, &c., may be swept up into the receiver, and afterwards emptied into the cart or other receptacle by a weighted lever or other means. Second, an inclined plane and receiver may be attached to the cart or other receptacle by pivots, &c., so that the contents may be readily emptied into the cart or other receptacle.—Patent completed.

2435 W. C. THURGAR. *Improvements in apparatus for regulating the supply of gas to burners.* Dated August 26, 1867.

This apparatus is actuated by clockwork which is wound up once a week, or at other convenient intervals of time. The clockwork drives a spindle which turns once an hour. This spindle has one tooth on its end, which tooth acts upon one tooth of a 24-cogged wheel which it gears with. This 24-cogged wheel has a spindle through its centre of suitable length, and fixed on the top of this spindle is a plate which has two arms, one of which is fixed while the other is adjustable for increasing or diminishing the distance of the two arms, according to the time of gear, the plate being marked to show the position to which the adjustable arm should be moved. This plate revolves horizontally once in twenty-four hours, and as it revolves one of the arms presses one side of a cam, of which there are two fixed on one end of the tap which runs through the vertical gas pipe; the tap has a small groove round the perforation, so that the gas gets through a little in daytime. When the cam is acted upon, it turns the tap so as to lower the flame, and when the other arm comes round, it comes against another part of the same cam, so as to turn the gas on full. The small blue flame which burns in the daytime is protected from the air by a guard which is pressed up by one cam in the morning, and again lowered by the arm coming against the other cam in the evening. This guard is a globe which has perforations at the bottom to let air in; the globe has a tube fixed at the bottom, and on the other end of the tube is a small plate, by pressure on which one of the cams (being fixed to the tap) lifts up the guard to shield the small blue flame in the daytime. The guard tube fits over the gas pipe.—Patent completed.

2436 E. SONSTADT. *Improvements in the treatment of seaweed for obtaining valuable products from it.* Dated August 26, 1867.

Here the patentee makes a stack of timber built in alternate layers, or in concentric layers, with seaweed, which may be wet or dry. An opening in the middle of the pile is left as a chimney into which lighted fuel may be introduced. The chimney should be closed soon after firing. He makes the covering of fresh or wet seaweed, and fires the pile, adding more wet seaweed to the covering from time to time, as may be found necessary to effect the carbonization of the interior. The process is conducted somewhat after the manner, and with the usual precautions, taken in making wood charcoal in piles. But it is advisable to place, in building the stack, iron tubes or other channels, horizontally, near the floor of the stack, penetrating to the interior timber, and projecting externally. These channels can be opened or closed at pleasure, and give control over the progress of the carbonization. He carries on the operation by preference on a cemented or waterproof and fireproof floor, provided with a trough or other means for the collection of the drainage.—Patent completed.

2437 W. R. LAKE. *A new green colour.* (A communication.) Dated August 26, 1867.

This invention consists, principally, in the employment of linseed oil, acid, and oxide of copper. It is produced by precipitating a neutral soap prepared from linseed oil with a dilute solution of copper, or in letting linseed acid act on oxide of copper, or a combination, consisting partly of oxide of copper. Oleic acids produced from other oils also furnish the said colour in divers shades.—Patent abandoned.

2438 G. HASELTINE. *Improvements in the manufacture of iron and steel.* (A communication.) Dated August 27, 1867

An extension of time for completing this patent having been petitioned for, the documents relating to the invention cannot at present be seen.

2439 W. MUIR. *Improvements in machinery or apparatus for stitching or ornamenting and uniting fabrics.* Dated August 27, 1867.

This invention is not described apart from the drawings. —Patent completed.

2440 J. W. WEBB. *Improvements in reefing topsails from the deck.* Dated August 27, 1867.

This invention is not described apart from the drawings. —Patent completed.

2441 W. E. GEDGE. *An improved machine termed a crusher, intended to divide break, or crush all substances capable of being triturated, more especially bones and horny substances of every kind, for converting them into manure.* (A communication.) Dated August 27, 1867.

This machine is composed of two cast-iron plates, the one fixed and the other movable. Each plate carries a cast iron or steel crown strongly fitted to it by four iron bolts, each crown being furnished with quadrangular and conical teeth arranged with precision, and in such wise that those of the upper plate set or take very exactly into those of the lower place, and *vice versa*. The movable or running plate, which works at a speed of about 700 revolutions a minute, is beneath, and the upper or fixed plate is strongly secured to two wooden cross pieces by four bolts. The running plate is fixed by a wedge to a vertical iron shaft, which also passes through the fixed plate to maintain it in perfect harmony with the running plate, and prevent deviation, which would inevitably lead to the immediate breakage of the machine. On the upper or fixed plate between the crown and the axle an opening is made provided with a hopper by which the substance to be treated is introduced, so that it falls perpendicularly on the running plate, which, in its rotation, throws and divides the substance between the crowns.—Patent abandoned.

2442 E. B. BIGELOW. *Improvements in jacquard power looms, and in apparatus for driving looms.* Dated August 27, 1867.

This invention comprises, among other features, the following:—One of the objects of the invention is to facilitate the operation and adjustment of the jacquard harness. The first part relates to a mode of moving the trap boards and journals to raise and depress the harness to form the shed, and is particularly applicable to jacquard looms in which the harness is counterpoised. The next part relates to a mode of raising and depressing the jacquard machine to adjust the height of the harness as it distends or contracts by atmospheric or other causes. Another part relates to a mode of operating the cylinder or polygon which carries the pattern card in jacquard looms. The object of another part of the invention is to diminish the amount of shafting heretofore required for driving looms, and to lessen the expense for belts used therefor. The detailed description of the arrangements employed for performing the invention is too voluminous to be produced here.—Patent abandoned.

2443 J. A. A. ETAIX. *Improvements in hand screw propellers.* Dated August 27, 1867.

This invention consists of the following arrangement by which the screw propeller of a boat can be put in motion without the use of steam, or of any other force than the hand. For this purpose the screw is fixed to the end of a horizontal shaft provided with a gearing on which catch the teeth of a cogwheel turned by a vertical shaft to which a flywheel has been added, and which is put in motion by a crank. This crank is either horizontal, to be turned by a man sitting, or vertical to be turned by a man standing. But the essential feature of the invention is the addition of a flywheel to the vertical shaft, which flywheel permits the increase of the revolutions of the screw. The size of this flywheel is proportionate to the space allowed and to the required motive power.—Patent abandoned.

2444 M. A. SOUL. *Improvements in fastening iron bands on bales, and in fasteners or ties for that purpose, and also in levers or implements to be used therewith for effecting the fastening.* (A communication.) Dated August 27, 1867.

This invention consists in making the ties or fasteners of such an improved construction and shape that they admit of the instantaneous application of a peculiarly shaped lever (which is used much in the manner of a button hook) for bringing together the ties which are fitted one to each end of the band.—Patent abandoned.

2445 T. SAGAR and T. RICHMOND. *Improvements in looms for weaving.* Dated August 28, 1867.

This invention has reference to the "letting-off" motion of looms, and relates to a former patent, dated July 4, 1866 (No. 1732). The present improvements consist in dispensing with the catches and ratchet wheels described in the specification of the former patent, and in using in lieu thereof the following parts:—To the axle of the usual vibrator the inventors fix a toothed segment or lever with a stud or studs; the teeth of this segment, or the studs of the lever, take into the teeth of a wheel on the boss of which is a pinion gearing into a wheel on the axle of the warp beam. When the tension of the warp depresses the vibrator, the tooth of the segment or the stud of the lever is raised, and allows one tooth of the wheel in which it gears to slip, thereby letting off a portion of the warp. The parts remain in these positions until the tension of the warp depressing the vibrator again allows another tooth to slip, and thus the warp is let off as required. The second part of the invention consists in tightening the warp when the reed is beating up the weft by an eccentric on the crank shaft acting on a lever to which the vibrator is connected; or by connecting the lay sword or the lay to a lever loose on the axle of the vibrator, in the upper arm of which lever is a set screw against which the vibrator presses when the reed beats up.—Patent abandoned.

2446 H. HANSON. *Improvements in machinery or apparatus employed for finishing cotton, band, twine, ropes, cordage, and other fibrous substances.* Dated August 28, 1867.

This invention relates to a former patent, dated December 31, 1857 (No. 3195). The inventor employs, instead of the ordinary walk, a rail or tramway of any desired form or length, and places upon it a travelling frame or carriage supported by any suitable number of wheels, and capable of being drawn from one end to the other, both ways, either by hand or by drums and ropes driven by power. The top of the frame or carriage forms the table for supporting the material to be sized and finished, and also holds the size, &c., employed, and the present invention consists of improved means of giving the to-and-fro motion to the travelling carriage. Instead of employing two drums and two ropes, and allowing the ropes to be wound on and off the drums alternately, he employs an endless rope or band passing over pulleys and through guides and a locking box in the carriage, the top of the rope always passing in one direction, and the bottom part of the rope in the reverse direction when the machine is at work. The rope passes in a groove of a double-grooved pulley turned by toothed gearing and driving pulley, then over a guide pulley and another groove of the double-grooved pulley, from which pulley the upper and lower parts of the rope pass to the carriage, and then over a pulley at the end of the tramway. There are other details included in the specification.—Patent abandoned.

2447 J. E. BOYCE and R. HARRINGTON. *Improvements in umbrellas and parasols.* Dated August 28, 1867.

The patentees claim applying to the stick of the umbrella or parasol two bow-shaped springs provided at their middle with a raised part or nib, with the raised part or nib of one or other of which springs a slot in the runner is made to engage to fix the umbrella or parasol in its open or closed position, substantially as described and illustrated in the drawings. Second, steadying the runners of umbrellas and parasols having taper sticks by bow springs made from sheet steel, or other elastic metal, substantially as described and illustrated in the drawings.—Patent completed.

2448 W. WILSON and J. COWBURN. *Certain improvements in looms for weaving.* Dated August 28, 1867.

This invention relates to that description of looms which have movable shuttle boxes actuated by the mechanism known as "Diggle's chain," and are employed for weaving patterns, and the invention is designed for effecting a continuous action of the said chain, so that one pattern may be woven continuously when desired without the regular motion of the "star" wheel affecting it so as to alter the pattern. Second, the invention is designed to enable the shuttle to make several "picks" to each "card." —Patent abandoned.

2449 G. G. TANDY. *Improvements in the preparation of vulcanizable compounds, and in the manufacture of articles therefrom.* Dated August 28, 1867.

This invention consists, under one head, in an improvement in the mode of preparing compounds of india-rubber and sulphur, or other vulcanizable gums or resins used for making ebonite or vulcanite, so as to render them more plastic than can at present be attained, whereby a great amount of labour and expense is saved. Hitherto little or no solvent has been used in these compounds in consequence of the great amount of porosity resulting from the escape of the vapours generated during the process of vulcanization (or hardening). This escape of the vapours the inventor overcomes by exposing the moulded articles to a sufficiently high temperature to expel the solvent previous to subjecting them to the indurating process; and he finds that, by using petroleum spirit not having a higher specific gravity than ·630 (although a higher specific gravity may be used) the expulsion is easily effected, and that the resulting vulcanite or ebonite will be of a much more elastic and tougher nature than that produced without the aid of such solvent.—Patent abandoned.

2450 W. PEDDER. *Improvements in brushes.* Dated August 28, 1867.

This invention consists in the manufacture of skeleton brushes, namely, brushes open at the back, in order to prevent the accumulation of dirt or wet at the bottom of the bristles or hairs.—Patent completed.

2451 J. ELLIOTT. *Improvements in machinery used in cutting coal, stone, slate, and other minerals, and in forming tunnels and galleries, and for other quarrying purposes.* Dated August 28, 1867.

This invention consists in machinery for driving a circular rotating disc or discs, either with teeth, or formed to receive movable tools of varied form set in a slightly spiral line in the direction of the forward cut, and in facilitating the removal of the core produced by the forward cut by a cranked arm or arms connected by a pivot joint to the disc or discs, entering the forward cut with the disc or discs, and set in action in order to cut the core at back by the portion of the cranked arm without the cut operating on that within it; or by a key and spindle connected with an arm used as a back core cutter setting such arm in action.—Patent abandoned.

2452 J. H. JOHNSON. *Improvements in apparatus for the aeration of fresh water obtained by the distillation of sea water.* (A communication.) Dated August 28, 1867.

The apparatus for carrying out this invention cannot be described without reference to the drawings.—Patent completed.

2453 J. STOREY, W. E. BICKERDIKE, and W. V. WILSON. *A new method of bronzing metallic and other surfaces.* Dated August 28, 1867.

It is well known that all the dye stuffs produced from aniline, such as roseine or magenta, aniline or phenyl, blues and violets, all the violets and green dyes produced by the action of the iodides of the alcohol and beta alcohol radicals upon rosaniline, possess a brilliant bronze-like lustre in the solid state. This new method of bronzing metallic and other surfaces consists in the application of solutions, more or less concentrated, of the above-named dyes in alcohol, or other volatile solvent, to polished surfaces (or to surfaces prepared by Japan varnish or paints), such as iron, steel, and other metals, papier mache, and paper rendered impervious by varnish, or other well-known means, porcelain, slate, enamel, leather, bone, ivory, wood, or straw, when, by the evaporation of the solvent at ordinary or elevated temperatures, a film of the solid dye stuff remains upon the surface, presenting its characteristic lustre.—Patent completed.

2454 W. T. WATTS and D. J. FLEETWOOD. *Improvements in, and applicable to, hydraulic and other presses, parts of which improvements may be employed for, or with, other descriptions of machinery.* Dated August 28, 1867.

This invention relates to a former patent granted to D. J. Fleetwood, dated April 9, 1867, in the specification of which former patent was described a press consisting of a hydraulic cushion as a bed or anvil, and a forcer worked by steam or other power, which press was applicable to the manufacture of hollow forms, the cutting out or piercing of blanks, and to other similar uses. The patentees propose by the present improvements to render this compound press applicable to the purposes of coining, medalling, punching, shearing, and other analogous operations, as well as the manufacture of hollow or tubular forms. The press consists of a hydraulic ram arranged to act as a cushion or anvil, upon which a die or dies or tools may be suitably secured, and the blow or pressure is given by a top forcer working in a guide, and actuated by cam, eccentric, or other suitable medium; and with this description of press, when used in the manufacture of hollow or tubular forms, they propose to employ a pressure plate capable of being acted upon or held down upon the surface of the metal blank under operation by hydraulic rams governed by valves or weights, leverage or springs bearing upon the pressure plate with sufficient power to retain it in position, so that the metal will be drawn equally, and without buckling, from beneath the plate as the forcer operates; and which pressure accommodating itself to the gradual thickening of the periphery of the blank, permits the inner or middle surface to be forced into or through the mould, die, or shaping tool by the forcer or ram. This resilient or self-acting pressure plate may also be used with other kinds of presses, stamps, or hammers.—Patent completed.

2455 W. B. SMITH. *An improved construction of lever watch movements.* Dated August 28, 1867.

This invention is not described apart from the drawings. —Patent completed.

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2456 R. EDWARDS. *Improvements in the construction of locomotive traction engines.* Dated August 28, 1867.

This invention relates, firstly, to means of avoiding the difficulty hitherto experienced in the boilers of locomotive and traction engines when travelling up and down inclines. In constructing such boilers the inventor proposes to divide them transversely into two or more compartments, and to connect the steam spaces of each division by pipes or otherwise. The water spaces he also connects together, but he places valves in the connections, so as to be able to open or close communication between the divisions. The invention relates, secondly, to the construction of gear used in conveying motion (in locomotive engines especially) from the crank or other shaft to the driving shaft wheels or other shafts. The last improvement consists in mounting the axle of the driving wheels (in locomotive engines that are driven by a pitch chain geared to the driving axle) in slots or in links, and by screws or keys shifting the axle in a line with the centres of the pitch chain wheels for taking up any slack chain.—Patent abandoned.

2457 J. MACINTOSH and W. BOGGETT. *Improvements in springs for boots and shoes.* Dated August 29, 1867.

According to one method of carrying out this invention the patentees take two pieces of sheet india-rubber (previous to its being vulcanized or converted, so as to render the same permanently elastic, as is well understood), of the size and shape of the boot or shoe spring required, and coats them on one side with india-rubber cement. They then place the two cemented sides together with a strip of tape or woven fabric inserted between them at the edges to prevent the stitching from giving way when applied as a spring to the upper of a boot or shoe.—Patent completed.

2458 C. D. ABEL. *A new or improved process for the direct production of phosphorus for industrial purposes.* (A communication.) Dated August 29, 1867.

Here phosphate of lime in the form of either apatite, bones, fossil, phosphates, or in any other form, is introduced in a pulverized state in a closed vessel, where it is mixed with twice its weight of silica, also in a pulverized state, in the form of sand, sandstone, or in any other suitable form; charcoal, coal, or coke dust is then added to the extent of twenty-five per cent of the weight of the phosphate, and the mixture is then heated to a temperature between an orange red and a white heat. The silica then re-acts upon the phosphate to form silicates of lime, and the liberated phosphate acid is completely decomposed by the carbon, thus producing phosphorus, which is volatilized and collected in a receiver in any known manner.—Patent abandoned.

2459 H. J. SIMLICK. *Improvements in cigar and pipe lights, and in their mode of construction, composition, and manufacture.* Dated August 29, 1867.

Here the inventor takes ordinary wooden splints, and envelopes them with a coating or network of metallic wire, or sheet or other metal, in conjunction with cotton, by an ordinary braiding machine, and dips them in a pastile composition. By preference he uses four parts of gum, ten of chlorate of potass, three of fine powdered charcoal, one of gum benzoin, and eight of Gascarilla bark. The wire to which the pastile composition has adhered has a permanent hold upon, and to, its stem, and is not liable to fall off.—Patent abandoned.

2460 A. STEWART. *Improvements in textile fabrics, and in the apparatus or means employed for effecting the same.* Dated August 29, 1867.

This invention relates to arrangements of mechanism for printing warps by which new effects are produced upon the cloth made with warps so treated, and consists as follows:—The part of the warp to be printed is carried upon a beam in the ordinary manner, and is led therefrom over a roller on which the blanket used in warp printing machines travels, from which point it is conducted round a steam can, and thence to the warp beam. Near to that point where the warp passes over the blanket, one or more revolving printing rollers are placed which revolve in proximity to the warp as it travels, and, therefore, being supplied with printing liquid, the pattern of the roller or rollers is transmitted to the warp. To produce the new appearance upon the cloth, it is necessary to separate the printed warp threads by warp threads of another colour. This is effected by putting the other half of the warp upon a separate beam, and in passing the printed and unprinted warp threads through separate splits in a reed, after passing through which the two parts of the warp are wound up upon the warp beam ready for being placed in the loom to be woven into cloth. —Patent completed.

2461 J. DOUGLAS. *Improvements in the means of ventilating and regulating the draft of close fire ranges or kitcheners.* Dated August 29, 1867.

Here the patentee makes an aperture at any suitable point in the front or side of the range above the fire, and communicating with the flue. This opening he provides with a door or flap, hinged or otherwise mounted, of a size to fill up the whole area of the flue; this flap is held in any suitable position by a bent arm attached thereto, having teeth or notches catching in a guide fixed at the upper part of the aperture; or it may be otherwise arranged to hold the flap more or less open, as desired. By adjusting the position of the flap, which acts both as a ventilator and damper, the draft in the flue may be regulated according to the requirements.—Patent completed.

2462 C. SLAGG. *Improvements in the application of sewage and other liquid manures to land.* Dated August 29, 1867.

This invention consists in laying down in the land a system of tubes or channels by which the liquid manure is distributed in sufficient proximity to the roots of the plants or crops to which it is applied, instead of on the surface, as heretofore. These channels may be in the form of drain tiles, and laid in like manner to such tiles; these tubes or channels are placed in connection with culverts or main channels or pipes carried along the headlands of the fields or otherwise.—Patent abandoned.

2463 J. and G. W. DYSON, and S. MARTIN. *An improved mode of cutting up iron and steel rails, and rail ends, in order to utilize them.* Dated August 22, 1867.

The patentees claim cutting up iron and steel rails and rail ends longitudinally at each end of the web by circular cutters, substantially in manner and for the purpose described.—Patent completed.

2464 J. and R. D. PAULIN. *Improvements in apparatus for feeding paints on the stone or stones on which they are to be ground.* Dated August 29, 1867.

The patentees make a receiver for the paint of any convenient size, form, and material, within which, and at the bottom thereof, is a knife (by preference double curved) revolving on its spindle; at the side of the receiver is an opening with arrangements for closing the same to a greater or less extent, as may be desired. The knife during its revolutions pushes some of the paint through the opening in the side of the receiver into a box. Another knife moved by a crank at the proper time cuts off that portion of the paint which projects from the receiver into the box, and in travelling back to its former position carries such portion of paint to a position immediately over or communicating with the eye of the stone; and provision is made for raising the knife preparatory to its being moved again towards the receiver, so that the paint is dropped which falls or is conveyed into the eye of the stone.—Patent completed.

2465 W. MUIR. *Improvements in apparatus for starting, propelling, and stopping, railway trains or carriages, and ships or vessels.* Dated August 29, 1867.

This invention consists in starting, propelling, and stopping railway trains or carriages by the adoption of a system of endless chains, bands, wire, or other ropes, one at least of such endless chains, bands, or ropes being used for a given length of the railway, and being conducted along each side thereof (near to each rail, for instance), and over wheels or pulleys situated at right angles to the lines of rails, or at the ends of the lines of rails, or in any other suitable position. One or both the wheels may be used as driving wheels, besides which the patentee uses other wheels or pulleys as guides, one at least being adjustable for tightening the chain rope or band.—Patent completed.

2466 A. M. CLARK. *Improvements in apparatus for submarine exploration.* (A communication.) Dated August 29, 1867.

This invention consists in combining with the working chamber or chambers in which the explorers are to be placed a reservoir or reservoirs containing air, forced in before sinking, compressed to such an extent and in such quantity, and so combined with the said working chamber or chambers, that the explorers inside may draw the required supply from the reservoir to suit their own demands for respiration, and to control the buoyant or rising power of the apparatus, or sustain it with the top above water when the top is open for any purpose.—Patent abandoned.

2467 W. E. NEWTON. *Improved steering apparatus.* (A communication.) Dated August 29, 1867.

Here, on the upper part of the rudder post, a collar is firmly secured, and is provided with three radial recesses to receive a dog, which is pivoted in a plate or stock firmly secured to the deck. When the dog is raised, the rudder is free to turn, but when the dog is let down and adjusted in any one of the recesses of the collar, the rudder will be held firmly in position, and may be retained in any of the positions necessary in sailing a vessel, or when the same is lying in port. To the upper end of the rudder head there is firmly attached a toothed segment, the teeth being pendent or projecting downward, and into the teeth of this segment gears a pinion on a shaft which carries a spur wheel which gears into a pinion on the hand wheel shaft.—Patent abandoned.

2468 A. M'N. and M. A. WIER. *Improvements in signalling and indicating apparatus.* Dated August 29, 1867.

Reference to the drawings is essential for a full description of this invention.—Patent completed.

2469 W. E. NEWTON. *Improvements in rudders.* (A communication.) Dated August 29, 1867.

This invention consists in constructing the rudder with a wrought or hollow cast-iron post provided with a projecting V-shaped feather for receiving the back of the blade of the rudder, which is of wood, and is secured to the post by metal straps which pass round the post, and are fixed to the blade by transverse bolts. The rudder post is secured to the stern post of the vessel by means of similar straps which pass round the rudder post and lie in recesses made in the rudder post. These recesses admit of the post having considerable endway or vertical motion. The post is supported from above by a collar which rests on a plate let into the deck.—Patent abandoned.

2470 J. SILVESTER. *Improvements in spring balances.* Dated August 30, 1867.

Here the patentee makes the trough-like frame or case of the balance open at its front and at its bottom end. The top of the helical spring of the balance is hooked to a pin or projection at the top of the case, and the bottom of the spring carries a movable bottom plate, which, when the spring is in its contracted or normal position, closes the open bottom described of the case of the balance. To the bottom or closing plate described a flat plate, nearly as long as the balance, is fixed. To the top of this flat plate the finger or pointer of the balance is fixed. The helical spring bottom and flat plates being fixed together, they are placed in the case of the balance, and the top of the spring is hung to the top of the said case. The parts described are fixed in their places, and the front of the case is covered by a dial plate having a slot in its middle, in which slot the finger or pointer on the flat plate works. The top of the case carries a ring or loop by which the balance is suspended, and the movable bottom plate carries a hook to which the article to be weighed is hung. On placing a weight on the hook described, the helical spring is elongated, and the lower part of the spring, and the bottom or closing plate and flat plate connected with the said spring, are made to project from the bottom of the case of the balance. By the elongation of the spring and the descent of the flat plate, the pointer carried by the said flat plate traverses the slot in the dial plate and indicates upon the dial plate the weight hung on the balance.—Patent completed.

2471 A. M. CLARK. *Improvements in the mode of removing and cutting the hides of animals for the manufacture of driving bands or tubes of leather.* (A communication.) Dated August 30, 1867.

This invention relates to the production of driving bands and tubes of great length of leather without joins or rivets, or with only one join. In order to obtain them the patentee adopts a new mode of skinning the animal from which the hide is obtained, and also of cutting up the hide. One method is as follows:—The hide is cut along the line of the back, and then in the line of the longitudinal axis of the head, and also along the whole length of the belly. The hide in this manner will be severed in two parts, except in the hind part, which serves to connect them, and when the hide is opened out, strips double the length of the animal may be cut therefrom.—Patent completed.

2472 R. WEARE. *Improvements in furnaces.* Dated August 30, 1867.

In arranging steam boiler and other furnaces the inventor forms the firedoor as an open frame, into which, on the side next the fire, a number of plates of zig-zag form are fitted, so as to leave air passages of a similar form between them. On the outside of the door there are lower plates by which the admission of air to the passages may be regulated. The firebars are cast with curved notches in their sides at short distances apart, so that when the bars are set up for use they form a grate or surface with numerous passages through it for the passage of air to the fuel. A water cistern with a supply and an overflow pipe is provided in the ash-pit beneath the firebars.—Patent abandoned.

2473 I. DIXON. *An improved submerged propeller for navigable vessels.* Dated August 30, 1867.

To construct a propeller according to this invention, the boss or nave may be oval-shaped, or egg-ended, from which spring two or more flat, or nearly flat, blades set at the required angle to the driving shaft on which the propeller is mounted. When these blades are made from plates of sheet metal, it is preferred they should be tapered or chamfered off at one or both sides of the outer edges, so as to form feather or sharp edges on outer rims of the blades, and when the propeller or blades thereof are constructed of cast metal to ensure strength and easy evolution in the water, it is preferred to form the back and front surface of the blades slightly convex, that they may have sharp edges, and the body of the metal of which they are formed placed in the best position to ensure maximum mechanical strength in the amount of the material employed, and at the same time prevent the least possible resistance to their evolution in the water.—Patent completed.

2474 M. HAMMERSTEIN. *Improvements applicable to cigars, cheroots, cigarettes, pipes, and other smoking tubes.* (A communication.) Dated August 30, 1867.

To apply this invention to (say) a cigarette, a thin film of cork of (say) from half an inch to three-quarters of an inch wide, on one side of which is applied any suitable waterproof composition of gum, glue, &c., which is then rolled round the end of the cigarette that is to be placed between the lips, thus forming a cylindrical belt encompassing the inner end of the cigarette.—Patent completed.

2475 A. H. BRANDON. *An improved carpet stretcher and tack driver.* (A communication.) Dated August 31, 1867.

This invention consists in arranging and combining together two parts, one the shaft for the stretcher, the other the tube and operating parts for the tack driver, these operating parts being, first, a plunger or hammer. Second, a spring by which the hammer is operated. Third, a peculiar shape to the lower part of the plunger by which the descent of the tack is regulated. Fourth, the jaws which hold the tack ready to be driven into the floor by the blow of the plunger, and which open at the required moment to allow the tack to pass.—Patent completed.

2476 J. A. BROWN. *Improved apparatus for propelling ships and other vessels, and for actuating machinery applicable to other purposes.* Dated August 31, 1867.

This invention, when applied to the propulsion of ships and other vessels, consists in the construction and arrangement of two or more separate horizontal propellers attached to either side of the keelson, either at the stern or bows, or amidships, or at all such parts within or outside the lines of the ship or vessel to be propelled. The patentee claims the mechanism described, and shown in the drawings, as a combined apparatus for propelling ships or other vessels; but more especially he claims the peculiar mechanical contrivance of feathering the fin blade or propelling arm, and the manner of performing and regulating the same in the various positions of its stroke; and also employing the same mechanism as a motive power for actuating machinery by the pressure of wind or water. —Patent completed.

2477 W. J. MATTHEWS. *Improvements in breech-loading firearms.* Dated August 31, 1867.

The patentee claims constructing and arranging breech-loading firearms as described. He also claims closing the breech of the barrel by a block turning in behind it about a transverse axis, and being then secured by a second block carried by the first block on a longitudinal axis, and moving in rear of the first block, as described. He also claims constructing and arranging the extractors, as described.—Patent completed.

2478 W. AUBERT. *Improvements in apparatus for diffusing odours or perfumes.* Dated August 31, 1867.

According to this invention the inventor employs for evaporating perfumes an apparatus of an ornamental form, consisting of a covered reservoir in which the perfume is placed, and through the cover of this reservoir a large number of holes or perforations are formed, through which small strips of sponge, &c., are inserted. These strips suck up the perfume from the reservoir in its liquid form, and expose it to be evaporated on their ends, which are above the cover, and present an extended evaporating surface. In this way the composition of the liquid in process of evaporation is maintained until it has all volatilized, identically what it was at the commencement of the operation. The cover supports an ornamental vase which forms a funnel for supplying the reservoir from time to time.—Patent abandoned.

2479 A. FENTON and J. SANDILANDS. *Improvements in machinery to be employed in the manufacture of fish hooks and fishing rods.* Dated August 31, 1867.

This machinery consists of a horizontal shaft working in bearings, and provided with a flywheel and fast and loose pulleys. Upon the shaft two steel cylinders are mounted, one of the said cylinders being provided with semicircular grooves, and the other with V-shaped grooves. The said grooves of the cylinders are made into filing or cutting surfaces, and are of different sizes for filing different sizes of fish hooks. The cylinders or circular files are composed of a series of steel discs strung upon the shaft, and bound together by collars. The fish hooks to be filed or finished are fixed in a holder upon a horizontal table or slide working in a dovetail on the bed of the machine. A rapid rotatory motion being given to the cylinders or circular files, the table carrying the fish hooks is advanced by a lever towards the said circular files, and the points of the barbs of one set are filed or finished by the semicircular grooves of one circular file, and the sides of the barbs of another set are filed or finished by the V-shaped grooves of the other circular file. The fish hooks are fed to the holder by hand, or by a hopper, or otherwise.—Patent abandoned.

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2480 D. NICOLL. *Improvements in electric telegraph conductors, and in the means of laying and securing the same, also in the machinery and apparatus to be employed therein.* Dated August 31, 1867.

The patentee claims the use and application of a locomotive steam engine or machine for opening and preparing earth, soil, or sand to receive underground telegraphic wires, and for supplying the trenches so prepared with insulating material or waterproof compound for an extra or final insulation and protection of the wire or wires when such have been received or laid therein in lengths or rigid sections, such wire or wires having been previously and separately insulated, and when several are used solidified together, as described in the specifications of two former patents, and more particularly in that dated March 11, 1867 (No. 694). He also claims the completion of the junctions of a continuous wire or wires by the use of percussion or compression obtained by steam, hand, or other machine, all substantially as specified.—Patent completed.

2481 E. K. DUTTON. *Improvements in window sash fasteners, which are also employed to sustain the window sashes in any desired position when the window is opened.* (A communication.) Dated September 2, 1867.

Here a lever works in a "frame" or "fixing" of a suitable form and material, the fulcrum of the lever being nearer to one end than the other, the shorter end of the lever having been suitably formed to have affixed thereto a pad of caoutchouc, &c., and the longer end of the lever being suitably shaped to be operated upon by the hand. The frame and lever are affixed to the side of the "sash frame," or so let into the same that the pad of caoutchouc is pressed against the fixed window frame in which the sash slides, a spring operating upon the lever to give the said pressure; when the window is closed, a projecting portion of the lever enters a slot in a metal plate affixed to the window frame and effects the desired fastening.—Patent abandoned.

2482 H. O. W. and E. F. COOPER. *An improved method of watering roads, streets, and other places.* Dated September 2, 1867.

The patentees claim the use of chloride of calcium, or chloride of magnesium, and common salt or rock salt in water for watering roads.—Patent completed.

2483 R. WATSON. *Improvements in brakes for railway trains, parts of which can be used or applied for signalling on trains in motion.* Dated September 2, 1867.

This invention relates, first, to an arrangement of mechanism to be applied to railway carriages when coupling chains or ropes are employed to connect the brakes from one carriage to another, and has for its object to keep the chains or ropes tight at all times. In carrying one part of the invention into effect the inventor connects or couples to the carriages, or between the brakes on the carriages next to each other, an arrangement of three, four, or more levers; he prefers four. These levers are jointed together at their ends on studs, the number of the studs being the same as the number of the levers, on which they are free to move. On the studs, pulleys or rollers are fitted, and the coupling chains or ropes are passed over these. The levers, studs, and pulleys or rollers when fitted together and placed in position (four levers being used) are of a diamond form in outline, and whether drawn out longitudinally by the carriages moving further apart, or folded up by the carriages coming nearer together, the same quantity of chain or rope is required to pass over them.—Patent abandoned.

2484 C. GELSTHARP. *Improvements in the manufacture of malleable iron, cast iron, and steel, and in the construction of furnaces to be employed for such purposes.* Dated September 2, 1867.

The patentee claims, first, the construction of the blast gas furnace which separate melting and reducing chambers, and the arrangement of a separate fuel chamber, as described and set forth. Second, the construction of furnaces for reducing iron ore with solid or gaseous fuel by direct heating with a non-oxidizing flame passing under the ore bed, before or after passing over the ore, as described and set forth. Third, the application of the gas blast furnace to the melting of spongy iron, as described and set forth. Fourth, the methods of treatment in the manufacture of malleable iron, cast iron, and steel, substantially as described and set forth.—Patent completed.

2485 A. V. NEWTON. *An improved manufacture of tool for cutting stone.* (A communication.) Dated September 2, 1867.

This invention relates to a novel saw or rotary cutting tool. The edge or periphery or perimeter of the cutting tool is studded with small precious stones of great hardness or pieces thereof (diamonds being preferred), the same being so disposed that the stones shall form the cutting edges or points of the saw, some of them projecting on either side of the saw plate to cut a "kerf" sufficiently wide to keep the plate from binding in the kerf.—Patent completed.

2486 H. VALLANCE. *Improvements in fastenings suitable for casement windows.* Dated September 2, 1867.

The patentee claims combining with the latch fastening of a casement window a rod passing along the frame to a pin or bolt locking with a quadrant, in such manner that the movement of the latch handle is communicated to the said locking pin or bolt, as described.—Patent completed.

2487 C. TESSIER. *Improvements in the apparatus for moderating or regulating the feeding of the pulp in paper machines.* (A communication.) Dated September 3, 1867.

This invention is not described apart from the drawings.—Patent completed.

2488 W. R. PAPE. *Improvements in breech-loading firearms.* Dated September 3, 1867.

This invention relates to breech-loading firearms, more especially to that class of arm commonly called "drop down" guns, and consists, first, of an improved action and cartridge extractor, by which action the empty cartridge case, after the piece has been fired, is drawn out by the act of opening the breech, instead of being pushed out in the ordinary way. The invention further consists of an improved form of locking down wedge by which the wear is compensated. Another improvement consists in fitting an anvil or striker to the cock; this anvil is actuated by the motion of the cock as it is drawn back by hand, or driven forward by the lock mainspring.—Patent completed.

2489 A. FIELD and W. B. NATION. *Improvements in ornamenting candles, and in apparatus or machinery employed for that purpose.* Dated September 3, 1867.

One part of this invention consists in producing upon the surface of candles helical or straight grooves, and in filling such grooves with wax, stearine, paraffin, or other suitable fatty matter of a different colour or colours from that of the candle. Another part has for its object to produce candles with ornamental designs upon their surfaces by folding moulds.—Patent completed.

2490 A. LEIGH. *An improved compound or composition to be employed in sizing and finishing woven fabrics and yarns.* Dated September 3, 1867.

This invention consists in mixing together the following ingredients in about the proportions given, and in applying the composition to woven fabrics or yarns as a sizing material. The inventor takes about six pounds of yellow resin, and about four pounds of pearl ash, and dissolves them in about twenty-five gallons of hot water; he then adds thereto about four pounds of farina, and six pounds of brown whitening, and thoroughly intermixes the whole, which is then ready for use.—Patent abandoned.

2491 J. M'KECHNIE. *Improvements in apparatus for applying concentrated heat, and suitable for lighting fires, brazing, and similar uses.* Dated September 3, 1867.

This invention consists in adding to ordinary portable bellows an equalizing air compartment compressed by a spring weight, and by fitting thereto a duplex nozzle in place of the ordinary one, such duplex nozzle having a central channel for the air, and a concentric annular channel for gas, or for oil or other burning fluid. When made for gas, the nozzle has fitted to it a small stopcock to receive a small flexible tube from any convenient gas-pipe or bracket; but when made for oil, it has fitted to it a small receptacle for the oil; and if the apparatus is made for lighting house fires, the receptacle may be made of a size to contain the small quantity requisite for lighting one fire. A wick is, by preference, used with the oil, and the annular channel must be made large enough to receive it, and in two parts that can be separated so as to introduce it.—Patent abandoned.

2492 A. E. GELHAYE. *Improvements in machines for manufacturing chains, cords, ropes, and the manner of making such chains, cords, and ropes.* Dated September 3, 1867.

The patentee claims the construction of a machine, as described, or a modification thereof, with an eccentric grooved cylinder, hollow centre pinion, or grooved pillar, with rising and falling slides, needles, and clutches, the whole being worked by steam or hand power, or by treadle, if preferred.—Patent completed.

2493 P. F. LUNDE. *Improved apparatus for obtaining extracts from vegetable substances.* Dated September 3, 1867.

The patentee claims causing the water to pass through successive layers of the vegetable substance intended to be operated upon, in such order that the water is always made to pass first through the first layer or charge of vegetable substance, and in succession through those layers or charges which have been subsequently added, as set forth.—Patent completed.

2494 E. Y. ROBBINS. *Improvements in firegrates.* Dated September 3, 1867.

This invention consists in forming the front of the grate basket, or part of the grate in which the fuel is held, concave in its horizontal or vertical, or in both its horizontal and vertical sections, so throwing the fuel into such position that there is cross radiation from one part of the front of the fuel upon another part, keeping the entire front surface of the fuel hot and brightly incandescent; also forming a highly heated channel of draught, drawing up smoke and the dust of ashes into the flue, this channel of draught being entirely within the fireplace or stove, and the bars so shaped that any smoke coming from the fuel between the bars is under the arch and within the jambs, and not likely to get out into the room.—Patent completed.

2495 L. N. LE GRAS. *Improvements in milk cans.* Dated September 3, 1867.

This invention consists, first, in making milk cans of two or more thicknesses of tin, &c., the space or spaces between the thicknesses being filled with charcoal, or other non-conductor of heat, so that milk placed in the can is not affected by change of temperature. Second, in compressing the milk when in the can so as to make it, as it were, a solid body incapable of any movement.—Patent abandoned.

2496 E. T. ARCHER. *Improvements in spring mattresses.* Dated September 3, 1867.

The patentee claims constructing mattresses of a combination of wood laths and springs, and accessory parts, arranged and applied in the manner and for the purpose described.—Patent completed.

2497 A. M. CLARK. *Improved machinery for cutting, carving, and engraving upon ivory, wood, stone, metals, and other substances.* (A communication.) Dated September 3, 1867.

This invention is not described apart from the drawings.—Patent completed.

2498 G. SMITH. *Improvements in ladders suitable for fire-escapes and other purposes.* Dated September 4, 1867.

According to this invention the inventor combines two or more ladders, according to the amount of extensibility required, disposed one within the other, the inner ones being capable of sliding in the outer ones. The outer ladder of the series is pivoted or carried on hinges or centres at its lower end, such centres being fixed on a carriage mounted on wheels for the facility of transport. There are various other features comprised in the invention.—Patent abandoned.

2499 G. CRANE. *Improvements for speedily and effectually removing snow from roads and streets.* Dated September 4, 1867.

Here the patentee proposes to provide a small steam boiler on a land carriage drawn by one or two horses for the production of steam at a pressure of about 40lb. The boiler is to be provided with pipes or hose to convey the steam and apply it as follows:—A gang of men is to be employed in bringing the snow by scraping it up, or in hand barrows, from the more distant parts, that is, from equal distances between the openings to the sewer to the openings. A perforated iron shield is to be placed over the opening, to keep the snow from actual contact with the grating of the sewer. The pipe or hose from the boiler is to be inserted beneath this shield, and the steam allowed to play upon the snow as fast as the latter can be conveyed and piled upon the shield.—Patent abandoned.

PROVISIONAL PROTECTIONS.

Dated January 22, 1868.

224 C. R. Broadbent, Southampton-buildings, Chancery-lane, doctor of medicine. Improvements in the manufacture of shoes.

Dated January 25, 1868.

272 F. Wirth, Frankfort-on-Maine, Germany. An improved apparatus for heating, evaporating, and decomposing water, oil, and other substances. (A communication.)

Dated January 27, 1868.

282 W. Ellis, Colwick-lane, Sneinton, Nottinghamshire, scaleboard cutter and box maker. Improvements in, or applicable to, circular or rotating machines for cutting wood by hand or steam power, for making laths, cards, strips, or slices of wood and other articles.

Dated February 3, 1868.

369 J. Offord, Oxford-street, and S. W. Hale, Paddington, coach builders. Improvements in public and private carriages and vehicles, in regard to opening and closing the heads or hoods of those having movable heads or hoods, and opening and closing the doors of public and private carriages and vehicles generally.

Dated February 10, 1868.

450 A. M. Clark, Chancery-lane. Improvements in breech-loading ordnance and projectiles. (A communication.)

Dated February 13, 1868.

489 C. Blyth, mill manager, Dundee. Improvements in machinery and apparatus for measuring and cutting cloth for bags and for other purposes.

Dated February 15, 1868.

515 L. Mummenhoff, Saint Mary Axe, City. Improvements in compositions for the manufacture of building blocks, and for use in building. (A communication.)

Dated February 18, 1868.

526 A. M. Duflihol, Passage des Petites Ecuries, Paris, Captain and Adiutant Major in the 5th Regiment of Dragoons of the French Army. An improved method of shoeing horses, and other beasts of burden.

Dated February 20, 1868.

571 W. E. Newton, Chancery-lane. Improvements in mechanical movements adapted for use in clocks and watches, and wherever else it is desired to multiply motion or to convert speed into power. (A communication.)

Dated February 22, 1868.

589 R. B. Mitchell, Sheffield, edge tool maker. An improved method for making plane irons, sheep shears, and other edge tools.

Dated February 24, 1868.

604 H. Chamberlain and J. Craven, Wakefield, Yorkshire, engineers, and H. Wedekind, Dunster-court, Mincing-lane, City, engineer. Improvements in the burning of bricks, lime, cement, and other like substances, and in the kilns employed therein. (Partly a communication.)

Dated February 25, 1868.

618 J. Vevers, Leeds, machinist. Improvements in spinning and twisting machinery. (A communication.)

628 F. Remy, Rue du Faubourg St. Martin, Paris, manufacturer. An improved steel seat or chair.

Dated February 26, 1868.

640 T. Lythgoe and H. Thornton, Manchester, joiners and builders. Improvements in the construction of walls, floors, and roofs for buildings in which concrete and iron are used, and in apparatus employed therein.

Dated February 27, 1868.

654 F. Dumas, Passage des Petites Ecuries, Paris, proprietor. Improvements in bathing dresses, for the treatment of skin and other diseases.

665 W. E. Newton, Chancery-lane. Improvements in pens and pen and pencil holders. (A communication.)

670 G. Hart, Wakefield, Yorkshire, engineer. An improved mode or method of, and apparatus for, effecting the consumption or prevention of smoke in steam boiler and other like furnaces.

Dated February 28, 1868.

673 J. Livesey, Victoria Chambers, Westminster, engineer. Improvements in coupling, driving, and retarding locomotive carriage or other wheels on railways, or for other purposes.

680 J. Dunkerley, Denton, Lancashire, hat manufacturer. Certain improvements in the method of manufacturing hats or coverings for the head, and in apparatus employed therefor.

Dated February 29, 1868.

690 E. Baker, Charles-street, Mortimer-street, Middlesex. Improvements in the formation and application of screw bolts.

691 H. B. Wilder, Sulham House, Sulham, Reading, Berkshire. Improvements in magnetic electric telegraphic apparatus for signs, letters, or sentences, with bell and self-acting mechanical switch.

692 J. Collins, Dawson-street, Dublin. Improved apparatus for filling cartridge cases for breech-loading guns.

693 L. C. Detouche, Rue St. Martin, Paris, clockmaker. Improvements in apparatus for registering the number of passengers travelling by public conveyances, and the amount of fares paid.

696 W. Smith, J. Giddings, and J. Rank, Hull, Yorkshire. A new or improved fire-escape.

698 R. Zwez, Harrington-street, Hampstead-road. A new or improved can for containing petroleum, paraffin, hydrocarbons, and such like oils or spirits, and other liquids.

700 W. Barford, Peterborough, Northamptonshire, and T. Perkins, Hitchin, Hertfordshire. Improvements in apparatus for raising and stacking straw and other agricultural produce.

702 L. B. Schmolle, Aldermanbury, City, manufacturer. Improvements in skeleton skirts.

Dated March 2, 1868.

706 W. Rollo, Dundee, Forfarshire. Improvements in the arrangement and construction of water-closets.

708 W. E. Newton, Chancery-lane. Improved apparatus for burning hydrocarbons for heating purposes. (A communication.)

710 T. Horsley, Coney-street, York. Improvements in breech-loading firearms.

712 A. Smith, Litchurch, Derbyshire. Improvements in the construction of railway waggon axle boxes.

Dated March 3, 1867.

714 W. E. Gedge, Wellington-street, Strand. A mineral paper-hanging intended to preserve apartments from dampness. (A communication.)

717 F. Moss, Eccles, Lancashire. Improvements in apparatus for registering passengers travelling by public vehicles, and in the construction of certain vehicles to be used in combination therewith.

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719 T. Bisset, Marlee, Blairgowrie, Perthshire, implement maker. Improvements in reaping and mowing machines.

720 W. B. Thompson and W. Gall, Dundee, Forfarshire. Improvements in machinery or apparatus for winding yarns or threads.

721 J. A. Haswell, Gateshead, Durham, engineer, and G. Brown, York, carriage builder. Improvements in signal apparatus to be used in railway passenger trains.

722 J. Manly, Birmingham, brassfounder. Improvements in nails which are used upon furniture, saddlery, and trunks, and for other useful and ornamental purposes.

723 W. Spence, Quality-court, Chancery-lane. Improvements in machines for making nails. (A communication.)

724 H. Zox, Nelson-square, Blackfriars, hat manufacturer. Improvements in the manufacture of hats and caps, and other coverings for the head.

725 W. Whittle, Harborne, Staffordshire, mechanical engineer. Improvements in steam engines and steam boilers.

726 J. Dewar, Kirkcaldy, Fifeshire, doctor of medicine. Improvements in preserving blood for use as food.

727 G. Anderson, Northumberland-street, Strand, gas engineer. Improvements in apparatus for moulding and compressing substances for artificial fuel.

728 E. Burton, Clapton, Middlesex, and J. Lawrence, Uckfield, Sussex, engineers. Improvements in machinery for screening and sifting coals, cinders, and other matters.

729 H. Kennedy, Southampton-buildings, Chancery-lane. An improved machine for cutting files.

730 S. A. Bell, Bow-lane, City, and G. H. Higgins, Fairfield-road, Bow, machinist. Improvements in the manufacture of match boxes, and in apparatus to be used therein.

731 T. Johnson, Runcorn, Chester. Improvements in treating ores to obtain copper therefrom, and in evaporating brine.

732 J. W. and C. R. Harrison, Hampstead-road. Improvements in parallel rulers.

733 B. W. A. Sleigh, Langham-place, Portland-place. Improvements in hydrostatic engines.

734 J. A. Lee, Lydney, Gloucestershire. Improvements in machinery for cutting and reducing wood, adapted especially to prepare it for the preparation of paper fibre therefrom.

735 I. W. Nasarow, Finsbury-square. Improvements in the manufacture of iron and steel. (A communication.)

Dated March 4, 1868.

737 S. Jefferies, Dudbridge Hill, Stroud, Gloucestershire, engineer. Improvements in, and apparatus for, securing, adjusting, and arranging cords, ropes, and chains employed for raising and lowering venetian blinds, curtains, windows, shutters, and other analogous purposes.

739 A. Cole, Erith, Kent, merchant's clerk, and J. Carter, Bexley Heath, Kent. Improvements in, and applicable to, lamps for burning petroleum, hydrocarbon, and other oils.

740 E. Clifton, Bradford, Yorkshire, ironmonger. Improvements in adjustable door handles.

742 H. E. Smith, Hereford, engineer. Improvements in the hauling or winding gear of engines used for agricultural and other purposes.

743 A. M. Clark, Chancery-lane. Improvements in paving roads, streets, or ways. (A communication.)

744 W. K. Stuart, Glasgow, chemist. Improvements in arrangements and apparatus for dealing with and utilizing sewage.

745 J. G. Kincaid, Greenock, Renfrewshire, engineer. Improvements in twin-screw propelling apparatus.

746 W. and T. Mitchell, Stacksteads, Lancashire. Certain improvements in the manufacture of felt carpeting, and in apparatus to be employed therein.

748 C. Scholefield, Beverley, Yorkshire, engineer. An improved method of hanging or suspending window sashes.

749 J. Askew, Charles-street, Hampstead-road, engineer. Improvements in the construction of a hook and eye for fastening together the ends of window blind cords, and cords for hanging pictures.

750 J. Brigham and R. Bickerton, Berwick-upon-Tweed, agricultural implement makers. Improvements in reaping and mowing machines or harvesting machines.

751 L. Cole, manufacturer, and A. Maxfield, machinist, Birmingham. Improvements in sewing machines.

752 C. R. Rockley, Cannon-street, St. Paul's, City. Improvements in pipes for smoking tobacco.

Dated March 5, 1868.

755 F. T. Baker, Fleet-street, City, gunmaker. Improvements in the manufacture of cartridge cases.

756 J. J. F. Stevens, Southwark, Surrey, engineer. Improvements in the construction of railway and other signal apparatus.

757 J. Hammersley, Spencer-street, Clerkenwell, chronometer manufacturer. Improvements in the construction of marine chronometer boxes.

758 H. A. Dufrene, South-street, Finsbury. Improvements in covers or capsules for jars, pots, and other vessels. (A communication.)

759 W. Hunt, Castleford, Yorkshire, manufacturing chemist. Improvements in treating certain compounds of copper and iron, and in utilizing residual products obtained therefrom.

761 W. E. Gedge, Wellington-street, Strand. Improvements in steam engines. (A communication.)

762 J. Westray and J. Forster, Barrow-in-Furness, Lancashire, engineers. Improvements in machines for drilling and boring.

763 J. Hartshorn, Nottinghamshire. Improvements in the manufacture of lace in twist lace machines.

764 J. L. Clark, Beechmont, Sydenham Hill, Surrey. Improvements in differential galvanometers.

765 C. H. Gould, Birmingham. Improvements in single or combined rivets for riveting the soles of boots and shoes, and in the machinery for manufacturing them; likewise in the means for grooving boot and shoe soles for receiving such improved rivets, and also in the tools used for applying the same.

767 H. Drake, Chef of the Carlton Club, Pall Mall. Improvements in the preparation of essences suitable for soups.

769 A. V. Newton, Chancery-lane. Improved apparatus for cultivating land and sowing seed. (A communication.)

770 A. M. Clark, Chancery-lane. Improvements in steam pumps. (A communication.)

771 J. Dickson, Belfast, mill mechanic. Improvements in lubricators or tallow feeders.

Dated March 6, 1867.

773 I. L. Pulvermacher, Regent-street, electrical engineer. Improvements in apparatus or means for producing, applying, and ascertaining the power of electric currents.

774 J. Brinsmead, Wigmore-street, Middlesex, pianoforte manufacturer. Improvements in the construction of pianofortes.

775 J. M. Stanley, East Parade, Rhyl, Flintshire, ironfounder. Improvements in the construction of furnaces.

776 T. Whittaker, Manchester. Certain improvements in the preparation of paper to be employed in the manufacture of waterproof paper.

778 G. Hauxwell, Durham, engineer and millwright, and J. Ryder, Sunderland, Durham, miller. Improvements in preparing hard foreign wheat for manufacturing into flour, and in apparatus to be employed for such purpose.

780 J. Watson, Durham, manufacturing chemist. Improvements in blast furnaces, and in obtaining a hot blast for the same.

782 T. Atkins, Fleet-street, City. Improvements in apparatus for extinguishing fire.

784 J. Parker, Lilford-road, Camberwell. Further improvements in apparatus for obtaining motive power for engines by a combination of steam and air, and for the prevention of racing in steam and air marine engines, and for a condenser applicable to steam and air engines, and for other purposes.

786 J. G. Tongue, Southampton-buildings, Chancery-lane. Improvements in the construction of steam boilers. (A communication.)

Dated March 7, 1868.

788 J. Campbell, Founder's-court, Lothbury, City, engineer. Improvements in floating docks.

790 R. Leake, Manchester, and R. Platts, eccentric engraver. Improvements in machinery for etching or engraving rollers for printing.

792 H. Simmonds, Mark-lane, City. Improvements in machines for hulling or decorticating cotton or other like seed. (A communication.)

794 A. C. Kirk, Glasgow, engineer. Improvements in treating cast iron.

796 R. Tooth, Fenchurch-street, City. Improvements in the evaporation of liquids, and in apparatus to be employed therein.

798 J. Thompson, Manor House, Camberwell-road, and J. Thompson, Camberwell Green. Improvements in fixing door and other knobs, and in connecting knobs to spindles.

802 E. Casper, Cannon-street, City, merchant. An improved apparatus for raising and forcing liquids, more especially designed for supplying water to steam boilers. (A communication.)

Dated March 9, 1868.

804 H. M. Lee, Cross-street, Manchester, jeweller. Improvements in cases employed to contain visiting or address cards.

808 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in screw bolts and nuts for securing fish plates and other objects. (A communication.)

810 A. F. Baird, Pimlico, Lieut.-Col. in the Bengal Staff Corps. Improvements in earth closets, applicable also to urinals.

812 H. Willis, Rochester-terrace, Camden-road, organ builder. Improvements in the construction of organs.

814 E. Morewood, Cheam, Surrey. Improvements in coating metal plates, and in apparatus used therein.

816 A. M. Clark, Chancery-lane. Improvements in the means and apparatus employed for freezing liquids. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated March 11, 1868.

841 P. Lennox, Lynn, Essex. An improved machine for beaming hides or skins, as well as for scouring and sleeking leather.

Dated March 13, 1868.

865 C. R. Broadbent, Southampton-buildings, Chancery-lane, doctor of medicine. Improvements in the manufacture of hats, bonnets, and other similar articles.

Dated March 16, 1868.

886 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in jacquard looms. (A communication.)

887 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in the permanent way of railroads. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," March 24, 1868.

3181 S. Buxton and W. Gardam. Safety lamps for mines.

3185 W. R. Lake. Armour for war vessels. (A communication.)

3197 R. P. Faucheux. Tobacco pouches.

3202 M. B. Westhead and R. Smith. Arranging tapes in boxes.

3204 L. A. Badin. Bungs for casks.

3210 F. Andrew and E. Whittaker. Rollers for printing colours on yarns.

3220 P. E. Bland. Machinery for making bricks.

3225 R. Harrison. Cocks or taps.

3234 P. M. Parsons. Manufacture of artificial granite.

3240 L. B. Bertram. Tobacco pipes.

3243 A. M. Clark. Refining copper. (A communication.)

3244 J. Templeman. Manufacturing fire-lighters.

3250 C. E. Brooman. Ornamenting bottles. (A communication.)

3255 R. W. Pearce. Apparatus for developing the power of pianofortes.

3257 J. M. Napier. Machines for printing calico.

3259 W. Bailey. System of ornamenting paper-hangings.

3260 J. G. Tongue. Process for ageing and refining wines. (A communication.)

3264 C. E. Brooman. Process of manufacturing metal direct from the ore. (A communication.)

3272 T. Wood. Lamps.

3273 R. Ward and T. Travis. Manufacturing woven fabrics.

3283 S. Coulson. Manufacturing coffins.

3290 W. Brewster. Apparatus for boiling clothes. (A communication.)

3294 G. F. Redfern. Paving. (A communication.)

3307 V. Burchell. Machinery for manufacturing soda water.

3314 G. D. Hughes. Apparatus for consuming smoke.

3223 W. Mort. Preserving meat. (A communication.)

3349 J. H. Johnson. Treating rabbit skins. (A communication.)

3354 C. Coates. Machinery for cutting stone.

3355 J. H. Johnson. Construction of piles. (A communication.)

3357 A. M. Clark. Ornamenting gauze. (A communication.)

3368 W. Palmer. Horses' shoes.

3386 T. B. Jordan and J. Darlington. Machinery for boring rocks.

3393 J. H. Johnson. Machinery for grinding bones. (A communication.)

3419 W. Schofield. Preparing cloth.

3431 S. Vaile. Labels.

3489 W. Clissold. Machinery for preparing fibrous substances for spinning.

3507 W. Palliser. Ordnance.

3563 E. H. Bentall. Apparatus for controlling the draught of water from constant supply pipes.

3588 S. Marsters. Machine for rubbing ropes.

3591 W. E. Newton. Apparatus for manufacturing tinned leaden pipes. (A communication.)

3647 C. J. Adams. Self-acting fire alarm.

3670 B. and J. B. Bowen. Manufacture of gloves.

202 A. V. Newton. Sewing machines. (A communication.)

224 C. R. Broadbent. Manufacturing shoes.

281 W. E. Newton. Machinery for forming hat bodies. (A communication.)

369 J. Offord and S. W. Hale. Carriages.

481 J. G. Willans. Manufacturing iron and steel.

566 P. N. Goux. Disinfecting human excreta.

571 W. E. Newton. Mechanical movements to be used in clocks and watches. (A communication.)

586 A. V. Newton. Reaping machines. (A communication.)

629 J. M'Leod. Apparatus for washing yarns.

685 W. E. Newton. Drying felted goods. (A communication.)

726 J. Dewar. Preserving blood.

746 W. and T. Mitchell. Manufacture of felt carpeting.

778 G. Hauxwell and J. Ryder. Preparing hard foreign wheat for manufacturing into flour.

808 C. D. Abel. Screw bolts. (A communication.)

841 P. Lennox. Machine for beaming hides.

865 C. R. Broadbent. Hats.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed March 20, 1868.

2656 G. E. Marchisio	2715 J. Jameson
2657 J. Hargreaves	2717 E. T. and C. Horsley
2662 B. and A. B. Blackburn	2719 J. Jameson
2665 A. Mackenzie and S. Robinson	2733 J. and J. A. Huggett
2668 A. Aitchison and H. J. Grantham	2753 J. Dewar
2687 W. Winter	2800 R. Hattersley
2688 G. Batcheldor	2888 W. R. Lake
2690 J. H. Brown	2907 W. B. Adams
2692 T. H. Williams	3178 W. Thompson
2701 W. Woodcock	3697 J. E. Gowen
	186 J. Carr and C. Lucop
	345 H. M. Ragland
	283 F. N. Clerk

Sealed March 24, 1868.

2703 A. Rooker	2851 G. Twigg
2706 J. and J. Kirk	2854 J. Withinshaw and J. E. Baker
2713 J., B., and R. Wood	2889 M. A. F. Mennons
2714 A. Morrall	2903 E. Gesaner
2716 G. Wilkinson	2992 J. Mitchell
2731 L. de la Peyrouse	3424 J. Hadley
2736 H. A. Bonneville	3632 J. Hadley
2743 J. Elder	149 J. A. Jones
2763 W. Mitchell	161 S. and E. Burrows
2796 J. Offord	
2838 H. Wallwork	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

734 S. B. Boulton	799 W. J. Coleman
750 J. Bullough	808 G. E. Donisthorpe
753 A. V. Newton	815 D. Mackenzie
759 E. Pilling and J. Harper	818 A. B. Baron von Rathen
768 J. H. Kidd and J. C. Mather	819 R. W. Morrell
771 J. T. Romminger	820 H. Oakes
775 A. G. Browning	822 J. Tall
776 A. V. Newton	823 T. Roberts and L. Luc
785 C. Farmer and T. Turner	824 G. H. and J. A. Castree
778 S. Chatwood	853 W. Betts
	937 P. J. Jamet
	956 W. Bulstrode

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

719 J. Victor and J. Polglaise	710 W. Andrews
	729 A. Haley

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending March 21, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1907	0 4	2273	0 6	2296	0 8	2315	0 4	2333	0 4	2353	0 4
2008	0 4	2274	0 8	2298	0 6	2316	0 4	2336	0 6	2354	0 4
2223	2 6	2275	2 4	2202	3 4	2317	0 4	2338	0 4	2355	0 4
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2258	0 4	2288	0 8	2309	0 4	2327	0 4	2348	0 4	2402	0 1
2260	0 10	2291	0 10	2312	0 4	2328	0 4	2349	0 4	2439	1 4
2263	1 10	2293	0 8	2313	0 4	2332	0 8	2351	0 10	2459	0 4
2264	1 4										

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, APRIL 3, 1868.

COMPOSITE SHIPS.

ABOUT four years since we placed before our readers those facts of interest and importance with which we were at that time cognizant in reference to the construction of composite ships; and, as with England, beyond any other nation, the efficiency and economy of our mercantile marine are of paramount importance, we now revert to that subject. In dealing with vessels of this description—or, indeed, with vessels of any other character that may hereafter be projected—their standard of excellence must necessarily be arrived at by comparison with the existing kinds of vessels they are required or expected to supersede. Commercially, these latter are of two kinds—firstly, those with hulls composed entirely of wood; and, secondly, those with hulls composed entirely of iron. We believe we shall run no risk of contradiction when we state that the old-fashioned wood merchant vessels are doomed in the race of competition now in progress, referring as we do, of course, to the entire mercantile navy, steamers and sailing vessels, required for our ever extending commerce. This point granted, it is only necessary for us to deal with the composite as compared with the iron ship, and it is to this that we invite attention. In dealing with this question, the term efficient must be allowed a more extended meaning than is usually accorded it. Every shipowner is aware that he may be supplied with two vessels of similar sailing and carrying qualities, each at the time deemed "efficient" for a given trade, whilst the cost of the one may be nearly double that of the other, and as economy in these matters is, and probably always will be, the great desideratum of the capitalist, he will naturally invest in that description of property which promises, after all probable contingencies have been duly weighed, the greatest return for his outlay.

The chief advantages of an iron ship are, firstly, great general strength of hull; secondly, small liability to decay; and, thirdly, cheapness of construction. The chief disadvantages are local weakness and liability of the bottom to fouling—the latter being by far the greater barrier to the rapid development of iron ship building. The composite system of construction is susceptible of many ingenious combinations, and in its earlier stages many and varied were the plans adopted. To this fact, to a great extent, must be attributed the greater cost of those vessels, and hence, at one time, the comparatively small demand for them. The one great feature which gave these vessels an ascendancy over those built of iron was the practicability of sheathing their bottoms with yellow metal or copper sheathing, thus enabling them to prosecute long voyages under the most favourable conditions for speed. No one of course doubted their success in this respect, since no new principle was involved in the trial; but the rapid passages made by many of them in the China trade confirmed the most sanguine expectations. But let us see what experience and more mature study have led, and are still leading us, to in the mode of combination; for if it be demonstrated that speed and quick passages are compatible with seaworthiness and durability, it is just possible that a small additional first outlay may eventually be much more than counterbalanced.

Want of space prevents us here entering into the details of the many methods of early construction. It will be sufficient for us to state, broadly, that three modes of combination at first prevailed, which we may briefly describe, or rather classify, as follows:—Firstly, that in which one thickness of planking was employed fastened by iron nut-and-screw bolts; secondly, that in which one thickness of planking was employed fastened by yellow metal nut-and-screw bolts; and, thirdly, that in which two thicknesses of planking were employed—in the last-named case the first or inner skin being fastened through the frames by iron nut-and-screw bolts, and the outer or second skin being fastened to the inner skin alone by bolts of yellow metal or copper driven through and clenched upon rings upon it. With reference to the first-mentioned mode of combination it will by many be known that the heads of the bolts were sunk about 1½in. within the outside surface of the planking, and it was sought to protect them from the deleterious influence of the metal sheathing by means of wooden plugs driven upon them dipped into or covered with white lead or some glutinous composition, and it was asserted by many at the time that the experiment would prove unsuccessful. Experience has proved the truth of this prophecy, for, in several vessels, on examination of the bolts on their removal after three or four years' service, their heads, and necks under the heads, have been found to be considerably affected, the water having doubtless been the constant medium of communication from a very early period after their immersion. These facts, then, would appear to dispose of the principle of iron fastening, inasmuch as concerns those portions of the vessel under, or immediately contiguous to, the yellow metal sheathing.

We now come to the consideration of the class previously designated as Class 2, or that method of construction in which one thickness of planking is fastened with screw-bolts of yellow metal, the nuts of the same material being "set up" upon the inside of the iron frames. We have been reliably informed that these vessels quite realize the expectations formed of them, the iron to be acted upon in these cases being the internal frames or ribs, which, from the absence of the water, remain unimpaired. This exemption, however, would probably not extend to the frames and floor-plates situate in the vessel's bottom were it not for the fact that they are covered with cement to the upper part of the bilges, as are the bottoms of iron vessels. From enquiries we have recently instituted, we learn that this is the type of composite vessels now being adopted, since amongst not less than two dozen, representing a tonnage of upwards of 15,000 tons, now in course of construction at a few of our principal outports (not a bad omen in the present depressed condition of the shipbuilding trade) not a single vessel having two thicknesses of planking is reported as under construction. It should be observed that the yellow metal fastenings, for economy's sake, are not carried above a height where the galvanized iron bolts may be employed with safety as to their proximity to the metal sheathing, and this height is defined to be at a distance of about one-fifth of the vessel's depth of hold set down from the upper deck. From the above facts there can be but little doubt that the extra expense attaching to vessels with two thicknesses of planking is the principal cause for their not being adopted, since it is not by any means the first cost alone that has to be considered, but the many subsequent outlays attending repairs which may be rendered necessary from groundings, collisions, and other contingencies.

Penning the word "collisions" reminds us of a matter in connection with these vessels which we deem of great importance, but which we fear is seldom—if ever—considered, namely, a forward or collision bulkhead. When we remember that the same facilities for their erection exist in these as in iron ships, and bearing in mind the insignificance of the expense as compared with the immense service to be expected of them, we think that no vessel should be considered complete without one. We shall of course be glad to learn that our fears in this respect are without foundation, but we remember going carefully through a long list of suggestions for the construction and classification of composite ships, prepared by the Committee of Lloyd's in the year 1867, and although every page of that list bore evidence of careful research and study, yet we believe that not in a single instance was a bulkhead mentioned. We cannot afford the space necessary for the mere mention of the many instances of their efficacy; but we cannot forbear to instance the collision between the iron steamers "Eider" and "Curfew" off Souter Point, as recently as the 14th of February last. In this case the vessels came fairly end on to each other, and, although the crash was terrific, and the damage great, yet the bulkheads were the means of the preservation of the two ships, and which are now probably running as usual, instead of lying at the bottom of the sea.

If it came within the compass of this article we should like to draw a comparison, as far as is practicable, between the two descriptions of vessels—the composite and the iron—and to show the comparative sectional areas of those portions of their structure which assimilate to each other, for we find that a striking similitude of sectional area exists in all the principal parts of the frames proper, by which we mean the frames, reverse frames, floor-plates, keelsons, beams, stringers and deck stringers, tie-plates, &c. It is true, indeed, that the frames of a composite vessel are spaced somewhat closer than the frames of an iron one, doubtless with the view of contracting the spaces of the plank fastenings in consideration of the caulking, but this addition, with the outside sheer, bilge, and intermediate strakes of plating, make up the chief difference between the two vessels—excepting, of course, that of the planking in the one case, and the plating in the other. It remains, then, to determine which of the two it is desirable to adopt. This will be settled, doubtless, in favour of iron wherever the exigencies of the trade will admit of the frequent cleaning of the bottom; but in the absence of these opportunities, and where facilities do not exist, a copper or metal-sheathed bottom will be adopted, and we doubt not that the composition principle of construction will steadily gain favour as its many advantages become more generally known.

PRESSURE OF THE WIND.

AS the weight of a bridge tends to counteract the momentum, or *vis viva* of a rolling load, so does that of a roof act as a resisting agent against the force of the wind, and were it not that engineering skill and financial economy forbid the adoption of unnecessarily heavy structures, the elements of mass and weight would be more prominently conspicuous in their details. We have now arrived at a time when the theory of the strains, whether due to a live or dead load, brought upon the various parts of bridges and roofs is thoroughly understood. Their direction and amount can be rigidly investigated and accurately ascertained, and instead of, as formerly, combating their action by increasing the total insistent weight of the structure, that is, by mere brute force, the aid of science is brought to bear upon the subject. By its unerring assistance, the requisite degree of strength is bestowed upon each individual member; some are stronger, some weaker than others, but every one receives its proper share of material and performs its own duty, instead of contributing to the stability of the erection in an uncertain, vague, and unsatisfactory manner. Previously to the introduction of wrought iron as a constructive material, weight and strength were synonymous terms, and it was not until the rapid spread

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of steam locomotion necessitated the employment of bridges exceeding in size all existing examples, that it became apparent that the "ponderous principle" must be abandoned. One reason why mass was so much relied upon in earlier times, and regarded as identical with strength, was that the arch was the only known method of spanning any intervening space, and in this form alone the weight may be increased enormously, before it begins to act in a detrimental manner. In the horizontal, catinarian, and other systems, every ounce of weight is a direct element, and constitutes a definite proportion of the breaking weight of the structure. The limit, therefore, at which a bridge designed upon any of the above principles would give way under the action of its own dead weight is soon arrived at, since, while its powers of resistance increase as the square, the force tending to break it augments as the cube. This fact should be borne in mind by those who are advocates for bridges of spans so stupendous as a couple of thousand feet or more.

The pressure of the wind has been variously stated, ranging from 10lb. to 40lb. per square foot. At the Menai bridge the maximum observed was equal to the latter amount, but a pressure so high as 65lb. per same unit of area has been registered by an undoubted authority. From 28lb. to 30lb. per square foot is an ample margin to assume in the case of roofs and all similar buildings. There is perhaps no principle of bridge construction in which a superabundance of dead weight would be more injurious than in the suspension. To a certain extent, it would act antagonistically to a moving load, but if we suppose it to be once set in motion to become itself part of the moving load, it would tend most materially to the downfall of the bridge, and this is what really occurs whenever a suspension bridge is in a state of oscillation. Hence the difficulty of applying this principle to railway purposes. A strong gale of wind was quite sufficient to actually break down some of the earlier suspension bridges, and throw them into a state of undulation to the extent of four and five feet. Bracing in a scientific and judicious manner has been found to be a partial remedy, but it yet remains an unsolved problem how far this remedy can be applied *in extenso*. The question of the pressure of the wind upon a large tubular bridge was entertained at length previously to the erection of that over the Menai Straits. The engineer considered it as a trifle, and not likely to be felt by the bridge, instancing the case of a chimney, which, if properly constructed, rarely suffers from this cause. Nevertheless, chimneys built in the best manner have frequently succumbed to the violence of the hurricane and the fury of the storm.

There is a difference to be noted in the distribution of the wind pressure upon a tubular girder and a roof. In the one it is scarcely necessary to regard the action of the force in any but a lateral direction, whilst in the other it must be considered as exerting a strain in every direction. Although the force of the wind has not been proved to do any injury to bridges even in the most elevated positions, it has produced some serious results with respect to the passage of trains. No less than four accidents have occurred upon the Midland Railway of France, and the company in consequence caused some statistical information to be drawn up which is of much interest. One of the trains which suffered from the cause alluded to, consisted of seven carriages, and the accident took place at a time when it was running over a straight piece of line at a rate of about twenty miles per hour. The wind was a strong north-wester, and its direction was nearly perpendicular to the line of route. Two of the third-class carriages were overturned. The weight of one was almost exactly seven tons; its moment of resistance five tons, the surface exposed to the force of the wind 150 square feet, and the lateral pressure required for its equilibrium 39lb. per square foot. As the carriages were overturned, it is clear that the pressure per square foot was greater than the above quantity, and it is unfortunate that means were not taken to register its actual intensity. At the same time it was ascertained that the force did not exceed a certain limit, since a heavier description of carriage was not overturned. This was a luggage van, of which the weight was rather over 7¼ tons, the moment of resistance above that of the two that suffered overturning, the surface exposed to the pressure considerably less, being, instead of 150, only 110 square feet, and the equilibratory pressure 62lb. per square foot. Had the force of the wind exceeded this latter quantity, the van would have been also overturned. The limits, therefore, of the pressure exerted may be considered as 39 and 62, or, in round numbers, between 40lb. and 60lb. per square foot, which is a very close approximation to those already mentioned at the commencement of the present article. It would appear from these statistics, that when the pressure of the wind exceeds 40lb. per square foot, some of the carriages upon the French railways are liable, in nautical language, to be capsized. This dangerous liability would be farther increased on the supposition that the train was running round a sharp curve, with the wind acting in a direction from the centre to the circumference of the arc. An addition might thus be made towards the centrifugal force, which might prove too much for the ordinary precautions adopted upon the curved portions of a line.

EFFECTS OF CARBON ON THE ELECTRO-DEPOSITION OF SILVER.

We have just witnessed a series of experiments on the deposition of silver from cyanide solutions, with a view to ascertain the reason of the various textures of the deposits under different conditions. The texture of the silver deposited from a new and pure solution of cyanide of silver in a solution of cyanide of potassium is of a soft silky appearance and of a pearly whiteness, having a slight rosy reflection. If this appearance were only permanent it would render articles so coated very beautiful, but it speedily vanishes on being exposed to the air. Of course if this appearance were not so evanescent, still portions of articles so coated would be polished, but its evanescence necessitates the polishing of all articles so coated and on the whole of them. This was felt to be a great inconvenience, consuming so much time, and it was felt that it might be possible to deposit the silver in a polished state,—first, because it was known that gilding could be done with a polished surface; moreover, it was seen that on certain parts of certain articles there were deposited streaks of polished silver; for example, above any small hole or small projecting point there would be a streak of polished metal, but no one could surmise the reason of it.

We think this might have been seen if the nature of the solution and the laws of electric action had been considered; but perhaps neither the one nor the other was clearly understood by the operators; at any rate, the thing was not reasoned about but groped for, and by chance the discovery fell to an operator who was experimenting for another purpose. Elastic moulds were being used for the solid deposition of silver, and it was found that around these moulds the articles received a bright deposit, and it was naturally concluded that it was something in the moulds which produced it. This could be neither the gutta-percha nor the india-rubber of which the moulds were made, so that it was clear that it must be the solvent of these articles, which was bisulphide of carbon. Bisulphide of carbon being tried it was found to produce the desired result. Since then, what is called brightening solution has been used by most electro-platers. This is made by adding periodically to the ordinary cyanide, solution, in the proportion of a few drops of bisulphide of carbon to each gallon; but it is found that this solution is difficult to manage. It is found that dark streaks occur frequently where bright ones occurred in the ordinary solution, and this has not been well understood, or, in fact, the reason of it has not been understood at all. Besides this, opaque white patches will occur, or the whole surface of the article will become opaque white, the solution appearing to be most capricious in its action: consequently, other carbides have been tried,—for example, different hydrocarbides; but these have not been found to work so well as the bisulphide, so that this is still retained by those who use the brightening solution.

Now we feel quite convinced, from the experiments we have made in this matter, that all these inconveniences are easily explained and avoided. It is the carbon in these solutions that is the cause of the bright deposit, not only in the carbide solutions, but in ordinary solution where bright streaks occur. Wherever there are asperities on an article those will receive a greater amount of electricity than other parts, and if the general current be such that it is just below the point of decomposition of the solution, at these points it will commence to decompose it, and carbon will be set at liberty. In the carbide solution the black streaks occur from the same cause. The bisulphide solution is decomposed on being added to the cyanide, a black cloud of carbon being produced, which, on being stirred in, is held in suspension, and the sulphur unites with the potash of the solution; this, on a strong current of electricity being passed, is decomposed at the afore-mentioned asperities, and sulphide of silver is produced, which is black. Now, sulphur is the one thing that we have to protect silver from, being the thing that most readily tarnishes silver; therefore, a sulphocarbide should not be used, or, if it be, great care should be taken in the management of the battery. Too great an intensity decomposes the solution and also produces an opaque white deposit.

But the great question to be solved is, in what way does carbon produce such a brilliant and dense deposit? In appearance it is like fused silver, but denser than rolled silver. Does carbon unite with the silver as it does with iron to produce steel? If it does, it must be in almost infinitesimal quantities, for two drops of the bisulphide to the gallon of the normal solution is sufficient to produce the bright deposit. It cannot be due to the electrical current, for the same current in an ordinary solution will not do it. We are of opinion that the carbon unites with the silver, and produces a body somewhat analogous to steel; but it will require the delicate chemical manipulation of M. Stas to detect the carbon or to prove its absence. However, the valuable fact remains, that silver can be electro-deposited in a harder and more durable state by means of a soluble carbide than it can be produced in any other way, and with care can be as easily deposited as from any other solution.

THE SILVER COINAGE OF GREAT BRITAIN.

It may be permitted us to hope that out of the deliberations of the International Coinage Commission, now holding its sittings in Whitehall, some definite proposition may spring for the reformation of the coinage of this country. We have faith in the members of that commission, for all of them are eminently qualified by talent and by experience for executing the task they have undertaken to perform. They are *bonâ fide* work-

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ing men, in the highest sense of the term, and are well calculated, therefore, to initiate practical improvements rather than to offer fanciful and theoretical suggestions. It is perhaps too much to expect that the commissioners will go so far as to recommend the decimalization of the coinage off-hand, although that is "a consummation most devoutly to be wished," but it is not to be doubted that in the abstract they will favour that conclusion. The usefulness of the coinage is undoubtedly the primary and most important consideration, and when the word "usefulness" is employed, it is here meant to imply the fitness of coins composing it for the purpose especially, of making small payments with exactitude, and with as little inconvenience as possible to the payer and the payee. The one great point to be regarded in altering a coinage is, therefore, how to add to its usefulness. The making a change for the mere sake of change, it is needless to say, would be a proceeding of a very unwise character. In this—as, indeed, in all other countries—a very large proportion of the retail purchases are made for the coin's worth, or the articles are made to be sold for the known individual coins in circulation. The adaptability, then, of coins for making such purchases is the great test of the merit or demerit of any system of coinage. Of course, it is of consequence also that the question of account keeping should not be disregarded in the arrangement of the various denominative coins. This affects the affluent and the educated rather than the poor and the ignorant classes of society, and is really of secondary moment. To facilitate the distribution of commodities in retail markets and retail shops, is the one great object to be kept in view by those who attempt a salutary reformation of the coinage. That the introduction of a decimal system of currency would answer this vital purpose more effectually than any other mode of reforming the coinage which can be suggested is, we think, indisputable. It would certainly facilitate commercial transactions with other countries to a greater extent than the introduction of only one or two coins of assimilation, as has been suggested in some quarters.

The question of decimalization, however, we leave for the present in the hands of the Commission, and shall venture to offer a few remarks upon the existing silver coinage of Great Britain. This, there can be no hesitation in saying, is in every way in an unsatisfactory state. One of the first steps taken with a view to the improvement of the silver coinage, whatever may be ultimately done in the way of decimalization, should be the withdrawal from circulation of all crowns, half-crowns, and fourpenny pieces. They have long since been doomed to a gradual process of extinction, and numbers of them find their way annually to their birthplace and their grave—the crucibles of the Royal Mint. This is not enough. They linger on the stage when their parts have been already played out, and interfere injuriously for the public interests with their fellow performers. A very large proportion of the crowns and half-crowns have been in circulation ever since the great re-coinage of silver in 1816-17. They have consequently deteriorated in appearance and lost weight by attrition to such an extent as to render them unfit for service, and in every way discreditable specimens of British mintage. Beyond these patent and notorious defects, there exists another evil which is perhaps of more serious moment. The smooth-faced crowns and half-crowns present almost irresistible claims upon the attention of professional manufacturers of spurious money. Such pieces may be imitated in base metal by even "'prentice hands" engaged in the nefarious trade. There are no artistic or fine lines to copy, and plaster of Paris moulds and pewter pots yield excellent copies of the 'erstwhile beautiful examples of the engraver's skill.

It is understood by those who are in a position to know the fact that many thousands—and, it may be, hundreds of thousands—of counterfeit crowns and half-crowns are now eddying along the channels or lurking in the creeks of general circulation. The palpable remedy for these defects is the speedy recall of all the genuine coins, their transmission to the Mint, and their conversion into coins of existing and not of extinct species. The collection of the condemned pieces might be made simultaneously throughout the country by the assistance of provincial banks, the authorities of which might previously be supplied with florins, shillings, and sixpences of recent mintage for exchange. The loss of weight contingent upon re-melting and re-casting the obsolete coins might well fall upon the national treasury, the public having had all the advantages of their long existence and contributed to their deterioration. All that is needed for giving effect to our suggestion is the issue of a Royal Proclamation and the completion of a few preliminary and minor arrangements. The fourpenny pieces, of which there are comparatively few in circulation, might be recalled and converted forthwith into threepennies (which is about their intrinsic value), and thus another source of annoyance would be got rid of.

It is said that the Mint stamping presses are only working half-time at present, and that the Mint workmen are consequently receiving only half-pay. The coinage of the three denominations of coins in question would correct both these evils and confer besides a benefit upon the whole community. It would, in fact, form a fitting prelude to whatsoever change may be finally decided upon as to the coinage of the country generally. It is intended that the subject of the silver coinage shall ere long be reverted to again in these columns, for it is impossible in the limits of one article to indicate all the improvements which ought to be carried into effect in regard to it. It was the privilege of this journal to suggest originally the supercession of the old copper coin by the introduction of the bronze money which now so admirably does duty in its stead. It shall be from no fault of ours if a similar and far more important improvement be not made with respect to the silver coinage of the British Empire.

FEATS IN TELEGRAPHY.

THE recent performances of the electric telegraph are interesting, and serve to mark the great progress which has been made in the art of electrical communication. Our readers remember that four weeks since we noticed the banquet given by Mr. Cyrus W. Field to celebrate the fourteenth anniversary of the day on which the New York, Newfoundland, and London Telegraph Company was formed. We then referred to the circumstance that during the evening telegrams were sent from the room to various parts of the American continent, replies being received with wonderful rapidity. We now give the interesting details of these operations. The messages were delivered at their respective addresses, and the replies to them were received back in the room in the following periods:—From the President at Washington, 2hr. 10min.; from Mr. Seward at Washington, 2hr. 25min.; from several persons in and near New York, average 1hr. 45min.; from the Governor of Cuba, who apologized for the delay caused by his residing at a distance from Havannah, 2hr. 24min.; from the Governor of Newfoundland, at St. John's, 38min.; and from Heart's Content, Newfoundland, 6min. These performances, however, are thrown into the shade by an ordinary message sent from London to San Francisco on February 1 last, and which is thus recorded by Mr. Latimer Clark. The wires in America were joined up for experiment from Heart's Content to California, and the message was sent from Valentia at 21 minutes past 7 in the morning,; the acknowledgment of its receipt was received back in Valentia at 23 minutes past 7, the whole operation having only occupied two minutes the distance travelled was about 14,000; miles, and the message arrived, accordiug to San Francisco time, at 20 minutes past 11 on the evening of January 31, or the day preceding that on which it left England. It is well, adds Mr. Clark, to enjoy these surprises while we can, for they will soon cease to surprise. The truth is, telegraphy has outlived the troubles and misfortunes of its infancy, and is rapidly taking its place among the most perfectly understood of the arts. As it is a very remunerative one, we shall soon learn to regard an instantaneous means of communication with the whole globe as a matter of mere ordinary necessity.

ARTIFICIAL STONE SCREENS FOR THE NEW GOVERNMENT OFFICES.

THE adage, so often written on copy-books at school, that "Perseverance overcomes many difficulties," has found a notable illustration in the case of Mr. Frederick Ransome and his artificial stone; and it would have been a cruel reverse had the adage failed in his case. There could scarcely be a more convincing proof of the simple justice of patent right than this, in which so much time, toil, money, and vital energy, have been expended in the course of a long race from the starting post to the goal, a race in which, in the absence of patent right, an unprincipled interloper might have entered the course in the run home, and have beaten the better horse by a neck. We have from time to time had to notice the successful application of Mr. Ransome's chemical preservative agents upon numerous public and private buildings. We have also of late recorded the introduction of his artificial stone in foreign parts, and, considering its especial suitability for countries in which good building material and skilled labour are scarce and costly, its gradually extending use is not to be wondered at. Ample and satisfactory testimony as to the results of its adoption is borne by the professional gentlemen, both at home and abroad, under whose direction it is employed. Mr. G. W. Vivian, C.E., for instance, the architect of the Nawab Nazim's palace at Moorshedebad, which covers an area of 420ft. by 130ft., could only choose for his capital, finials, trusses, and other ornamental work, between plaster work and a stone of a costly though very poor quality. He therefore employed the patent stone, and states that "the result has been most satisfactory. The greater portion has been set for two years, subject to alternate rains and heat, such as are only known in a tropical climate; it appears (if possible) better now than when first set; it has the same spontaneous crystalline surface, appears more indurated, and is perfectly free from vegetation and fungus." An equally satisfactory expression of approval is given in an official report by Major Haig, R.E., Superintendent of the Godavery Navigation Works, who states that they have ascertained by actual practice that they can make excellent stone in India by Ransome's process. He writes:—"The principal advantage sought to be derived from this substitution of artificial for natural stone was not cheapness, but the saving of labour, which is effected wherever an article made, or partly made, in England, or elsewhere, can be supplied in lieu of one made upon the spot. The want of labour, the difficulty of collecting it in sufficient quantity, and of retaining it, being the great difficulty we have to contend with on this river, every substitute which machinery, steam, or art, can afford, is a great gain, and in this way I have no doubt that we shall derive valuable assistance from the use of the patent stone." The artifical stone is now being introduced into Ceylon also with great advantage, and our readers may remember

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that we recently gave a short description of a handsome fountain in this material which was sent out to Hong Kong on Government account.

The highest endorsement of the qualities and capabilities of this remarkable product is probably its intended introduction, by Mr. Digby Wyatt, in conspicuous positions in the new Government Offices, in Downing-street. It is to be used for a pair of enriched truncated pierced screens, in the Renaissance style, which are to enclose the third-floor galleries of the Indian court. This fine quadrangle was designed to have been left open at the top, but is being covered by an elegant roof of wrought iron, which will be filled in with glass throughout. The inner faces of the quadrangle consist of windows almost entirely, excepting only the spaces taken up by the polished granite columns, and the piers which support the superstructure, and spaces at the ends of the quadrangle for eight statues of distinguished Indian governors and heroes, and appropriate historical tableaux in alto relievo. Three galleries cross each end of the court on a level with the respective floors, the two under galleries having balustrades in front. The upper galleries will have the screens referred to, in addition to the balustrade. They have been designed, with exquisite effect, by Mr. Digby Wyatt, and are each 67ft. long by about 6ft. 8in. high, with a mean thickness of about 6in., and will contain about 340 cubic feet. Had the patent stone been liable to warp or shrink it would, of course, have been totally unsuited for ornamental work of such a high character. But it has been abundantly demonstrated to possess incapability of shrinkage, and the absolute rigid retention in every particular of the form in which it leaves the mould. A convincing test as to shrinkage has repeatedly been applied with success, viz., by casting in a block a piece of plate glass cut to parallel lines to preclude the possibility of dovetailing. On breaking the stone after it is thoroughly hardened it is found impossible to extract the glass by any other process than cutting round it to the bottom, which would not be necessary if even the slightest degree of shrinkage took place.

The patterns—to Mr. Wyatt's drawings—and the moulds from them, have been made by the art workmen at the company's works, East Greenwich, and the screens, which are in a forward state, will be finished and fitted as soon as the roof of the quadrangle is covered in, although that need not hinder their erection, the material being invulnerable to atmospheric influences. Builders and contractors are now getting bound doors, sashes, mouldings, and other carpentry goods from Norway and Sweden; they will never need to go so far afield for capitals, finials, trusses, balustrades, or other ornamental work in stone, while the Patent Concrete Stone Company is able, as now, to compete against all comers.

PONTON'S PHOTOGRAPHIC RESEARCHES.*

PROBABLY no branch of physics has so far advanced in its practical applications, and so little progressed as a science, as photography, the philosophy of some of its commonest phenomena being at the present moment as hidden in mystery as when they were first observed by the pioneers of the scientific art. After a collodionized plate covered with iodide or bromide of silver in contact with free nitrate of silver has been exposed in the camera, no change in the film is perceptible to the eye. Yet, when the developer is applied to the plate, out comes the picture on those parts which were exposed to light. Evidently, therefore, the momentary action of light had produced some decided change in the film which the eye could not see, and which, on experiment, it was found that chemical analysis could not detect. Hence the nature of the invisible image has always been a puzzle to photographers.

Recent discoveries in molecular physics, more especially that of atomic motion, were, about eighteen months ago, applied by one of the writers in the photographic journals to the explanation of the phenomena of the invisible photographic image. It was pointed out that if the chemical rays of the spectrum had the power of setting up a motion of separation between the atom of iodine and the atom of silver, the fact would account for most of the observed phenomena of the invisible impression. In the course of the discussion raised by these views, a clerical gentleman living at Clifton pointed out that Mr. Mungo Ponton, F.R.S.E., had published the fact a year or two before, in a book called "The Great Architect." This somewhat remarkable work treats of the construction of the whole of the visible universe, and enters largely into the questions of the size and motions of atoms, also their influence upon the undulations of the hypothetical ether. The author expressed his opinion how vibrations of light act upon a photographic film, as follows:—"In many cases a large portion of the motive energy possessed by the etherial particles, is by them transferred to the ponderable molecules of the bodies with which they are immediately and momentarily associated. Now, the motion thus acquired by the chemical atoms composing any substance, may be such as to give rise to some new arrangement of these among themselves, or, at least, so to modify them as to impart to them a predisposition to enter into new relations or combinations. This effect is most likely to be developed where the atoms are complex, and where the chemical affinity by which they are held together is weak. The transfer of motive energy from the ether to the chemical atoms, then, affords a satisfactory explanation of all the ordinary cases of photography."

Dr. Balfour Stewart, F.R.S., and other philosophers who have studied the subject of molecular physics, also incline to the opinion that when waves of light beat against the photographic film, they set up a motion of separation between the atom of iodine and the atom of silver. The molecules of iodide of silver may thus have the grouping of their atoms changed, or a modification made, which is rendered tangible to our senses by the blackening of the modified molecules under the action of the developer. There is plenty of evidence, as set forth in "Hardwich's Photographic Chemistry," that development is an act of rapid crystallization. The plate is covered with a solution which tends to deposit silver wherever local action begins, and a grain of dust upon the film will provoke a dark deposit of silver all round it, as photographers often learn to their cost. For the same reason, in all probability, the film has a tendency to blacken first wherever light has modified its original molecular structure.

Mr. Ponton's book not only gave the first glimmerings of knowledge as to the nature of the invisible image, but it goes further perhaps than any popularly-written book of the day, into the physical characteristics of the medium which transmits the undulations of light. The author weighs the evidence for and against the alleged storing up of light, as exhibited in some curious experiments by M. Niepce. The latter philosopher first published the fact that if a picture printed upon white paper be exposed for a long time to sunlight, and then be placed in the dark in contact with a sheet of sensitized photographic paper for twenty-four hours, a photographic negative of the engraving is impressed upon the paper. White feathers and marble will act in the same way after exposure to light. If a tin tube, closed at one end, and lined with white paper, have its interior exposed for an hour or more to sunshine, and then be turned mouth downwards upon a sheet of photographic paper in a dark room, an impression of the mouth of the tube will be obtained. Moreover, if the tube be hermetically sealed directly after exposure to light, then kept for a long time, and afterwards placed for twenty-four hours mouth downwards upon a sheet of photographic paper, the latter will be impressed with an image of the mouth of the tube. Mr. Ponton, after briefly describing the above and other experiments of the some kind, points out that the photographic action is not due to "stored-up light." The interposition between the tube and the paper of the thinnest sheet of glass, mica, or any transparent substance impervious to air and moisture, will entirely stop the discolouration of the photographic paper, yet light traverses such films without difficulty. Thin tissue paper, or any very thin porous films, do not arrest the photographic effects: hence there is evidence that the action is a chemical one, and that light liberates traces of ozone or other gases from the actinized paper to produce the observed effects. The necessity of sealing the tube in one of the foregoing experiments shows that the enclosed air has much to do with the results. Since the book by Mr. Ponton was published, M. Niepce de St. Victor has multiplied his illustrations of the apparent persistent action of light, but he has never been able to produce the effect through the thinnest film of glass or mica.

Next, Mr. Ponton criticises Moser's experiments with invisible images. M. Moser discovered that all smooth polished surfaces whatever exhibit a tendency to receive latent images from objects placed in contact, or very near to them, and that these images are capable of being rendered visible by condensing upon the polished surfaces vapours of different kinds. The phenomena much resemble those observed in the Daguerreotype process, and were attributed by Moser to the action of invisible rays. But in this instance, as in the former one, the thinnest transparent films arrested the action, nor could the supposed invisible rays be concentrated by a lens. Moreover, Moser's images were produced as easily in the light as in darkness; for instance, the glass taken out of the frame of an engraving will sometimes show an image of the picture when breathed upon.

The true cause of Moser's images has been very clearly shown by M. Waidelé, who proved that the surfaces of all bodies have a tendency to absorb gas or vapour, and to hold it adhering to them in a very condensed state. Heat, or the near approach of a substance of greater absorbing power, will deprive a polished body more or less of its layer of gas. Moser's images cannot be impressed upon clean plates of metal, which have recently been heated, or polished with fresh charcoal or tripoli, but mere rubbing with the finger, or exposure for a lengthened time to a damp atmosphere, restores the layer of gas, and renders the plate sensitive once more. The thinnest film of grease will produce an image: hence phantom images of printing-ink engravings are readily produced upon polished surfaces.

Of the nature of the action of light upon an iodized plate of polished silver, Mr. Ponton says:—"When an iodized plate is exposed in the camera obscura, the light, wherever it falls upon the plate, throws the molecules of silver into a state of greater or less agitation. This enables the iodine to penetrate further into the silver, and to leave the particles, at the immediate surface, less charged with iodine vapour than before,—some of them being reduced nearly to the pure metallic state. Hence, on the subsequent exposure of the plate to the action of mercurial vapour, these disengaged particles condense the mercury; while the portions of the plate which have escaped the action of light, being already charged with iodine vapour, cannot absorb

* "The Great Architect." By MUNGO PONTON, F.R.S.E. London: Nelson and Sons. Second Edition. 1866.

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that of mercury. It is to this difference that the development of the image is due."

Mr. Ponton also in his chapters on photography, calls attention to a beautiful example of photographic colouration in Nature. The bell-shaped flower of the Cobœa scandens is of a pale yellowish tint on the first day of its development, but gradually assumes a purple hue, which, on the third day, possesses great depth and beauty, resembling somewhat the dark colour acquired by chloride of silver by the action of the actinic rays. If the flower be kept in the dark, the colouration does not take place.

It would be beyond our province on the present occasion to consider the other subjects included in this interesting book, but those portions were very fully, and, on the whole, favourably reviewed a few months ago, in our contemporary the "Engineer." The book deals with the highest branches of physical science in an intelligent manner, and is throughout a very excellent sample of good clear English composition. The fact that it is published by a firm noted for its religious works, and that it has a title which gives no clue to its scientific character, is perhaps the reason why its existence is comparatively little known, and why the book has been long in coming prominently before the public.

ELECTRICITY AND TELEGRAPHY.

AT a scientific soirée recently held in Washington, Professor Page exhibited one of his small coils illuminating some Geissler vacuum tubes; the electricity used for this purpose was that obtained from a thermo-electric pile of Farmer's, to which we lately called attention.

The Malta and Alexandria cable is still broken down. The "Hawk" steamer, engaged in these repairs, returned to Malta after forty-four days' unsuccessful labour, bad weather prevailing. She was in want of fuel and more cable. She left again on the 25th, to continue the work.

The approaches to Kooria Mooria being rocky, the commander of the "Hydra," surveying vessel, disapproves of it as a station for the projected submarine cable to India. Soundings are to be taken between Aden and Bombay, where the bottom is smooth and undulating.

The bill for the purchase of the telegraphs was read and passed a first time on Wednesday last; it was postponed last week owing to more pressing business. In introducing it, the Chancellor of the Exchequer made mention of the fact that in 1866, in Belgium, one telegram was sent for every thirty-seven letters, whilst in England the proportion was as high as one in 121 letters.

The Swiss papers speak of the trial lately of an electric organ in the church at Sumiswald, in the canton of Berne. In this organ the electrical portion is an independent mechanism, so arranged as to be easily applicable in a short time to any church organ.

M. Becquerel has lately contributed some interesting experiments on the dialysis of electric currents. In passing discharges from an induction coil, between the upper surface of a saline solution and the extremity of a platinum wire fixed at a short distance, the spark was surrounded with a coloured cloud, depending upon the sort of salt experimented with. The saline solutions were placed in a glass tube, so that the discharge passed through their upper surface and the extremity of an insulated platinum wire fixed at a short distance from the liquid, the greatest intensity being obtained when the platinum wire was positive.

A novelty in electric clocks has just been invented by M. L. De Combettes. It consists of a long pendulum, on the lower portion of which is fixed the clock face. The weight is a sort of box containing an electro-magnet and armature, which, on being attracted, disturbs the equilibrium of the pendulum, and consequently gives it motion. The movement of the armature is made to transmit motion to the hands of the clock in a manner somewhat similar to the mechanism of the alphabet dial telegraph instrument. In order to make and break the electric circuit, the movement of the pendulum is made use of, one pole of the battery being connected permanently through the axis of suspension to one end of the electro-magnet, whilst the other pole is connected to a metal plate, against which a point of the pendulum, in connection with the electro-magnet, makes contact at every beat, thus completing the circuit and causing the electro-magnet to attract the armature. It is stated that only a weak battery is required, and that two Daniell's cells will keep it working for several months.

TESTIMONIAL TO MR. ALFRED WILLIAMS.

AS chroniclers of the proceedings of scientific bodies, it is often our pleasing duty to record, amongst others, those of the Society of Engineers. At one time it is its visits to public works or engineering establishments, at another its annual dinner, whilst its ably-written papers are constantly before our readers during the session. It is, however, with much more real pleasure than these things can afford, pleasant as they are, that we now record the presentation of a testimonial, by the members and associates of this Society, to Mr. Alfred Williams, its indefatigable honorary secretary. And this is not mere empty sentiment on our part, but an honest expression of feeling, to which he is entitled for the facilities he has always afforded the scientific press in publishing the valuable papers of the Society; and for the courtesy he has invariably manifested towards ourselves as journalists, in our transactions with him on that head. The pleasing occurrence of which we now write was the occasion of a banquet at the Bridge House Hotel, Londonbridge, on the evening of Friday last. Amongst the gentlemen present there were Capt. Selwyn, R.N., Mr. Thomas Hughes, M.P., Lieut. Woodhouse, Mr. William Wilson, C.E. Mr. Benjamin Fothergill, C.E. The Testimonial Committee consisted of the following members of the Society:—Messrs. William Adams (treasurer), Robert Brass, James Hendry, Baldwin Latham, W. H. Le Feuvre, William Macgeorge, Perry F. Nursey (hon. sec.), Lewis Olrick (chairman), John Pinchbeck, William Roberts, H. P. Stephenson, and George Waller. Besides the above gentlemen, there were also present Messrs. R. M. Ordish, W. T. Carrington, F. W. Bryant, Z. Colburn, J. H. Adams, A. Thorn, E. Field, G. W. Harris (secretary of the Society), David Thompson, as well as a large number of other members and associates of the Society. Mr. Lewis Olrick, the chairman of the Testimonial Committee, presided, and the vice-chairs were occupied by Mr. Baldwin Latham, president of the Society, and Mr. H. P. Stephenson, a past president, and one of the founders of the Society.

After the usual loyal and patriotic toasts had been given and duly honoured, Mr. P. F. Nursey, hon. sec. to the Testimonial Committee, read letters from Messrs. Henry Maudslay, John Penn, E. J. Reed (Chief Constructor of the Navy), William Naylor, James Hendry, and other gentlemen, expressing regret at their inability to be present on the occasion.

The CHAIRMAN then proceeded to present the testimonial, and to propose the toast of the evening—the health of Mr. Alfred Williams. In doing so he referred to the circumstance that Mr. Williams was elected a member of the Society in March, 1855. His abilities soon manifested themselves, for, on the 2nd of April in the same year, he was chosen one of a committee appointed to frame rules for the Society. On December 1, 1856, Mr. Williams was elected honorary secretary of the Society, which position he still continued to hold. When he was appointed, the number of members was 33, at the present moment the number was 486. That increase would give some idea of what Mr. Williams had done for the Society. That number was made up of 14 honorary members, who were some of the most eminent men in the kingdom, 18 life members, 338 annual members, 30 foreign members, and 86 associates. During the whole time of Mr. Williams' tenure of office, which was nearly twelve years, the whole of the Society's affairs had been dependent upon the exertions of the honorary secretary, and by his excellent management, he had facilitated the transaction of the Society's business in every department. He had also bestowed much time in preparing the transactions of the Society for publication. During the time the honorary secretary had been in office, many changes had taken place in the Society, which had constantly increased his labours, especially the alterations to the rules necessary to meet the requirements of a constantly increasing society. As a proof of Mr. Williams's attention to the Society's business, he (the chairman) might mention that during the twelve years he—Mr. Williams—had been in office, he had only been absent twice from either the council meeting or the ordinary meetings of members. In short, Mr. Williams had bee the mainstay of the Society of Engineers at a time when the Society could not stand alone. Without the aid of such an honorary secretary, the Society must certainly have collapsed, and could not have been in existence now. It was, however, possible that even Mr. Williams could be overworked, and it was found last year that the duties thrown upon him were now too heavy for him to continue single-handed. The council therefore engaged the services of a paid secretary, and it was at that time proposed that an appropriate testimonial should be presented to the honorary secretary, not as a recompense for his past services—for recompense would be simply impossible—but as an attempt to prove to him that the members were not ungrateful for all he had done for the Society, and he (the chairman) was sure that in reference to the presentation of that testimonial there was not one dissentient voice. He had now much pleasure in asking Mr. Williams to accept that testimonial from the members and associates of the Society. He had also, in conclusion, to perform the exceedingly pleasing duty of proposing the health of Mr. Williams.

The toast was drunk amidst enthusiastic and prolonged cheering.

The testimonial consisted of a handsome and costly silver tea service and a salver, which bore the following inscription:—"Presented to Alfred Williams, Esq., by the members and associates of the Society of Engineers, as a token of their high estimation of his invaluable services as honorary secretary to the Society, March 27, 1868."

The following address, artistically inscribed on vellum, and neatly framed, accompanied the present:—

TO ALFRED WILLIAMS, ESQ.,

HONORARY SECRETARY TO THE SOCIETY OF ENGINEERS.

It is now about twelve years since you first undertook the arduous, and, of late years, onerous duties attaching to the position of honorary Secretary to the Society of Engineers. The untiring zeal and energy you have displayed during the whole of that period in the very successful management of its affairs, not less than the invariable courtesy with which the numerous duties of your office have been discharged, have caused the members and associates of this Society to unite in offering for your acceptance the accompanying silver service, as a token of their appreciation of your invaluable services. We, whose names are appended hereunto, on behalf of the members and associates of the Society of Engineers, therefore beg you will accept this Testimonial as an acknowledgment of your past exertions, to which the success of our Society is so largely due, and as a proof of the high personal esteem and regard in which you are held by all the members and associates of the Society you have so long and so well served. Our united and sincere wish is that you may continue for many, many years to retain the post of honour, which you now occupy, of honorary secretary to the Society of Engineers.

On behalf of the subscribers,

LEWIS OLRICK, Chairman	WILLIAM ADAMS, Treasurer
ROBERT BRASS	WM. MACGEORGE
JAMES HENDRY	P. F. NURSEY, Hon. Sec. to the Testimonial
BALDWIN LATHAM	JOHN PINCHBECK
W. H. LE FEUVRE	GEO. WALLER
WM. ROBERTS	
H. P. STEPHENSON	

Mr. ALFRED WILLIAMS, in acknowledging the presentation, stated that his thanks were first due to those who in the early stages of the Society were kind enough to place him in the position of honorary secretary. He would also thank those who from year to year had enabled him to maintain that position, in consequence of which he was now the recipient of that magnificent testimonial. There were several ways of showing to an individual the appreciation of his efforts to serve his fellow men, but he knew of no more effective way of testifying that appreciation than their meeting together on an occasion like the present. He hoped that the address which had been presented to him would hang for many years in some prominent position in his house to attest that at some period of his life his services had been deemed worthy of recognition. The name of the Society would always be associated with the testimonial, and would recal to his mind the many kindnesses he had received from the members and associates of this Society. He had obtained photo-

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graphs of the service for presentation to the subscribers to the testimoual and to the company generally, as a memento to them of the kindness performed. The Chairman had stated that the success of the Society had been entirely due to him (Mr. Williams). If, however, he had not had such friends as were now around him, all his efforts would have availed but little. It had always been his opinion that such associations as these led to mutual friendships and business connections. During the twelve years he had been connected with the Society he had formed many valuable and lasting friendships. If gentlemen would join such societies as this, they would greatly add to their chances of success in life, and much mutual benefit would result from the union and interchange of ideas between the members. They should not keep their knowledge to themselves, because what was restricted was of no use to any one. The Chairman had referred to the publication of the transactions. The preparation of those transactions occupied, of course, a great deal of time, but that was compensated for by the fact that they had proved a great success, and were received by the scientific professions as volumes sufficiently valuable to add to their libraries. M. Flachat, President of the Society of Engineers of France, stated during the visit of our Society to Paris last year, that the very fact of the publication of its discussions so soon after they took place was acknowledged on the Continent to be one of the best features of any scientific society of this country. The past of this Society had been, as the Chairman had said, extremely successful. The present exhibited still greater success. As for the future, he hoped that during the next twelve years they might succeed in gathering together members in a greater proportion than during the last twelve years; that many mutual and valued friendships might be formed among the members and associates, and that the Society become and be acknowledged one of the first scientific societies in the kingdom. In conclusion, he would again offer his sincerest thanks to his friends for the very kind manner in which they had referred to his services, and for the very handsome and valuable testimonial they had presented to him.

Numerous other toasts of a complimentary character were given and acknowledged during the evening, the speeches being interspersed with songs. The arrangements of the presentation banquet were highly successful, and the company separated after a very pleasant evening, which left nothing to be desired—except, perhaps, that such another evening might occur soon—a desire, however, which is not likely to be gratified for some years to come in the Society of Engineers.

IMPROVED HYDRAULIC CRANE.

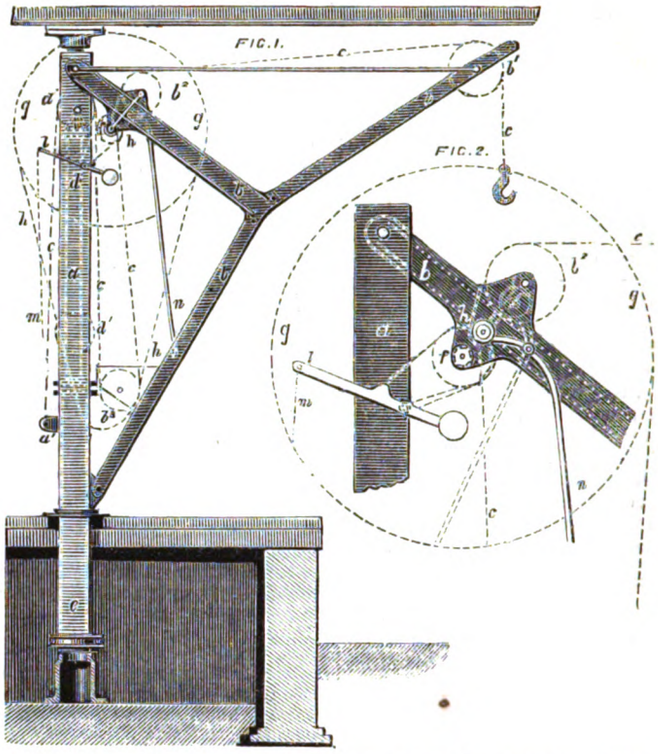
SOME improvements in cranes have recently been patented by Mr. Percy Westmacott, of Elswick, Newcastle-on-Tyne. His object is the combination of hand with steam, water, or air power by a ready means of attaching or disconnecting the auxiliary power to the lifting or hauling chain of the crane or hoisting machine. For this purpose he employs a drum which receives motion by means of the auxiliary power. The hoisting chain of the crane is arranged to pass alongside of the chain pinion, and when the auxiliary power is to be employed it is deflected from its direct course by a movable guide pulley mounted on a hand lever so as to cause the chain to bear against the chain pinion and to gear with it, the links of the chain being held by projections on the face of the pinion. When the auxiliary power is not required, by shifting the guide pulley the chain is allowed to pass clear of the pinion.

In our engraving, fig. 1 is side view of an hydraulic crane having Mr. Westmacott's auxiliary hand gear applied to it. a is the crane post; b the jib; c the lifting chain; it passes up over a pulley b^1 on the end of the jib, then around pulleys b^2 and b^3 and over a pulley d^1 mounted on the top of an hydraulic ram d working in a vertical cylinder e, and thence the chain passes to an eye a^1 on the crane post, where it is made fast. When it is desired to raise a weight attached to the crane chain, water under pressure is admitted to the cylinder e by valves, and the ram raises the pulley $d1$ from its lower position, in which it is shown in dotted lines, to its higher position, in which it is shown in full lines. Or the ram may be stopped by the valve when it has made only a portion of its stroke. The weight on the crane chain will be raised a distance equal to double the stroke of the ram. These latter arrangements, however, form in themselves no part of the invention; they are ordinary, and well known to our readers.

The auxiliary hand mechanism is shown on a larger scale at fig. 2. f is a pulley or drum of small diameter having recesses in its periphery to receive and hold firmly the links of the crane chain when it is caused to pass partly around it. This pulley or drum is mounted in bearings on the jib, and it has on its axis

HYDRAULIC CRANE.

BY MR. P. WESTMACOTT.



a large chain wheel g over which a hand chain h passes. k is a brake pulley on the axis of the chain pulley or drum f, and round it a brake strap passes to a lever l on the crane post. This lever is weighted, so that when the lever is left free the brake is taken off by the weight. m is a chain by which the brake lever is worked. The crane or lifting chain c, however, in passing direct from the pulley b^2 to the pulley b^3, does not come against the chain pulley or drum f, so that the main lifting mechanism can then be used altogether independently of the auxiliary hand mechanism. By means of the hand lever n, which is centered to the jib and has a small pulley at its upper end, the crane chain can be deflected, as our engraving shows it, from its direct course between the pulleys b^2 and b^3, and the crane chain then engages with the chain pulley or drum f, and then by using the hand chain and mechanism the crane can be used as a hand power crane whenever convenient to do so, or in cases of emergency produced by accidents to the hydraulic power.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

A GENERAL meeting of the members of this Society took place in the theatre of the Society of Arts on the evening of Thursday, March 26. The Duke of Argyll, President, took the chair at 8 p.m., when the proceedings commenced with the reading of a paper, by Mr. John Heath, on the control of balloons by pressure.

The plan proposed by the author was to encircle the sphere of the balloon by an exterior ring or belt of the same fabric stiffened by whalebone, and maintained at some distance from the sphere, so as to leave an annular passage. If during the ascent the lower loop of the belt is drawn eccentrically close to the balloon, and the upper one thrown out similarly in an opposite direction, it will set the whole belt in an inclined position, relative to the axis of the balloon, and, consequently, the current of air caused by the ascent rushing between the sides of the belt and balloon will cause the latter to rise in a path determined by the inclination of the belt. On descending, the belt is inclined the opposite way by means of suitable cords worked from the car, and the air again impinging on the belt, will still urge the balloon in the same direction, and by a series of these ascents and descents, the balloon will be caused to make progress in any required direction by means of a number of such traverses in a zig-zag course through the air like vertical tacking. The means by which the author proposes to obtain these alternate ascents and descents, without the expenditure of either gas or ballast, is by increasing or relieving the pressure of a stated weight at due intervals upon the bottom of the car by means of a system of cords and friction pulleys worked by a kind of windlass. The paper was illustrated by several elaborate and neatly-made models.

Mr. Wenham said,—The whole success of this plan must depend upon the force employed in obtaining an ascent or descent as required, but I must remark that I cannot see how any effect is to be obtained this way from an abutment contained within the machine itself. We have no power under such circumstances, that I am aware of, of destroying the force of gravity or creating it. Then, the elaborately-constructed car shown, and its contained machinery, is sure to be broken up on reaching the ground in even a seven mile breeze. As Mr. Glaisher can inform us, if the grapnel secures a hold, the balloon is sometimes ripped open by the wind from the base to the summit, and, on the contrary, if the grapnel fails in its hold, to make a rude but comprehensive comparison, the car is subject to a rough treatment similar to that of a tin kettle tied to a dog's tail.

The next paper read was by Mr. David Stephen Brown, "showing that for sustaining a body in the air by mechanical action, more depends upon the application of the power than on its actual amount."

It is not creditable to the present age that the principles employed in flying have not been elucidated. That it has not yet been practically demonstrated how an animal possessing a heavy body like a bird, is able to support itself with such ease in so attenuated a medium as the atmosphere. More especially is this felt when it is considered that the problem is of a mechanical kind, and that its solution involves the most perfect system of locomotion with which we are acquainted; for, not only is it found that a bird can fly faster than it can run, but, what is more, it can fly faster than the fleetest quadruped can run, notwithstanding that the quadruped is specially adapted for moving on the ground, and makes use of its four limbs for that purpose, whilst the bird is not specially adapted for moving in the air, and can, therefore, only use two of its limbs in doing so. Now, considering that muscular action is the common source of power in both cases, it follows that the difference in results must be ascribed to the merits of the respective media, unless it be assumed that birds make use of more muscular force in proportion to their weight than other animals. That they possess a greater amount of power is, I believe, quite true, but that they use it—or, rather, use it continuously in flying—is not possible, for the reasons which will be presently given. Indeed, I am inclined to think that the average amount of force consumed in flying is not

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greater than in walking, and certainly not greater than in running, for it can be continued for a longer time than either.

Most people still believe that a bird is buoyed up in the atmosphere by air-cells, although the merest tyro in science should know that as the specific gravity of the entire body of a bird is several hundred times more than air, any support derived from such a source can only count as "the dust in the balance." Others, with more correct views, while fully comprehending that the support is due to motion, yet insist that the force required to accomplish it is so great as to preclude all hopes of being able to do so by machinery. This opinion may be correct when confined to the principle upon which the screw has as yet been employed as a sustainer where the action has been continuous, which is not necessary for merely obtaining support in the air, but causes an immense waste of power. In natural flying the force is employed intermittently, and great economy is the result. For example, the wing of a bird, although moving at the rate of sixty feet a second, when exerting its useful action, may only then pass over a space of 1ft., which it would do in the sixtieth part of a second, the remainder of the time being consumed in slower motion—in making return strokes, and in a state of rest. Again, it is well known that a body falls by the force of gravitation 16ft. in a second, and supposing it to weigh 1,000lb., this would represent a force equal to thirty horses, but by reason of the motion being an accelerating one, the same body would only fall 1ft. in the first quarter of the second, representing a power of less than eight horses, and in the sixteenth part of a second the fall would be $\frac{3}{4}$in., equal to two horses' power, whilst in the sixty-fourth part of a second the fall would be less than the twentieth part of an inch, or at the rate of 3in. in a second, which represents only half a horse power.

When, therefore, it is considered that the wings of insects vibrate more than a hundred times in a second, causing so many interruptions to the accelerating motion of gravitation, or minute elevations, how astonishingly small appears the power to sustain under such circumstances. Nor, after all, is it surprising, for in theory, at least, no power is required for support. It is for lifting, not sustaining, that force must be consumed. The velocity acquired by a body in falling from any height is sufficient to carry it back to the same elevation from whence it fell, as seen in the pendulum of a clock, and still more to the purpose in the flight of a bird when making a swoop.

I have not deemed it necessary to touch on the subject of propelling in the air, because it is precisely analogous to screw propulsion in the water, which is too well understood to need any discussion; and the same applies to steerage, which is dependent on it. But, as regards the supposed great difficulty connected with artificial flying, namely, the power required for sustaining, I have endeavoured to show that this depends more on the application than on the actual amount, and should this view of the matter (corroborated as it is by the valuable contributions of Messrs. Wenham, Smyth, and Artingstall), be deemed correct, the prospect before us will be indeed cheering, for it cannot but be believed that with the immense engineering resources now at our command means will be found to apply force in any manner that may be required, and thus by machinery we may soon achieve the same locomotive triumphs in the air as have already been obtained on land and on water.

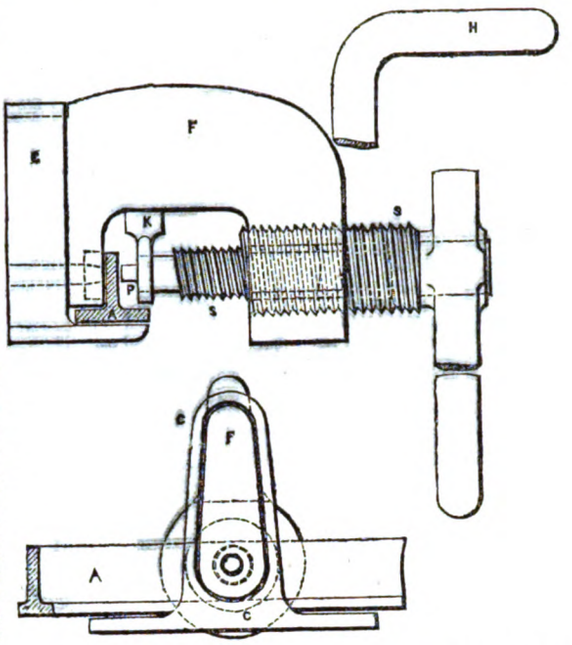
DISCUSSION.

The Duke of Argyll said,—I entirely agree with the principle just laid down, that there is much more to be done in studying the application of power than in increasing the quantity; but I think Mr. Brown is rather too sanguine as to the possibility of obtaining a sufficiently light motive power in the present state of science. The steam engine at the present day represents the greatest force to be obtained as yet. It is, however, not only a very heavy cumbrous metallic body in itself, but it requires a large supply of water and fuel to enable it to do its work; these are additional heavy bodies, and the combined weight of the machine altogether precludes the hope that an engine can be so made as to raise or move itself in the air. Still, the absence of the lighter motive power required ought not to stop us from investigating the principle upon which it is to be applied. Science one day will, no doubt, attain to this desired motive power, and I think that Mr. Wenham's paper, in addition to this one just read, goes far to show the principle upon which the power may be applied.

(To be continued.)

PORTABLE PUNCHING MACHINE, METROPOLITAN RAILWAY.

THE accompanying sketch illustrates a light portable machine for punching small holes through wrought-iron plates or bars in situations where the ordinary form of punching machine would be inapplicable. In glazing the roofs of the Metropolitan District Railway stations, it is found necessary to insert pins or dowels at intervals through the T-iron sash bars carrying the glass, this involves the punching *in situ* of a large number of holes, varying in size from 3-16in. to 5-16in. diameter. The following is a description of the machine designed by Mr. Edward W. Furrell, and adapted for this purpose:—A is the T-iron sash bar carrying the glass, a small hole being required near the middle of its centre rib, as shown: F is the frame or holder carrying a differential screw; S S' working through the solid metal of F (the outer screw S' is of greater pitch than the inner screw S), and having the punch P at the extremity of the inner screw S; H is a handle acting upon the outer screw S'. By the action of the differential screw a few turns of this handle gives the required motion to the punch P and forces it through the T-iron sash bar; by reversing the motion of the handle the punch is withdrawn. C is a wrought-iron ring slipped on to the end of the holder F, and terminating in a foot or clip, which passes underneath the sash bar and effectually holds the machine in position whilst operating upon the handle H; K is a guide ring for preventing the inner screw S from turning during the action of the screw S S'. The mechanical advantage of this screw is the circumference described by the power divided by the difference between the pitches of the screws S and S'.



The dimensions of the machine in operation are as follows:—Outer screw S', $1\frac{3}{4}$in. diameter and 1-6in. pitch; inner screw S, 1in. diameter and 1-8in. pitch; diameter of punch from 3-16in. to 5-16in.; circumference described by power, 100in.; weight of machine complete, 20lb.; size of T-iron sash bar $1\frac{1}{2}$in. by $1\frac{1}{4}$in. by $\frac{1}{4}$in.; average rate of punching with this machine, thirty holes per hour.

MIDLAND BOILER ASSURANCE COMPANY.

MR. E. B. MARTEN, chief engineer to the Midland Steam Boiler Inspection and Assurance Company, has issued his report on boiler explosions in 1867, which forms an appendix to the twelfth half-yearly report of the company. There can be no doubt that periodical inspection is the best safeguard against the explosion of steam boilers, and Mr. Marten's report shows that nearly all the explosions last year resulted from simple and well understood causes, and could have been prevented by proper examination. Mr. Marten's report is accompanied by some useful sketches to a uniform scale, showing the relative size and shape of the boilers, and also the effect of the explosion, by the fragments being arranged as near as possible to their original position. None of the exploded boilers were under the care of this company. Records are given of forty-eight explosions, causing the death of seventy persons, and the injury of eighty-eight others.

The exploded boilers were of the following descriptions:—

	Explosions.	Killed.	Injured.
Domestic	6	5	4
Cornish or others, with internal flues	17	29	30
Plain cylinders, without internal flues	13	19	32
Multitubular	6	12	14
Balloons	2	2	2
Various	4	3	6
	48	70	88

The exploded boilers were used for the following purposes:—

	Explosions.	Killed.	Injured.
Domestic	6	5	4
Collieries	7	12	16
Railways	5	2	7
Ironworks	3	2	6
Farms	3	11	10
Paper, spinning, dye, wool, flour, wire, and other mills	20	37	45
Unknown	4	1	0
	48	70	88

The causes of explosion may be thus stated:—

	Explosions.	Killed.	Injured.
Frost in the pipes of domestic boilers, without safety valves	6	5	4
Old and worn out; plates injured by too frequent or neglected repair, or accumulations over the fire	7	14	20
Faulty construction, or bad material or workmsnship, tubes without strengthening rings, flat ends insufficiently stayed, no provision for expansion, insufficient strength of manholes	15	17	26
Undue pressure from safety valves being fastened, or overloaded, or otherwise rendered inefficient	5	13	12
Corrosion at parts touching brickwork, and which might easily have been detected by inspection	8	14	13
Overheating through shortness of water	2	1	4
Carelessness in arrangement or management of fittings	2	3	2
Unknown, no trustworthy particulars having been obtained	3	3	7
	48	70	88

A glance at Mr. Marten's graphic illustrations, showing something of the wreck and damage of the past year, and the fact that none of the exploded boilers were under the care of the company, ought to suffice to make every steam user place himself under the protection of assurance and inspection.

THE following gentlemen will act as presidents of the various sections at the Norwich meeting of the British Association for the Advancement of Science:—Professor Tyndall, mathematical section; Mr. Frankland, chemical section; the Rev. M. J. Berkeley, biological section; Lord Strangford, geological section; Right Hon. W. E. Gladstone, M.P., statistical section; and Mr. G. P. Bidder, mechanical section. Professors Olley and Huxley, together with Mr. Scott, of the Board of Trade, are also expected to deliver lectures.

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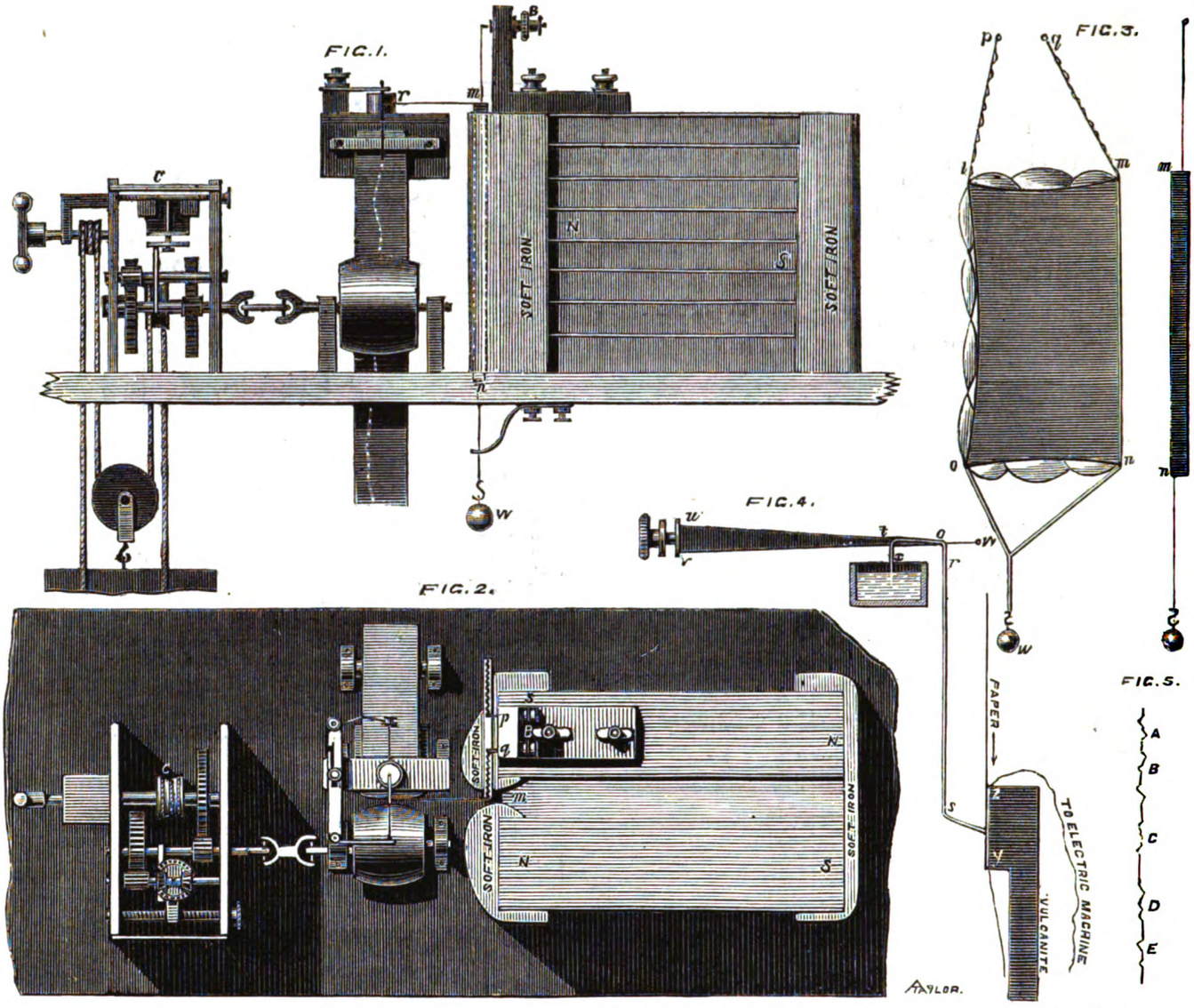
RECORDING TELEGRAPH INSTRUMENT.

BY SIR WILLIAM THOMSON.



SIR WILLIAM THOMSON'S NEW READING TELEGRAPH INSTRUMENT.

THIS new apparatus is designed by its distinguished inventor to record permanently such signals as have hitherto been received upon the Atlantic cable by his beautiful mirror galvanometer. The peculiar merit of the mirror galvanometer lies in the fact that it has a shifting zero, that it continuously indicates the variations of strength in the received current, even of the most delicate kind, and it enables signals to be received and interpreted which would be invisible on other apparatus. The new instrument replaces the movement of the spot of light by a curved or broken line, drawn or marked upon a strip of paper which gives a graphic representation of the varying strength of the current, and a permanent record of every feature of the effect due to the sender's action.

The difficulty hitherto experienced in producing such a recorder has been that of obtaining marks from a very light body in rapid motion without impeding that motion. Marks, either by points, pens, pencils, &c., introduce friction, and electrolytic action requires power exceeding the limits of safety. Sir W. Thomson has overcome the difficulty in an exceedingly beautiful and novel manner. The mirror of his galvanometer is replaced by a light capillary glass tube attached to a very light stiff coil of a small number of turns of fine wire, moving in a very powerful artificial magnetic field. He thus reverses the conventional system: the magnet is fixed and the coil movable. As the relative motions of magnets and currents are simply due to the reciprocal action of each, and are measured by the ratio of the strength of the magnetic field to the strength of the current, it is evident that by increasing the intensity of our magnetic field, which we can do *ad libitum*, we can produce motions upon the very lightest currents. Sir W. Thomson only uses a coil of a resistance equal to 20 Ohms, and he has obtained good results with copper wire weighing about $\frac{1}{4}$ grain per foot, and with coils containing about 20 turns. The strength of his signals with the same power are greater with the new instrument than with the mirror galvanometer; and the delicacy of his new recorder is such that a single Daniell's cell produces perfectly distinct signals through 8,000 Ohms, a resistance exceeding that of the Atlantic cable. One end, the short leg, of the light tube, which is a syphon, dips into an ink reservoir, and its long leg points obliquely downwards, its end being opposed, without touching, to a strip of paper which moves vertically in front of it. The paper is drawn over a metal plate which is electrified *positively*; the ink reservoir is electrified *negatively*. We have thus two points oppositely charged which tend to cause a succession of sparks to pass between them, but which under the circumstances produce a fine stream of ink, spirted out by electric force, and drawing or marking a sensibly continuous line without impeding by friction the motion of the tube as directed by the receiving instrument. Earth currents would cause the syphon to make long sweeps from side to side on the paper, still leaving the alphabetical curve clear and distinct.

In the accompanying illustration, fig. 1 is an elevation, and fig. 2 a plan showing the principal parts of the recording instrument. A large permanent compound steel magnet, N. S., made of a large number of straight steel bars with a soft iron junction piece, and soft iron poles, is used to produce a very intense magnetic field in the deep narrow space separating the poles, shown in plan at m, fig. 2. The light coil of fine silk-covered copper wire is shown in fig. 3, the wire is stretched on a couple of light struts or booms between $l\ m$ and $o\ n$. The side $m\ n$, composed solely of the fine wire, is formed into a thin flat cake by being cemented with paraffin. The side $l\ o$ is strengthened by a strong thread to relieve the copper wire from strain, and the axis of suspension is placed nearer the strengthened side. The coil is suspended by two fine silk fibres $l\ p$ and $m\ q$, so that the side $m\ n$ hangs in the magnetic field between the poles of the magnet, and is free to oscillate in a direction parallel to the straight bars forming the magnets; the two ends of the wire are twisted round the suspending fibres, and are attached to the terminals B B. The weight w keeps the coil in shape, and adds directing force to the coil. The peculiar form of the coil allows it to approach very close to the magnetic field, and the depth of the side $m\ n$ exposes a considerable length of wire to magnetic action. The capillary tube or syphon is shown in detail in fig. 4, marked $t\ r\ s$ and is attached to the top of the side $m\ n$ of the coil by a single silk fibre $m\ r$, the syphon being suspended with double threads $t\ u\ x\ v$ at one side, and a single thread $v\ w$ at the other side, so as to oscillate round a horizontal axis. The directing force of the double threads is adjusted so that the syphon can follow the movements of the side $m\ n$, to which it is attached, keeping the single fibre $r\ m$ always taut. The distance of the point of attachment r from the axis $t\ w$, is about 1-10th the length of the long leg of the syphon, so that any motion of the side $m\ n$ may be represented by a tenfold motion at the end of the syphon.

In fig. 4 the paper is shown on which signals

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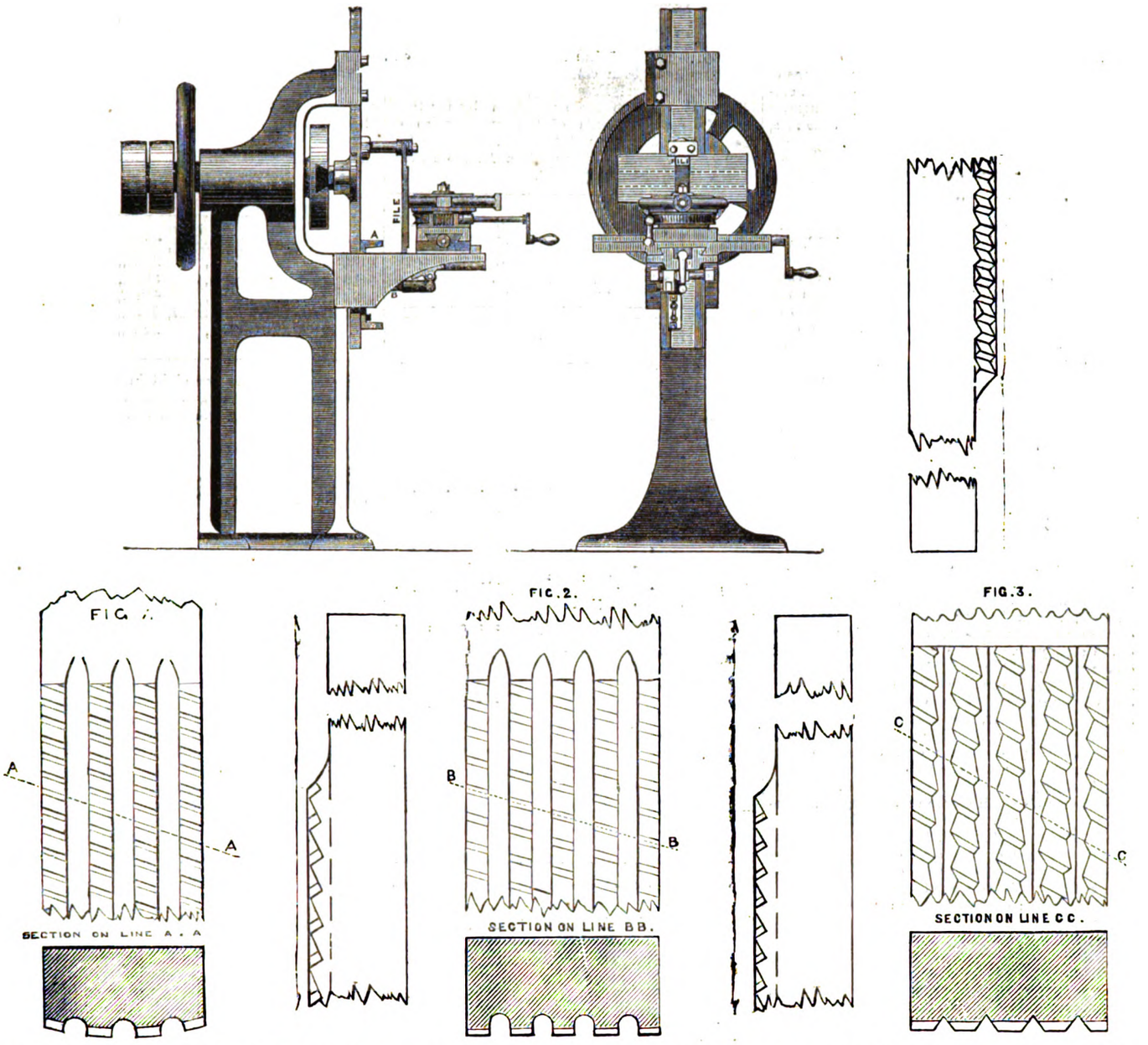
FILING MACHINE AT THE STAMP-END WORKS.

DESIGNED BY MR. G. WILKINSON.



are recorded, moving vertically past the long end of the syphon, the short end of which dips into a dish of ink. A brass plate, *x y*, across which the paper is drawn in front of the end of the syphon is connected with an electrical machine, and is kept constantly charged with electricity, whilst the syphon is in connection with the earth. When the recording instrument is at work, the brass plate and paper crossing it being highly charged with electricity, attract the end of the syphon, and under the influence of this attraction, and of a rapid vibration produced in the end of the syphon, and which is due to continual small electrical discharges, the ink flies in a succession of fine drops from the syphon to the paper. These drops blend into a continuous line on the paper as it is drawn regularly forward. This line records the position of the end of the syphon at each moment as it is moved backwards and forwards across the paper by the silk fibre *r m*, attached to the side *m n* of the receiving coil. The line drawn on this paper is, therefore, a continuous curve corresponding to the motions of the side *m n* of the receiving coil, and, therefore, to the varying currents producing the motions, and to the signals which those currents indicate. When no current is received a simple straight line will be drawn along the paper; short positive and negative signals will draw small ripples on either side of the zero line; in fig. 5 may be seen the curves representing the letters *a*, *b*, *c*, of the Steinbiel code. This beautiful instrument is intended to receive and record all signals such as have hitherto been received on the mirror galvanometer, thus doing away with the inconvenience of a darkened room, and avoiding the necessity and consequent risk of additional error of an extra repetition of signals. The invention is patented.

FILING MACHINE AT THE STAMP-END WORKS.

WE believe we are right in stating that within the last eleven years Messrs. Clayton and Shuttleworth, of Lincoln, have turned out a greater number of small steam engines—portable and stationary horizontal engines, for farm purposes—than any other makers. They have, accordingly, been enabled to carry out very extensively the use of special tools for finishing a large number of duplicate details. The connecting rods, for instance, are only just touched by the file in order to take off the slight burr, or arras, left on the edges of the straps and brasses on coming from the slotting and shaping machines. The fine last cut taken quite obviates even the use of the draw-file. The cottar holes are, of course, done in a slot-drill, and the semi-cylindrical edges of the cottars themselves are shaped in a special semi-rotating lathe by Smith, Beacock, and Tannett, of Leeds. The brass eccentric straps employed for the engines made at the Stamp-End Works are flat on the outside, and this part of the strap could thus with fair economy be finished in a slotting or shaping machine. But Mr. George Wilkinson, Messrs. Clayton and Shuttleworth's engine-shop manager, has found it yet more economical to employ the ingenious and original machine we now illustrate. The two halves of the eccentric straps are cast in one piece, and of course first turned up, and after the outsides have been got up they are slotted in two, the small space made by the slotting tool being afterwards filled up by a packing piece for taking up the wear.

The tool is like a small slotting machine, with the usual crank and slide for giving a reciprocating motion to the slotting frame. Instead of an ordinary cutter, however, the frame holds a sort of rough file, or even an ordinary file. The three different kinds, portions of which we have illustrated full size in figs. 1, 2, 3, are employed for roughing over the brass clips, which are afterwards finished with a file cut in the ordinary way. The slide table on which the pair of clips, still in one piece, are held by means of a bolt and a round plate, is fitted with a compound cross-slide and circular motion. The work is thus easily set and traversed under the tool; it can be rotated by the worm and wheel, and a very complex shape can be brought up to the toothed cutter or file. Provision has of course to be made to take the work beyond the range of the file on the return stroke of the machine, just as a hand-file has to be slightly lifted off the work on being drawn backwards. The sliding tool frame is hence furnished with two

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stop pieces, A A, which come in contact at each end of the stroke with a tappet lever fixed on a nut on the screw B. The other end of this screw is jointed to a rocking shaft carried at each end by two small brackets. This shaft itself, by means of a lever in the middle, acts on the slide table. The top stop then slightly moves back the table, just sufficient to clear the tool on the upward stroke of the file; and the bottom stop brings the table forward in time to receive the downward cut of the tool. The engravings of the full-size portions of the roughing-out tools show the kind of teeth employed. The entire length is 1ft. 2in., the narrow one 1in., and the two others $1\frac{1}{4}$in. wide on the face, with a depth, at the toothed part, of $\frac{3}{8}$in.

SOCIETY OF ENGINEERS.

(Continued from page 241).

UNDER date the 30th of January, 1850, the Court of Directors of the East India Company ordered the appointment of commissions in each presidency to inquire into and report upon the system of public works, and the whole subject of their superintendence and execution. The consequence of the reports of these several commissions was the establishment of regular public works departments for each presidency, in whom was vested the control of all kinds of public works. At first the engineer branch of the department consisted principally of military men, many of whom were officers of the Engineer Corps and Artillery, but some were drawn from the line regiments, of whom it is no exaggeration to say that many were not possessed of the slightest qualification for such appointments. In the early part of the year 1855, twelve engineers and twelve overseers were, at the request of the Government of India, sent out from this country for special employment on the irrigation works then in progress in the North-Western Provinces and the Punjab; and a further number of twenty-five engineers and overseers were sent out in the course of the same year. In the early part of 1859 six civil engineers of the rank of executive engineers, fourth class, and special assistant engineers, were sent out for service under the Bengal Government, and in the same year, in consequence of the necessity for annually recruiting the Public Works Department by engineers sent out from this country, it was determined to hold competitive examinations, to which any young men who had qualified, by a certain course of professional training, were admitted. The first advertisement was issued on the 4th of March, 1859, and the examination commenced on the 10th of May following. Forty-eight appointments were offered to competition, but only thirty-seven of the candidates were found qualified; of these fourteen were appointed to the Engineer Branch, and twenty-three to the Upper Subordinate Branch of the Department. All of the latter grade were, soon after their arrival in India, promoted to the Engineer Establishment, as they evidently belonged to a better class than that of which the Upper Subordinate Establishment was generally constituted. No more appointments of the lower grade have since been made from this country (with the exception of four who were sent out in 1860), but annual examinations have been held at the India Office, since 1859, for appointments to the Engineer Establishments. In consequence of the pressing want of more engineers—principally in connection with the proposed extension of irrigation works throughout India, which are henceforth, to a great extent, to be carried on by means of capital borrowed for the purpose, and which will be employed to augment the usual annual grants from surplus revenue—a second examination was held in December last, at which twenty-five appointments were offered for competition; and in the early part of the present year thirty temporary appointments to some of the higher grades in the department were made in this country in order to meet the immediate and pressing want of engineers in India. Altogether, since 1859, 181 engineers have thus been appointed from this country to the Engineering Establishment of the Public Works Department in India. The demands of the service for more men are still urgent, and in all probability will continue so for many years to come, as the increase in the prosperity of the country demands the construction of more public works for its necessities and conveniencies. Hitherto it has been found difficult to maintain the established proportions of military and civil members laid down for the Department. This is a difficulty which is likely to increase rather than to diminish, and it may with some reason be expected that India will for many years to come provide the best field for the energies of our profession.

In order to give some general idea of the prospects of the Government service in India, it may be as well to state the salaries of the several grades in the Public Works Department, and the average length of service, before reaching each grade. These particulars have been compiled from official documents, and can be vouched for as substantially correct. It is true that they have been calculated from the returns only of the Bengal Presidency, but as that establishment contains more members by far than both the establishments of the presidencies of Madras and Bombay put together, it affords the best general average of promotion for the Public Works Department in general.

Designation.	Civil Consolidated Salary, exclusive of Travelling Allowance.	Travelling Allowance for any Distance not exceeding 20 miles.
	Rupees.	Rupees.
Chief Engineer, 1st class	2,500	6 per diem.
" " 2nd "	2,000	
" " 3rd "	1,750	
Superintending Engineers, 1st class, 1st grade	1,600	
" " 2nd "	1,400	
" 2nd class, 1st grade	1,200	
" 2nd "	1,000	
These Superintendent of Works . "	900 to 1,400	
form Executive Engineer, 1st grade	900	5 per diem.
one " 2nd "	750	
class. " " 3rd "	600	
" " 4th "	500	
These Assistant Engineer, 1st grade	400	
form " " 2nd "	300	
one " " 3rd "	200	4 per diem.
class. Apprentice .	100	

Average length of the service of members in each grade:—

		Yrs.	Mon.
Chief Engineer, 1st class, 3 military	5 military	21	6
" 2nd " 5 "	1 civil	16	1
" 3rd " 3 "	7 military	17	7
Superintendent Engineers, 1st class, 1st grade.	1 civil	21	7
	5 military	4	6
" 1st " 2nd "	1 civil	16	1
" 2nd " 1st "	5 military	12	6
	1 civil	17	7
" 2nd " 2nd "	8 military	12	8
	3 civil	15	0
	25 military	14	4
Executive Engineers, 1st grade	16 civil	14	3
	29 military	14	2
" 2nd "	18 civil	11	9
	15 military	13	6
" 3rd "	28 civil	8	4
	34 military	10	8
" 4th "	43 civil	6	9
	24 military	7	11
Assistant Engineers, 1st grade.	48 civil	7	4
		6	2

It must be stated, however, that these figures do not correctly show the average length of service which civil engineers going out from this country must expect to pass before getting promotion from one grade to another, as in each grade there are one or more who, from their exceptionally long service, cause the general average to be unduly raised. Thus, amongst the assistant engineers of the first grade there is one who has served 19 years 7 months, another 17 years 7 months, another 14 years 9 months, and another 11 years 11 months. Amongst the executive engineers' fourth grade, are those who have been in the service for 19 years 1 month, 16 years 11 months, 16 years 10 months, and so on.

With only two exceptions, none of the civil engineers who have been sent out from this country since the year 1855 have yet attained a higher rank than that of executive engineers' first grade. The following statement gives the number of civil engineers appointed from this country, in each grade, and the average length of their service before being promoted to that grade:—

No.	Rank.	Average Service.	
		Yrs.	Mon.
5	Executive Engineers, 1st grade	8	11
1	" " 2nd "	9	5
10	" " 3rd "	8	8
22	" " 4th "	5	9
21	Assistant Engineers, 1st "	3	8
8	" " 2nd "	1	3

Besides which there are eight in the third grade of assistant engineers, amongst whom, however, there is only one included who went out during last year. Omitting, then, the seventy who have been sent out from this country within the past twelve months, for employment in the Public Works Department, the foregoing particulars relate to all but thirty-five of the total number sent out since 1859, a few of whom belong to the Public works Departments in the other presidencies, some have left the service, and others have died.

Finally, it may be stated that the author of this paper has seen the several attacks made on the Indian Public Works Department, which have appeared from time to time in letters to the "Builder," the "Engineer," and the "Irish Times"; but, with the single exception that the salaries on first appointment are not sufficiently high to attract young men of promise from this country, there has not been one complaint thus publicly made which cannot be most positively contradicted. Several instances have also come to the knowledge of the author of this paper of persons having left the department with the supposition that they could obtain better appointments, seriously regretting that action as a false step, and desiring to be re-admitted to the service. Some have succeeded in re-establishing themselves upon the strength of their own merits, others have failed. If the remuneration of Government service is comparatively small, it must be remembered that it is sure, and that the reversion of a pension after a certain number of years, though perhaps remote in its realization, is yet equivalent to an increase of income. The public service is an honourable service, and, though the prizes may appear few and remote to beginners, it may be stated in full confidence that they are certain of attainment, in due course, by the honest and persevering.

THE THAMES EMBANKMENT.

MR. BAZALGETTE, the Chief Engineer to the Metropolitan Board of Works, has presented a report to the Board having reference to the arrangements for opening the Thames Embankment, road, or footway, during the ensuing summer. Mr. Bazalgette says, that to form the carriage-way along the face of the embankment would not at present be prudent, because it would have to be taken up for the construction of the Metropolitan District Railway underneath it. The specification and drawings now submitted for the approval of the Board provide for the formation of a paved footway, 20ft. wide, along the face of the embankment from Westminster-bridge to the west end of the Temple-gardens. Two approaches will be connected with Westminster-bridge, one down the steps to and along the new steamboat pier, and the other at the back of the pier, by a gradual incline from the level of the bridge down to that of the embankment. A subway for foot passengers is to be formed from the Houses of Parliament underneath Bridge-street to the station of the Metropolitan District Railway, and Mr. Bazalgette is now in communication with Mr. Barry with a view to submitting for the consideration of the Board a design for the continuation of that subway to give access to the Westminster steamboat pier, and for allowing foot passengers to pass from the footpaths on the Thames Embankment to any part of Westminster without encoun-

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tering the carriage traffic in that locality. A temporary paved foot approach is proposed to be formed from Villiers-street, Strand, to the embankment roadway and Charing-cross steamboat pier. Some arrangement will have to be made with the South-Eastern Railway Company in order to maintain the full width of this approach at the upper end, and it would be to the public advantage and the company's interest that they should also form an approach by steps from the footway at the side of the Charing-cross railway bridge down to the embankment footway. A third temporary paved foot approach would be formed from the steps at the side of Waterloo-bridge, giving access between Wellington-street and the Waterloo steamboat pier. The fourth temporary paved foot approach would be from the steps at the end of Essex-street, Strand, to the Temple steamboat pier, which, for the present, would be the eastern end of the Thames Embankment promenade. A communication may also be made with the Temple-gardens, if desired by the representatives of that property. The whole of these footways will be fenced off by temporary wooden fencing, and may be opened to the public in the course of the coming summer.

IRON-CLAD SHIPS.

ON the evening of Friday last, Mr. E. J. Reed, the Chief Constructor of the Navy, delivered a highly instructive and interesting lecture on iron-clad ships, at the Sailors' Home, in Dock-street, near the London Docks. The large dining hall which accommodates about 500 persons, was on this occasion converted into a lecture hall, and some 300 tenants of the "Home" and visitors attended. The walls were covered with diagrams, and the lecture table with models of iron-clads and of armour-plates. Mr. Reed commenced by describing the floating batteries which were used against the Russian forts during the Crimean war, and then explained the various steps which had since been taken by the Admiralty for increasing the naval defences of this country. He minutely described the peculiarities of each successive step, which had been devised and launched under his own direction, and entered especially into the question of their vulnerability or otherwise. Comparisons were also instituted between French and English vessels of war, which resulted in a demonstration of the superiority of the latter over the former. The various kinds of backing, and of inner skins employed in the construction of iron-clad ships, and of experimental targets for testing the penetrative powers of the Whitworth and other guns, were explained, and then the lecturer advanced to a consideration of the fleet of the future. Although carefully guarding himself from divulging the plans of the Government, it was quite apparant that Mr. Reed's inclination was towards the introduction of shorter ships, thicker armour-plates, increased steam power, twin-screws, and greater coal stowage. The lecture, which lasted an hour and a-half, gained the close attention of a very appreciative audience, in which the nautical element strongly predominated. Captains Fremantle and Pollumbe, R.N., respectively proposed and seconded a vote of thanks which, with the addendum of three hearty cheers given by the sailors present, was finally awarded to the Chief Constructor. The Rev. Dan Greatorex, the indefatigable chaplain of the "Home," and who was himself originally an engineer, presided, and he was supported by Major Joselyn, Captain Kintoul, Mr. Newton, of the Mint, Mr. Graveley, and other scientific gentlemen. Altogether, the proceedings were of a gratifying nature, and certainly a more appropriate locality could scarcely have been chosen for such a lecture.

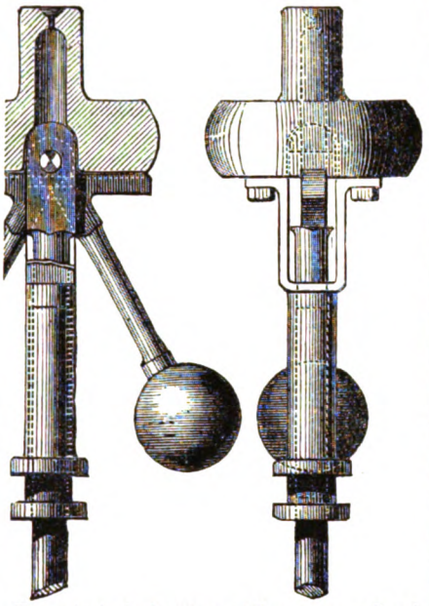
BELGIAN TELEGRAPHS.

THE telegraphic systems of Belgium, which are managed by the State, have now been established sixteen years, and the cost of their establishment have been entirely covered by the surplus receipts. The annual cost of the service is about 840,000fr.; but this sum does not strictly represent all the cost of administration, inasmuch as many buildings occupied and much assistance rendered by the railway and Post-office employés should be included in the general estimate. But, on the other hand, the telegraph gives to the other departments more than it borrows from them, for, according to returns for the year 1866, it appears that out of nearly 312,000 official messages transmitted during the year, 28,000 only were on account of the telegraph service itself. There are 106 telegraphic offices in operation in the stations of the State railways, fifty of which are used almost exclusively by the various departments of the Government, and very seldom indeed by the public. The night service, also, which is managed by a staff of fifteen clerks, is seldom required for other than messages in connection with passengers and goods' trains, so that, in fact, it is difficult to estimate the total cost of the service, inasmuch as it receives and gives in return benefits that could not be obtained on equally advantageous terms elsewhere. During the years 1864, 1865, and 1866, the inland messages cost more than they produced, and it was found that all the profit which had accrued arose from international messages—for inland messages require two sets of operations, international messages one set of operations only, and a message in transit merely requires re-transmission, without any cost for receipt or delivery. The tariff for an inland message is now reduced to half a franc, which involves a present sacrifice that could not have been borne unless the result of the first ten years had been superlatively prosperous. The real net profit of the year 1866 amounted to more than 122,000fr., and it is anticipated by the administrators that a reduction will shortly take place in the cost of working and on the average loss on each inland message, and that an increase of profit will obtain on each international or transit message.

IMPROVED GOVERNOR.

IN our report of the machinery at the Cattle Show last Christmas, we noticed a neat arrangement of centrifugal governor applied by Mr. Kinsey, of the Robin Hood Works, Nottingham, to his horizontal engines. From our illustration it will be seen that a cheese-shaped disc is placed at the top of the spindle, which is raised by the divergence of the balls, which are very small and driven at a high speed, securing very sensitive action.

FIG. 1. FIG. 2.



The principal advantage of the governor lies in its extreme simplicity; only a single pin is used, and therefore the surfaces exposed to wear are reduced to a minimum. The means by which motion is communicated to the throttle valve will be easily comprehended from the engraving. A number of these governors are now working very satisfactorily.

IRON FORTS AND HEAVY GUNS.

IT is with very considerable interest that we have observed so many notices entered by members of the House of Commons in respect to our national defences upon the production of the army estimates. Without doubt the defences of the country are not in a satisfactory state. We have never been alarmists, but we have been to the front in urging a judicious and proper expenditure of the vast sums of money which have been demanded and obtained for our new forts and fortifications. No less than £12,000,000 was their first estimated cost, and the subsequent introduction of iron shields and casemates will increase that amount by hundreds of thousands of pounds. And yet, notwithstanding the enormous sums so required, no trial of models of the works in progress have yet been made. Of the shields of the notorious Gibraltar class, which were made anp shipped to their destination before a single one was shot at, two are now to be brought home again, if we are correctly informed, for experimental trials to improve their structure. These unfortunate affairs wo would be willing enough to write off from memory, like bad debts, as a simple loss; but the same fatal error is being repeated over again in respect to the Bermuda and Plymouth forts. The representative section promised so long ago, when the contracts were first taken, to be shot against at Shoeburyness, is still tardily erecting, and will not in all likelihood be properly fit for half a year to come, and certainly even the iron portion could not be got ready, in any sense of that word, under six or eight weeks. But during all this time the contractors have been proceeding with their works, and in all likelihood the forts will be delivered to the nation before the model of the system on which they are built is ready for testing. And this model, when tested, will fail—will fail notwithstanding the many strengthenings and material modifications it has undergone at the hands of the Royal Engineers since the contracts it was intended to represent were taken. It was costly enough experimenting with Armstrong guns, and vexatious enough to have a result of nearly nil for many years' labour and millions of money, yet there was a justification for trying to make breech-loading cannon, and there would be still again if any likely plan were offered. But it would be dearer far and more calamitous to build iron forts which will not keep out the shots from naval guns. The iron plank system upon which the forts now erecting are designed, is, we have always contended, a defective one. And yet the work is going on untested, although the Minister for War himself has so far acknowledged the justice of the objections raised as to order a model for trial. If, as before, the works are finished before the models are tested we shall ten years hence be in the same plight with our fortifications that we are now with our guns. Why the haste to complete contracts for forts when there are no guns to arm them with is beyond all comprehension. Our newest ships, the "Hercules" and "Northumberland," will have to borrow from the land service, if the land service have any to lend them, some portion, at least, of their heavy guns, and the manufacture of large artillery is therefore as essential and of more immediate importance even than forts. And yet forts are important, too, for Russia is now having made in this country a shield of 18in. thick, composed of two large interlocking plates without bolts, and if this prove successful an order for 200 others will be forthwith given. Turrets, too, for ships, of 21in., in two plates, are about, we hear, to be produced for foreign governments.

As to heavy guns, the Americans, it is known, possess more than a hundred 20-inch 50-ton smooth-bore guns, throwing with 200lb. charges 1,080-pounder shot over a range of 4½ miles. Supposing the shells which these guns could hurl to a much greater distance to be 4in. thick in wall, the spherical bursting charge taken at 850 cubic inches would be 30lb. of powder, the destructive effect of which would be considerable. The Americans have monitors now carrying 16in. of laminated plating; and a powerful rolling mill without fly wheel, has, we believe, been ordered from one of our eminent midland manufacturers, so that thicker plates may be expected hereafter to form their mail.

Now, there is an essential condition of heavy projectiles which has not yet received proper attention in any discussion upon these topics in this country. It is the much greater distance of range over which the larger shot retain their energy than do the smaller ones. The resistance to the flight of projectiles is as the squares of their surfaces to their velocities. But the energy or momentum is as the cubes of their weights. Our 9-inch rifled gun with 250-pounder bolt would pierce at 200 yards an American monitor's 16in. of plating. The American ordinary heavy 450-pounder guns would pierce the "Hercules" at 200 yards. The vessels therefore could hardly fight at close quarters, or if they did both armaments would be equally effective, and both vessels alike vulnerable. All might have been said against the larger American guns that could be urged against smooth-bore cast iron cannon and spherical shot; but Ericcson is making a large wrought iron 20-inch gun, and we may therefore argue in our more familiar way of increased calibres of rifled guns. The 250-pounder projectile from our 9-inch gun, at a velocity of 1,340ft., would penetrate a 9¾-inch armour plate; our 400-pounder from the 10-inch gun would, with a velocity of 1,290ft. penetrate an 11-inch plate; our 600-pounder at a velocity of 1,220ft. would penetrate an 11½-inch plate; while the 1,200-pounder shot from a 15-inch rifled gun would at a velocity of 1,340ft., penetrate a solid 16-inch armour plate. It is true we have not yet made a 15-inch rifled gun, but the Royal gun factories are happily alive to the emergency, and desire to stake their reputation on the production of a 60-ton gun. We may, however, theoretically put the value of such a weapon before our countrymen in a somewhat more ordinarily comprehensible way. Its shot would, fired with 200lb. of powder against the "Hercules," pierce her thickest water-line plating at 2,000 yards. To give the power of this shot, as accurately as can be estimated, it would at that distance have a velocity of 1,156ft., and be equal to penetrating a 13¾-inch solid plate.

In conclusion, it will be well to state what guns we have fit for service. The seare:—Of 6½-ton

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7-inch rifled guns (115-pounders), on Royal gun factory system, 332, and on Fraser system, 180; of 7-ton 7-inch rifled guns (115-pounders) 51 on R. G. F. system, 12 Fraser system; of 8-inch 9-ton rifled guns (180-pounders), 77 on R. G. F. system, and 2 on Fraser system; of 9-inch 12½-ton rifled guns (250-pounders), 188 on R. G. F. system, and 70 on Fraser's system. There are also 51 smooth-bore 9-inch wrought-iron muzzle-loading guns (100-pounders), on R. G. F. system. The respective charges of the above guns are—7-inch gun, 22lb. l. g. r. powder; 8-inch, 30lb.; 9-inch rifled gun, 43lb.; and 9-inch smooth-bore, 25lb.

Of guns larger than the foregoing there is one 18-ton 10-inch rifled muzzle-loader, on Fraser system, at Shoeburyness; the "Horsfall" or Mersey smooth-bore 13-inch gun (500?-pounder); and five 12-inch rifled 600-pounders in the workshops at Woolwich; two on Armstrong system, finished; and three on Fraser system, finishing. The present capabilities of the Royal gun factories are equal to producing twenty heavy guns in six months; a single one could not be produced in less time. It is well, therefore, that these facts and considerations should be duly weighed in the coming discussions which are inevitable both inside and outside the House of Commons.—"Standard."

ORIGIN OF COLOUR AND THEORY OF LIGHT.*

By Mr. J. Smith, M.A.

ON a former occasion the author proved experimentally that colour could be produced by the mere motion of a white ray without the aid of refraction; his object now was to explain those physical laws by which colour is produced from a homogeneous substance. He argued that as we hear through the medium of the air—a homogeneous substance—and the variety of sounds is equal to the variety of colours, we may have as great a variety of colour from the ether considered as homogeneous as of sounds from the air so considered. The difficulty was to prove by what process nature modifies so wonderfully the motion of a homogeneous substance. Many years ago he found that by pressing a piece of glass with a point he obtained colours. If the glass pressed were laid on an irregular surface, as a piece of ivory or steel, the colours were in irregular patches; but if the glass were laid on another piece of glass, the circles were complete. This proved that Newton's rings, as they are called, were produced by undulations or waves in the glass, that these waves are virtually small prisms, and that they are stationary as long as the pressure is stationary.

He afterwards found that similar waves or bands exhibited themselves in a film of soap when made to cover the mouth of a tumbler, and that they were particularly interesting and instructive when the tumbler was held at an angle to the horizon. He also found that by blowing through a tube on a plate of glass, a converse series of rings was obtained. And as a proof that these rings were formed of waves, we had merely to examine their motions—the motion of the one series was the converse of the other. Again, he took a thin disc of glass and laid it on another piece of glass of any thickness, and subjecting it to pressure and then cementing the pieces together at the edges, the rings were made permanent. He also showed how the parallel bands of colour could be imitated by prismatic refraction of white bands of the same ratio as to breadth.

The author then applied these laws to explaining the phenomena of the prism. He argued that all matter was put in motion by light, just as we were sensible that every atom of a body was moved by heat. He showed, not only by diagrams but mechanically, the physical laws by which light was refracted and reflected, and expounded, as he considered, the true theory of prismatic refraction. As—how a ray of light was always refracted towards the base of a prism, and how it could not be physically otherwise. Then from these laws he concluded—Given the molecular vibration of matter, given the dispersion of light. He consequently arrived at the conclusion that light no more passed through glass than does sound. If we could withdraw the ether from a glass globe, we could no more see through the glass than we could hear through it if the air were removed.

As to the ether being heterogeneous, we do not say the atmosphere is heterogeneous because one sound differs from another. Why should light, then, differ from sound? Why compound, when the same uncompounded air can convey as great a variety of notes as there are shades or varieties of colours? A prism no more analyzes light or the ether in motion, than an Æolian harp analyzes sound, or the air in motion, for light and sound are both merely modes of motion of two different elements. As a magnet conveys motions of one kind, so glass conveys motions of another, the one not more wonderful than the other. We surely consider the molecules of the magnet to vibrate. Why not the molecules of glass, and consequently of all matter refracting light? A telescope is but another kind of telegraph, only much more comprehensive in its range.

* Literary and Philosophical Society.

PELLET GUNPOWDER.

AN appendix to the March issue of the "Army Circular" gives a list of changes in artillery *materiel*, small arms, and other military stores, with instructions relating thereto. These lists of changes will in future be issued monthly, instead of quarterly as heretofore. The present list contains an order that pellet gunpowder is to be provisionally adopted for all gun charges of 50lb. and upwards. The difference between this and ordinary granulated powder is due to the fact that the composition, after having been converted into "meal" in the breaking-down machine, is pressed at once into cylindrical pellets instead of being made into "press cake" and then broken into grains in the granulating machine. The pellets are formed by the meal being placed in a number of holes in a metal plate, into which closely-fitting punches (having projections that form a cavity in the end of each pellet) are forced by hydraulic pressure, adjusted to give the density required. This is the method by which pellets for fuzes and blank ammunition for Snider rifles have long been made in the Royal laboratories. When the pellets are dry they are drummed for about half an hour with black lead to glaze them.

The following are the particulars of the powder provisionally approved:—

Range of density of the pellet	1.65 to 1.7.
Diameter of pellet ...	0.75in.
Depth	0.485in. to 0.495in.
Diameter of cavity or indentation in end of pellet	0.2in. at top. 0.15in. at bottom.
Depth of ditto	0.25in.
Range in weight of the pellets	85gr. to 95gr., *i.e.*, about 78 to the pound.

Pellet powder has been introduced in consequence of its exercising a materially less destructive effect on the guns than the present L. G. R. powder, than which it exerts a smaller maximum pressure. The repeated failures of 13-inch guns, only two of several of these pieces now remaining serviceable, was doubtless due to the destructive quality of this L. G. R. powder when used in very large charges; and, accordingly, the select committee, after instituting experiments with pellet powder, and comparing them with the results obtained in Russia and in America, recommended the introduction of this powder for the guns of the future, in which the charge would exceed 50lb. There are no guns larger than the 9-inch of 12 tons actually in the service as yet, though experiments have been made with a 10-inch rifled gun at Shoeburyness, and some 12-inch guns have been constructed during the last year; so that the introduction of the powder will be simultaneous with that of these heavier guns. We may, therefore, hope that no more large and costly guns will find their way to the list of those which have already yielded to the destructive action of our large grain rifled powder, which is far more powerful than that used by any other nation. Further experiments with pellet and prismatic powder are still in progress, and are likely to extend over a considerable period.

THE BOARD OF NAVAL SURVEY BILL.

DURING the American war a proposition was made in Congress to establish a "Board of Admiralty," analogous, in its general features, to the Board which it is now contemplated to create under the title of a "Board of Naval Survey," the leading features of which we have placed before our readers. The project failed from the strong opposition it encountered; and among its opponents was the United States "Army and Navy Journal," from which paper we take the following article. Says our contemporary:—To the bill now introduced into Congress we as unhesitatingly give our support, as we withheld it from its predecessor; and it will be an easy matter to show why a Board of Survey is expedient now, but was inexpedient several years ago. The Board of Admiralty bill was introduced at a critical period of the war. It was then no time for re-organization, for the emergencies of war were constantly pressing on the department. It was, perhaps, safer to make mistakes and suffer losses than to experiment with new projects. It was probable that before the Board could be well organized the war would come to an end, and it would require re-adjustment on the peace basis of the naval establishment. Blunders enough, it is true, had already occurred to justify the establishment of such a Board; but at that time the only question was as to what was needed for immediate use against the enemy, without distracting the attention of the department. These considerations no longer have any force. Peace has come, and with peace comes the necessity of providing that the blunders and follies of the late war be never again perpetrated. Take, for example, the "light-draught" business—a performance which a contemporary has, with just severity, pronounced an "engineering blunder without parallel in the annals of professional incompetency." These twenty nondescripts, which were to have been built for less than 400,000 dollars each, have already, it seems, cost 538,000 dollars, and the contractors declare that about 150,000 dollars additional will be required. For these fourteen millions what have we to show? Nothing. Twenty vessels "hardly worth their weight in old iron." They did not fire a hostile shot in the rebellion; their designs were so bad as to render them worthless; they are a disgraceful monument of naval inefficiency.

Who is responsible for this great blunder? The responsibility has been fixed nowhere. It has been trundled about from the shoulders of one man to the shoulders of another, and "nobody to blame," like the verdict on a railroad accident, it is all the satisfaction the country procures. Had a Board of Survey been in authority when these light-draughts were proposed, is it possible that these blunders would have been made? They certainly would not have been. The utter worthlessness of the designs was not only at the outset made the subject of criticism and remonstance by eminent contractors and engineers in the country, but their views were laid before the department. But nothing was done—whether according to the maxim that "what was everybody's business was nobody's business," or for some other cause, we cannot say. The ships were constructed according to the worst plans, and at localities where they could least easily render the services for which they were designed. Now, we have no disposition to reflect on the department in this matter. On the contrary, we may assume that their affairs were conducted with efficiency and honesty. But, if this is so, then the Board of Survey is an absolute necessity to the Navy Department. That this and similar blunders of the most glaring and costly character have been committed, and are still committed, nobody pretends to deny. And if we admit that the fault is one that could not be laid at the doors of the department, then it is a matter of logic that some new organization must be added to its working power. Such an organization is furnished by the Board of Survey; and the Navy Department, in view of the past blunders in construction, ought really, for its own vindication, to be the strongest advocate of such a Board. To conclude otherwise is to say that it is an unavoidable necessity that the country shall be ruined by incompetency and extravagance—a point which taxpayers will hardly concede. As it is now, owing to the conflicting views of the different bureaus, almost everything in the way of construction that comes from the Navy Department is an expensive failure. There was a minor instance of the same sort (involving, it is true, but a million of dollars), which we will mention, because we have never before alluded to it in the journal. The "Tonawanda"—whose construction was a favourite project with the Naval Bureau—was built in the Philadelphia Navy-yard. There could be no plea of want of supervision. It was built under the very nose, as we may say, of the constructional bureaus. It proved an utter failure, having failed in flotative power. Somebody made a mistake—whether in calculating the displacements or in crowding in the weights. It was a very simple arithmetical problem, but it was a failure. The only possible explanation is in a want of harmony between the bureaus. They evidently had no conception of what they were about, and each was content to do its own work, without reference to the other. In view of such a performance, it would seem but a vindication of their own character for these various bureaus to advocate a Board of Survey.

We could cite scores of instances of blunders, any one of which would be ground sufficient for the immediate establishment of some such Board as the one now proposed. The truth is, that some remedy for the enormous errors and follies of the past few years must be applied—and what other is proposed? Take, for example, our entire new screw fleet, representing millions upon millions of dollars. We have thoroughly exposed these astounding constructional blunders, which have made us a laughing stock to all European engineers of the highest skill. We believe this to be a subject which will bear ventilation. We publish arguments against the Board with as much eagerness as arguments in its favour. We are bound, however, to say that the leading argument urged against the Board seems to be founded on a grave misapprehension; and, when we explain it, much of the objection to the project may be overcome. It is feared that the Board of Survey is simply an adaptation in America of the British Board of Admiralty. This is quite erroneous. The Board of Admiralty is a political rather than professional body, and is liable to change with the Ministry. In other words, it has the same defects that result from our own system, where each new administra-

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tion sweeps out all the bureau officers of its predecessor. Now, this fundamental objection is precisely the one we desire to avoid. We desire to establish a professional, not a political, Board—whose tenure of office shall be entirely independent of political considerations, and who shall devote their life-long energies to bettering the material of the Navy. The Board of Admiralty has been described as "an organization of the Ministry in the administrative department of the Navy." The Board of Survey would be a permanent and responsible Board of high professional navy officers.

TWISTED BARS.

WE have recently examined some samples of twisted wrought-iron bars which combine the four great essentials—strength, lightness, elegance, and cheapness. These bars are largely manufactured by Messrs. Macnaught, Robertson, and Co., of 5, Bankside, Southwark. The bars are drawn from the rolls in the cruciform section, and and twisted hot, so that the fibre of the iron is not injured. A regular twist of pleasing appearance is produced, two bars in some patterns being twisted together. The various sizes and patterns are well adapted for the purposes of ornamental ironwork in general. Although very light, these bars possess considerable strength, as will be seen from the following results of tests to which Messrs. Macnaught and Co. have submitted them.

diam.	lb. per ft.		diam.	lb. per ft.
1¼in.	1·17	being of equal rigidity to a bar of solid wrought iron.	⅞in.	1·47
1⅜ „	1·44		1 „	2·0
1½ „	1·67		1 „	2·61
2⅛ „	3·69		1¾ „	4·94
3⅛ „	5·53		1¾ „	8·01
4 „	8·89		2¼ „	13·25

Correspondence.

THE PATENT OFFICE LIBRARY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I crave the use of your columns for the purpose of calling attention to the condition of the public library of the Commissioners of Patents, in Southampton-buildings. This collection of scientific works, perhaps the finest in Great Britain, containing upwards of 46,000 volumes, is the resort of large numbers of persons whose labours as literary men, inventors, &c., are practically beneficial to the whole of the community; and there can be no manner of doubt, that if it were more widely known to be free of access to the public it would be at all hours in the day most inconveniently crowded with readers. The present library rooms have been but recently built in the top of the house. They afford accommodation the most ample that can be hoped for, so long as science shall be elbowed by law into out-of-the-way offices and an attic floor. It is not surprising, therefore, that books are now again to be seen in gathering heaps upon the tables; and the cheerful prospect is held before students of science that some of the works they may need for reference must speedily be searched after in cellars, and, as Diogenes groped for his "honest man," with a lantern.—I am, Sir, yours, &c., J. T. DEXTER.

Public Museums and Free Libraries Association, 150, Strand, W.C.
March 25.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—M. H.—G. L.—T. C.—Messrs. M. and T.—G. H. D.—G. E. P.—Messrs. K. and K.—G. J. G.—M. E.—J. T. D.—J. T. D.—F. W. B.—A. E. S.—T. W.—A. K.—J. B. T.—R. C.—A. C.—G. H. D.—A. W.—W. H. H.—Messrs. D. and M.—G. W. H.—J. M.—J. N.—S. M.—R. S.—F. W. B.—R. T.—Messrs. K. and K.—E. F. S.—R. T.—A. R.—G. W. H.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending March 28 was 3,587; total number since the opening of the museum, free daily (May 12, 1858), 1,267,629.

Meetings for the Week.

MON.—Royal Institution.—General Monthly Meeting, at 2 p.m.

Society of Engineers.—Mr. Sydney A. Reade, M.A., on "The Sewerage Works at Redhill," at 7.30 p.m.

TUES.—The Institution of Civil Engineers.—1st, Discussion on "The City Terminus Extension of the Charing Cross Railway;" 2nd, Mr. W. Airy, A.I.C.E., on "The Experimental Determination of the Strains on the Ties of a Bow-String Girder," at 8 p.m.

Naval, Military, and Gunnery Items.

OWING to unavoidable circumstances, the First Lord of the Admiralty's levee, announced for the 7th instant, will not be held.

SIR WILLIAM MUIR has drawn up a minute with the object of demonstrating the inexpediency of the Home Government requiring the gratuitous supply of Indian troops for the Abyssinian Expedition, it being a dangerous precedent.

THE annual course of musketry instruction commenced on Wednesday last at Aldershot, and will be continued during the season. A medical officer is detailed for duty at the ranges every day, unless musketry instruction be suspended by any interrupting circumstance.

The ship "City of Melbourne" was burnt at the Williams Town Railway Pier on January 25 last. She was a fine vessel of 1,828 tons burden. She had a portion of her cargo for England on board, among which it was supposed might have been some damp wool, causing spontaneous combustion. A coroner's inquiry has thrown no light on the origin of the fire.

WITHIN the last few days the whole of the steamers and sailing ships of war attached to the reserve ordinary at Chatham have been removed from the harbour to Stangate Creek, where they are moored with the other vessels of the reserve squadron, in three divisions, until the Lords of the Admiralty have finally decided as to their ultimate disposal. In a few days Chatham will be without a single vessel of war in its harbour—a circumstance that has not occurred for some centuries.

WE hear that the Government are about to contract with Captain Hugh P. F. Palmer, late of the yatch "Warhawk," for the removal of the top of Daunt's Rock. Captain Palmer has had considerable experience in submarine engineering, and in this contract it is said will employ some new machinery which he has adapted for the work, and by the use of which the services of divers will be very little required. There is about half a million tons of solid rock to be removed, all of which is under water.

The Board of Trade have determined to present honorary certificates, illuminated and engrossed on vellum, to Pierre Eleonor Mulard, pilot; Jacques Auguste Dutertre, pilot; and Jean Adolphe Delannoy, coxswain, who, together with ten seamen, manned the Calais life boat on the occasion of the rescue of the crew of the schooner "Forester," of Ryde, on December 2, 1867. The service was one of much gallantry and danger. Pecuniary rewards have been given to the rest of the crew.

THE "Cracker," twin-screw gunboat, composite built, was recently put through a trial of her speed over the measured mile in Stokes Bay. She drew 7ft. 2in. forward, and 8ft. 2in. aft. Condensing she realized a mean speed of 10·423 knots, and under high pressure a mean speed of 10·212 knots. The machinery of the "Cracker" consists of two sets of engines, by Maudslay, Sons, and Field, taken out of two condemned gunboats of the old class. They worked very satisfactorily, and the boilers generated an abudant supply of steam.

THE "United Service Gazette" records the following gallant act which we gladly reproduce. A little after midnight on February 20, in the middle of a heavy thunderstorm, a marine of her Majesty's ship "Royal Alfred," at Bermuda, blinded by the lightning and rain, walked overboard. Navigating Lieutenant Kiddle, and a corporal named Parsons, jumped overboard and succeeded in reaching him as he was sinking. With difficulty, owing to the intense darkness of the night, they succeeded in swimming with him to the landing place.

SIR JOHN PAKINGTON, as Secretary of State for War, has nominated the following gentlemen to act as a committee to inquire into the character and construction of our coast defences, whether of iron, masonry, or earthwork, as recommended by the Royal Commission on National Defences:—Admiral the Hon. Sir F. G. Grey, G.C.B., Chairman; Major-General Collingwood Dickson, C.B., Royal Artillery; Major-General Simmons, C.B., Royal Engineers; Major-General Harness, C.B., Royal Engineers; and Mr. Hawkshaw, C.E. It is presumed that an officer of the Royal Engineers will be selected as secretary.

A CONTRACTORS' trial of the engines of the gunvessel "Lapwing," lately took place outside Plymouth Sound. She is of 663 tons burden, and belongs to the new class, of which there are eight vessels, and was constructed at Devonport. The "Lapwing" is the first of the four tried, and she is supplied with two pairs of engines by Messrs. Rennie to work her two propellers. The mean of six runs, at full power, gave a speed of 10·46 knots at a mean number of 116 revolutions per minute, the mean pressure in boiler being 26lb. The vacuum 25in., giving an indicated power of 830 horses, being five times the nominal power, 160, and 110-horse power more than the contract indicated power. These engines are of the ordinary type, without surface condensers or superheaters, and were tried under the regulations recently issued by the Admiralty. The result may, therefore, be considered satisfactory. The mean speed at half-boiler power was 8·06 knots, the revolutions 97, and pressure of steam 19lb.

Miscellanea.

WE are glad to see that there is at length a prospect of the passengers to London by the South-Western Railway being admitted to direct access to the City by the Charing Cross and Cannon-street line.

THE Minister of the French Emperor's Household and of the Fine Arts has appropriated a sum of 400,000f. for the reconstruction of the tower of the Cathedral of Notre Dame d'Arras.

A NEW cloth factory has commenced operations at Geelong. It is the first factory of the kind established in Victoria. A paper mill is now nearly completed on the banks of the Yarra, and is probably in full working order by this time.

THE committee appointed to report upon the construction of the bridge over the Hooghly, to form a junction between the Great Indian and Eastern Bengal Railways, is favourable to the Government plan, a new company undertaking the work.

THE surveying ship "Hydra" has arrived at Aden, having been engaged in taking the line from Aden to Bombay for the projected submarine cable. The greatest depth obtained between Bombay and the island of Kooria Mooria is 2,080 fathoms.

ON Wednesday last, a deputation from the Royal Agricultural Society waited upon the Prince of Wales with the request that his Royal Highness would act as president of the Society during the ensuing year, to which the Prince consented.

THE visitors to the South Kensington Museum during the week ending March 28, were, on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 10,599; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 5 p.m., 1,680; total—12,279. Average of corresponding week in former years, 10,914; total from the opening of the Museum, 7,267,637.

THE total imports of Australian gold within the last ten years have been as follows:—1858, £9,064,763; 1859, £8,624,566; 1860, £6,719,000; 1861, £6,331,225; 1862, £6,704,753; 1863, £5,995,368; 1864, £2,656,971; 1865, £5,051,170; 1866, £6,839,674; and 1867, £5,801,207. Upon the whole the gold-yield of Australia would thus not appear to be making progress, although the deliveries are still considerable.

SAYS the Austrian correspondent of the "Telegraph," "I hear that Count Edmond Zietry has really got the concession for the Oriental Railway (Stamboul, Adrianople, Sophia, Tatar-Bazar, Novi-Bazar, with branches to Onos, Salonica, and Varna) from the Porte, and that a firman to that effect will soon be issued. London to Constantinople in three days eighteen hours? What will Mrs. Partington say to that, I wonder?"

THE increase in the imports of cotton from the United States this year has been very great, 792,336cwt. having come to hand from that quarter to February 28, as compared with 486,415cwt. in the corresponding period of 1867, and 570,735cwt. in the corresponding period of 1866. British India, however, sent us only 102,539cwt. of cotton to February 28 this year, as compared with 96,500cwt. to the corresponding date of 1867, and 305,907cwt. to the corresponding date of 1866.

MESSRS. BELL AND DALDY have in preparation a volume of Scotish scenery, containing views of many of the places of interest visited by her Majesty and the Prince Consort, accompanied by descriptive letterpress, with an essay on the characteristics of Scottish scenery, by a popular writer. The illustrations are exquisite sun pictures, taken by a process discovered by Mr. Joseph Adam, who has been engaged many years in bringing it to perfection. By this invention the photographs have all the soft appearance of the finest line engravings, and are works of a very high class.

AN explosion of a serious character lately took place at the carriage works of the North of England Railway Company, the Marsh, Preston. A number of workmen were employed on a large casting, and when they had got about six tons of metal in, an explosion took place, caused by the splitting of a core. A current of air got between the cinder bed and the core, which forced the metal out, scattering it about the shed in all directions; sand and other *débris* was thrown into the room above. A workman who was standing on a crane was blown off; and four others were severely injured by the hot metal.

AT Melbourne an address was presented to the Duke of Edinburgh by Victorian colonists of not less than a quarter of a century's standing. Though the time for signing the address was short, it had

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more than 600 signatures, twenty-four dating back their residence in the colony to 1836 or earlier, two to 1834. All the signatures have been photographed for preservation. Mr. Henty, the oldest Victorian colonist, read the address. The Hon. J. P. Fawkner informed the Prince that he was in Port Phillip in 1803, and that he was the oldest inhabitant of Melbourne, where he settled in 1835, one year after Mr. Henty settled at Portland.

THE Royal Horticultural Society is this year extending its exhibitions of spring flowers, by the plan of allowing the leading nurserymen to make displays of the specialities they cultivate. On Saturday, Mr. William Paul commenced his show. The leading features are a mixed bank of forced hardy trees and shrubs, hyacinths, tulips, roses, the new double crimson thorn, standard variegated geraniums, &c. One hyacinth, of a yellow shade, called "The Bird of Paradise," has no less than eight spikes of flowers, and plants of the Erica Willmoreana have spikes 18in. long. There was a large and fashionable attendance. The band of the 1st Life Guards performed selections of music during the afternoon.

FOR some time past the Conservative party has reckoned on having as one of its representatives for the borough of Bedford Mr. James Howard, so well known to the agricultural and engineering world, and last year presented a requisition, numerously signed, calling on him to stand as a candidate. Mr. Howard, though a traditional Tory, declined the invitation; among other reasons, on the ground that his views on many important political topics were much in advance of those avowed by the party. Notwithstanding this reply, it was generally hoped that Mr. Howard's scruples would be overcome. So far from that being the case, however, the subsequent policy pursued by the Government has determined Mr. Howard to withdraw altogether from the Conservative party and to join the Liberal ranks.

THERE are sixty-three manufactories of beet-root sugar in Lithuania, Podolia, and a part of Bessarabia, of which half are also refiners. The smallest use from two to four presses, the largest twenty-two. 3,200,000 hectolitres of beet-roots are bought for the manufactories. The largest manufactory belongs to a company of shareholders, who buy the beet-roots of the neighbouring proprietors, and beet-roots generally realise 3fr. 50c. the korsee, a measure equivalent to 1 hectolitre 28. Nearly 9,000 workmen are employed, whose wages amount to about sixteen millions of francs. Almost all the sugar not consumed in the country is sold to Russia. There are 1,428 distilleries, in which a large number of workmen are employed, and their manufacture represents the value of eighty millions of francs.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—2520, 2557, 2562
BUILDINGS AND BUILDING MATERIALS—None.
CHEMISTRY AND PHOTOGRAPHY—2522, 2524, 2546, 2548, 2549
CULTIVATION OF THE SOIL, including agricultural implements and machines—2507, 2508
ELECTRICAL APPARATUS—None.
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2510, 2518, 2527, 2533, 2551, 2552, 2560
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—2529, 2576
GENERAL MACHINERY—2503, 2509, 2515, 2523, 2525, 2520, 2537, 2540, 2565, 2566, 2569, 2572
LIGHTING, HEATING, AND VENTILATING—2531, 2577
METALS, including apparatus for their manufacture—2541, 2553, 2568, 2571
MISCELLANEOUS—2505, 2512, 2514, 2516, 2521, 2538, 2539, 2542, 2544, 2554, 2559, 2561, 2563, 2564, 2567, 2570, 2574, 2575, 2578 2579
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2511, 2517, 2519, 2526, 2532, 2543, 2558, 2573
SHIPS AND BOATS, including their fittings—2506, 2528, 2534, 2545, 2555
STEAM ENGINES—2535, 3536, 2556
WARFARE—2502, 2513, 2547, 2550

2500 H. G. GRAHAM. *An apparatus for heating, boiling, agitating, and raising size and other liquids.* Dated September 4, 1867.

This invention is carried out in the following manner:—First, the patentee takes a straight tube of copper, &c., and around the outside of that he winds, in a spiral form another tube, or what will, when attached, form a spiral tube. Through the exterior or spiral tube he passes the size or fluid to be heated or boiled, and into the interior or straight tube he passes steam or heated air which will heat or boil the aforesaid size or fluid. Second, in another form of the apparatus he takes two spiral tubes, one within the other. Through the exterior tube he passes the size or fluid to be heated or boiled, and into the interior tube he passes the steam or heated air which will heat or boil the size or fluid. Third, in another form of the apparatus he takes either of the two before-mentioned forms of apparatus, and encloses it in a steam-tight cylindrical vessel, taking care to arrange one or more small tubes communicating from the interior of the cylindrical vessel to the innermost tube. Into this cylindrical vessel and innermost tube he passes the steam or heated air, and through the other tube he passes the size or fluid to be heated or boiled by the steam or heated air. Fourth, if he wishes to raise or agitate the size or fluid, any of the before-mentioned forms of apparatus are placed and made to revolve in the manner of an Archimedian screw, which raises, and, at the same time, agitates the size or fluid.—Patent abandoned.

2501 W. WELDON. *Improvements in the production of artificial oxides of manganese, and in the manufacture of chlorine by means thereof, partly applicable also to other purposes.* Dated September 4, 1867.

The patentee claims the use of ozonized air for the peroxidation of low oxides of manganese, whether in the wet way, or in the dry way, the various methods of procedure, whether using ozonized air or ordinary air, and likewise the various details of apparatus, &c., all as set forth, and the air for the purposes indicated of artificial oxides of manganese peroxidized and otherwise produced and treated, as described.—Patent completed.

2502 G. W. HOWARD. *Improved apparatus to be used in the manufacture of ball cartridges.* Dated September 4, 1867.

The object here is to provide a small portable apparatus for fixing or cramping the ball or bullet into the metallic cartridge case known as the "Boxer" cartridge case. The bullet used with this kind of cartridge case is of a cylindro-conoidal form, the cylindrical part having circumferential grooves for the reception of the lubricating material or compound. This part is slipped into the mouth of the thin metallic cartridge case containing the powder, and is fixed therein by pressing or cramping the cylinder of thin metal into one of the grooves of the bullet. The apparatus which the inventor employs for this purpose consists of a case having a partially cylindrical groove of a suitable form and size to receive the cartridge case. At one end of this groove (and at right angles thereto) is a gauge plate having a circular hole to receive the conical part of the bullet. Attached by a joint to the base is mounted a lever (lying also at right angles across the groove) provided with a concave notch. The form and position of this lever are such that, when it is raised a charged cartridge case with the bullet inserted in the mouth is laid in the groove and pressed forward until its conical fore end fits into the hole in the gauge plate; the notch in the lever is exactly over one of the circumferential grooves. Pressure is now applied to the lever with one hand, whilst the cartridge is rotated with the other, which will have the effect of cramping or indenting the thin metal case into one of the circumferential grooves of the bullet, so as to attach the same firmly thereto.—Patent abandoned.

2503 F. B. DERING. *Improvements in machinery for boring, cutting, or working in rock, coal, and other mineral.* Dated September 4, 1867.

This invention relates, first, to an arrangement of machinery for undercutting or cutting a groove in rock; and, second, to engines and carriages or stands specially applicable to coal cutting. The main feature in the arrangement for undercutting or groove cutting is the combination of a longitudinal travel and a transverse travel given to the engine and cutting tool. The second part of the invention relates to arrangements of engines and carriages or stands specially applicable to coal cutting. The chief features of the arrangements are that the coal is chipped or cut by a series of blows, the cylinder advancing in the direction of its length at the end of each blow, or as required, according to the work done, and when it has reached the end of its travel on the cradle it is returned to its original position by another cylinder, and the carriage on which the engine is carried is moved laterally to commence a fresh cut. During the moving back of the cylinder to commence a fresh cut the piston is prevented from working. Reference to the drawings is essential to a full description of the invention.—Patent completed.

2504 J. K. SMYTHIES. *Carrying passengers through the air by a steam bird or flying steam engine fitted with wings flapped by the action of steam.* Dated September 4, 1867.

Here the patentee makes no claim to any separate part of the mechanism described, and he does not confine his claim to the details described, which may be varied, but he claims combining mechanism into a steam bird or flying engine with wings flapped by the action of steam, capable of carrying passengers through the air. We cannot here produce the details of the invention.—Patent completed.

2505 F. H. and J. W. H. PATTISON. *Improvements in a new or improved metal-founders' blacking.* Dated September 4, 1867.

This invention consists in the manufacture and use of a new metal founders' blacking, used for coating the inner surfaces of moulds and cores which receive the molten metal, and which imparts a fine skin or outer surface to the castings formed therein, formed mainly of "anthracite" or "blind" coal, known as a coal which emits little or no gas or flame in burning (and which has heretofore been used or employed for making such moulders' or founders' blacking); to this the inventors add a small proportion of fireclay, wood charcoal (by preference that formed from oak), animal charcoal, or the hard residuary carbon or coke from mineral oil refining stills, which latter is, in some cases, further calcined or burned in close retorts before being used.—Patent abandoned.

2506 G. T. BOUSFIELD. *Improvements in paddlewheels for water craft.* (A communication.) Dated September 4, 1867.

What is claimed as the improvement in paddle wheels having paddles capable while in action of varying their inclinations to the radial arms of the paddle-wheel frames, is the combination of the controlling frame of the paddles with the paddle guard by means of a flexible connection, substantially as set forth. Also the arrangement of the connection diagonally to the vertical and horizontal directions in which the paddle guard is moved by strains, substantially as set forth. Also the arrangement of the radial lines of the paddle crank arms and the radial lines of the flexible connection at equal angles with a vertical line, substantially as set forth. Also the combination of the controlling frame of the paddles, paddle guard, flexible connection link, and paddle shaft, substantially as set forth.—Patent completed.

2507 J. HOWARD and E. T. BOUSFIELD. *Improvements in machinery for cutting grass or corn.* Dated September 4, 1867.

This invention is not described apart from the drawings.—Patent completed.

2508 G. A. BUCHHOLZ. *Improvements in machinery for hulling wheat and manufacturing semolina.* Dated September 4, 1867.

This invention is not described apart from the drawings.—Patent completed.

2509 R. A. JONES and J. C. HEDGES. *Improvements in fire-escapes.* Dated September 5, 1867.

This invention has reference to those fire-escapes which have for their principal features of construction the adaptation of wire or other ropes, cords, or chains wound upon a drum of such like contrivance (to be unwound therefrom when the fire-escape is in use), and the invention consists in the use of the following arrangements:—The ends of friction bands to be used with the cords, ropes, or chains are to be made with lugs provided with a collar or box that has a binding screw with a spring coiled around it acting against such lug, and for the other lug a lever with handle centred in the collar or box, the end being allowed by a slot through the same to be pressed against the other lug. Or, in place of the frictional arrangement just described, they would sometimes adopt the following:—Within the case containing the rope, cord, or chain they have pulley wheels so arranged that the chain, cord, or rope may be taken in a serpentine course over them, thus causing resistance to the unwinding of the rope, cord, or chain, the friction band being arranged to work on the edges of the holder of the chain, cord, or rope, instead of having a separate pulley, and is provided with a crank lever handle so disposed as to be easily accessible.—Patent completed.

2510 A. C. HENDERSON. *Improvements in the manufacture of applique embroidery on tulle, muslin, or similar fabrics in various colours and designs.* (A communication.) Dated September 5, 1867.

This invention consists in working on a ground of coloured net, or other substance, pieces of muslin or similar material of any desired colour to form various designs, the articles thus manufactured being intended for window curtains, blinds, hangings, furniture coverings, and other purposes.—Patent abandoned.

2511 W. H. KITSON. *Improvements in railway wheels.* Dated September 5, 1867.

This invention consists of certain modes of securing the tyre of the wheel to the inner frame or centre of the wheel. One of the chief objects the patentee has in view is to so secure the tyre that more of the thickness of the tyre may be taken for wear than is practicable by the previous methods in use, and also so to secure the tyre that, in case of its breaking, the whole shall be held firmly together. One plan for effecting this object is as follows:—He forms a flange all round the inner circumference at or near the outside edge of the tyre, which flange may be made plain, or with a groove or dovetail inside. Having placed the wood or iron centre of the wheel in position in the tyre, he secures them by a loose ring furnished with a lip or flange fitting into a groove or dovetail formed at the inner or flanged side of the tyre; to secure the whole, he passes a sufficient number of bolts or rivets through the fixed flange on the tyre, the wood or iron centre, and the loose ring; or he can reverse this arrangement by forming the fixed flange on the inner circumference of the tyre, at or near the flanged side of the tyre, and letting the flange or dovetail of the loose ring fit into the outer edge of the tyre, and securing it in the same manner as in the last-described arrangement.—Patent completed.

2512 L. B. POTHIER. *Improvements in fastening or securing metal bands or hoops on cotton and other bales.* (A communication.) Dated September 5, 1867.

Here one of the ends of the band or hoop is bent into a plane parallel to the unbent portion, so as to form a hook, and the band or hook is passed around the bale in the usual manner, while the bale is under pressure in the cotton or other press. Upon the hook of the band a flat ring is placed, one end of the ring being situated against the end of the hook at the junction of the latter with the band or hoop. The other end of the band or hoop is next passed through the ring described, and its extremity bent around the end of the ring into a plane parallel with the ring and the band or hoop from which it was bent. A second hook is thereby formed. The extremities of the band or hoop are thereby bent in opposite directions, and the hooks thus formed bear respectively upon the opposite ends of the flat ring placed between them. The hooks or terminating portions of the band or hoop extend some distance on either side of the ring, the terminating portions being at least eight inches in length. When the bale is released from the pressure to which it has been subjected in the press, its expansion causes the hooks to bear with great firmness upon the opposite ends respectively of the ring, and at the same time the pressure which is exerted at right angles to that described presses the projecting ends of the hooks outwards, and binds them firmly against the band or hoop from which they were made.—Patent abandoned.

2513 H. CARTER and G. H. EDWARDS. *Improvements in breech-loading firearms.* Dated September 5, 1867.

This invention relates to that description of arm which closes with a sliding rotating bolt with projecting hand lever, for which letters patent were granted to the present patentees, September 20, 1865 (No. 2417), and consists, first, in leaving the back end of the breech, as also the lever slot, open for the ready withdrawal of the bolt when required for cleaning or otherwise, and in applying a cap or cover to the hinder part of a gun, which cap completely covers in the groove in which the sliding bolt works, with the exception of the opening necessary for the introduction of the cartridge, and for the necessary traverse of the hand lever of the sliding bolt. This cover is rounded, and partly follows the shape of the gun, its hinder part being carried a little way down the neck of the stock, tapering off, and forming a part thereof. In adjusting the cover it is slid on the shoe of the gun from the breech end, two projections disposed one on either side in the interior of the cover taking into grooves made longitudinally in the shoe, by which the cover is held closely down thereon. The whole is secured in place by a screw passing down through a projection formed under

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the tapered part of the cover, and screwing into the tail-piece of the shoe. This tail-piece has also a recess formed in it which, when the cover is pushed forward in place, receives the lower part of the above-mentioned projection, and through which the screw passes, thus firmly fixing the cover, and preventing all movement thereof until the release of the said screw. When it is desired to withdraw the bolt from the gun it is simply necessary to release the screw in order to take off the cover; the bolt is then free to be withdrawn from the gun. The invention consists, second, in combining the trigger and sear together so as to form but one piece. The sear may be shortened, while the trigger projects from the under side thereof, thus obviating the necessity of a separate fulcrum for the trigger, and rendering the action of the lock quicker. A third improvement consists in fitting the extractor applied to such guns so that a dovetailed end recessed into the sliding bolt shall be received in an undercut and dovetail recess when the bolt is drawn backward, so as to prevent its falling from the bolt when it is withdrawn at the breech.—Patent completed.

2514 G. COPE. *Improved apparatus for pressing and shaping cigar bunches.* Dated September 5, 1867.

This invention consists of two frame-pieces made of wood, &c., so fitted with projections and recesses on their faces, that, when they are placed together into the positions they occupy when giving pressure for either shaping or pressing, a number of moulds or openings are left between them, each one an exact negative of the shape of the cigar the apparatus is designed to produce. The recesses on one of the frame-pieces are formed by and between projecting sliding blocks, the face sides of which project like the teeth of a rack. These blocks slide on feathers or ribs secured to the frame; they are coupled together by a flexible or elastic band, by which they can be separated from each other a short distance. The recesses on the other frame are the spaces between stationary projections.—Patent completed.

2515 J. FORD. *Improvements in means for securing wheels, pulleys, cranks, and other articles on their shafts or axles.* Dated September 5, 1867.

When applying this invention to securing railway wheels on their shafts or axles the patentee keys the wheel on to the axle as usual, and forms a recess in the nave or boss to receive a ring flush with the outer face of the nave or boss, and he forms a shallow groove in the shaft or axle corresponding with the recess in the nave or boss of the wheel, the outer end of the key being made flush with the shaft or axle, and with the shallow groove. He then passes a ring previously heated over the end of the shaft or axle, and forces it into the recess in the nave or boss of the wheel; this ring on cooling shrinks within the shallow groove formed in the shaft or axle, and thereby firmly secures the wheel thereto, the wheel being thus held between the shoulder on the shaft or axle and the shrunk ring, which becomes firmly secured to the shaft or axle, and at the same time holds the key firmly in position.—Patent completed.

2516 J. S. HENDERSON and J. MACINTOSH. *Improvements in the manufacture of metallic cases or canisters, and in the machinery or apparatus employed therefor.* Dated September 5, 1867.

This invention has reference to a former patent, dated July 11, 1867 (No. 2033). Under the present invention, after the cylindrical part of the canister is formed, the bottom is placed either on it or into it, and the cylinder, together with the bottom, are placed upon a revolving platform or stand, which is put in motion either by manual or other motive power. The parts to be soldered have a ring of solder placed on or in them, and a heated bolt or jet of flame from a compound or other blow-pipe is brought to bear upon the solder or part to be soldered, and the solder as soon as melted fills into the spaces between the end or ends and body of the canister, and effectually joins these parts. After the canisters are filled, the cover is soldered to the body of the canister in a similar manner.—Patent completed.

2517 G. H. PIERCE. *Improvements in padding for horse collars, saddles, and harness.* Dated September 5, 1867.

Here the padding is effected by air contained in a cushion or bag of suitable form made of air-proof material.—Patent abandoned.

2518 E. BERNHEIM, G. W. WILSON, and E. LONGWORTH. *Improvements in the treatment and method of preparing printed warps.* Dated September 5, 1867.

This invention consists in treating the warps so as to produce a "chene" or intermixed effect when in the extended or "warp" state, and not in "hanks," and the method of preparing such printed warps is as follows:—The warps, either plain or dyed, are first "leased" as usual—that is, divided into sections widthwise, such sections being kept separated by transverse rods or battens, and the warp in this divided and extended state is printed upon by any ordinary suitable method, and after such printing every other divided section alternately, or such of them as may be desired, is "drawn up" a greater or less distance (the rods allowing the sections to slip), so as to displace the regularity of the printing, in which state it is afterwards used in weaving.—Patent abandoned.

2519 J. B. HANDYSIDE. *An improved construction of railway buffer.* Dated September 5, 1867.

This invention relates to a novel arrangement of buffer in which a floating piston for transmitting and distributing the pressure of the coiled springs is used in combination with a telescopic arrangement of case. The invention cannot be described without reference to the drawings.—Patent completed.

2520 A. V. NEWTON. *Improvements in the construction and fitting up of safety valves for steam boilers or generators.* (A communication.) Dated September 5, 1867.

This invention relates, first, to safety valves which are formed with a surface outside of or beyond the ground joint for the escaping steam to act against, and keep them open until the pressure of the steam in the boiler shall have fallen below the pressure required to open such valves. It is now proposed to apply to such valves means of regulating or adjusting the area of the aperture for the escape of the steam beyond the surface outside of the ground joint, so that the valve may be set to be closed by any desired pressure below the pressure required to open it. The invention further relates to means for preventing the guides and stem of a valve controlled by a spring from binding, and thereby impeding the movements of the valve; and this part of the invention consists in making the pintle or stem which receives the tension of the spring bear on the valve so far below the plane of the valve seat that the force of the spring shall always be communicated to the valve in the direction of its axis. The invention also relates to an improvement by which the loud noise produced by the sudden opening of a safety valve is materially reduced, which noise is very objectionable, particularly on locomotive engines, and which is due to the fact that, when first opened, the valve is thrown up too high above its seat, and with great force. The improvement consists in combining with the valve and its seat an adjusting screw so located that, when the valve is forced up, its stem comes in contact therewith, and prevents the valve from being opened beyond the extent required for the relief of the boiler. The last part of the invention relates to means by which the valve can be adjusted to open at any required pressure, and then enclosed and locked up so that the adjustment cannot be changed except by the person having charge of the key.—Patent completed.

2521 H. GARDENER. *Improvements in connection with miners' safety lamps.* Dated September 5, 1867.

This invention is designed to supply such a fastener or lock to lamps similar to "Davy" lamps for mining purposes that, when once lit and closed, it cannot again be opened without first destroying the efficacy and utility of the illuminating properties of the lamp, and the invention consists in the application of a tube for wick or "duct" for feeding the lamp with oil that is separate and detachable from the body of the lamp, the tube being constructed so as to form a plug, &c., that will prevent the escape of oil when forming a portion of the lamp, and that will also, when screwed to its seating, form a bolt or lock that will prevent the gauge or protecting cover being removed so long as the lamp is employed as an illuminating medium.—Patent completed.

2522 F. VERSMANN. *Improvements in the manufacture of varnishes.* Dated September 5, 1867.

This invention relates to the use of certain solvents for the gums, resins, or gum resins employed in the manufacture of varnishes, and it is particularly applicable in obtaining solvents of copal for that purpose. The solvents employed are these:—Alcohols of the series represented by the formula $C\,n, H\,2\,n + 2 : 0$ ($C = 12$), containing more than two equivalents of carbon, beginning therefore with propylic alcohol $= C\,3, H\,8 : 0$. The mixture of some of these alcohols, known as fusel oil, which contains chiefly anylic alcohol, answers the purpose very well.—Patent completed.

2523 N. SEWARD. *Improved means and apparatus for producing motive power.* Dated September 6, 1867.

Here the inventor proposes to use the sea, lake, pond, or river, or he constructs a reservoir or tank containing water, mercury, or other suitable fluid, in which fluid is immersed an air vessel descending to any desired depth, the bottom of which air vessel is open, while it is closed at the top. Communicating with the top of this air vessel is a pipe provided with a cock or valve through which air or gases under pressure are forced, either by pumps, or by the combustion of explosive compounds, into the upper part of the air vessel; a syphon tube also passes through the top of the air vessel, and descends in the fluid nearly to the bottom of the air vessel, which tube has a cock or valve to the bottom thereof, while the external leg of the syphon, also provided with a cock or valve, passes to a turbine, water wheel, or other motive power engine capable of being worked by the flow or pressure of the fluid. The pressure of the air or gas inside the vessel causes the water or other fluid to pass through the syphon on to the motive power engine, thus producing motive power available for industrial purposes, part of which power is employed in conveying the fluid passing from the engine back into the sea, reservoir, or tank, by a pump or other suitable apparatus for raising fluids.—Patent abandoned.

2524 S. CASSAN. *The purpose of affording instant relief to persons afflicted with asthma, or subject to any other affections of the lungs or chest.* Dated September 6, 1867.

Here the inventor makes use of ordinary filtered paper in sheets or strips, which paper is then prepared by simply dipping it (but merely sufficient so as to damp the same) into the following chemical preparation. In order to prepare, say, 500 sheets of this filtered paper, he makes use of one half gallon of pure water, one pound (avoirdupois) of saltpetre, half a pound of alum, and one ounce of essence of bergamotte, and afterwards he hangs up the papers, or exposes the same in the air till dried, when they will be fit for immediate use by the patient. The mode of use is by lighting and burning half a sheet of such paper, and inhaling the smoke arising therefrom.—Patent abandoned.

2525 T. HODSON, W. MATHER, and J. RISLEY. *Improvements in lubricating shafts and other similar frictional surfaces.* Dated September 6, 1867.

This invention consists in the use of a chamber or cavity within the lower part of the bearing to contain lubricant, which is transferred or supplied from the chamber to the shaft by a cylindrical roller of cork, felt, flannel, leather, &c. This roller is mounted on a spindle, and slightly projects through an aperture in the bearing, so as to be lightly in contact with the shaft, so that the revolution of the shaft causes the revolution of the roller, and the lubrication is thus effected by self-acting means.—Patent abandoned.

2526 W. G. CREAMER. *Improved apparatus for excluding dust from railway carriages.* Dated September 6, 1867.

This invention consists in the attachment to the windows of railway carriages of jointed wire gauze screens or blinds constructed to fit into the same grooves in which the sashes are held.—Patent completed.

2527 T. W. HELLIWELL. *Improvements in looms for weaving.* Dated September 6, 1867.

This invention is not described apart from the drawings.—Patent completed.

2528 A. M. CLARK. *Improvements in the construction of ships and other vessels.* (A communication.) Dated September 6, 1867.

This invention consists in joining together two hulls by so placing them one above the other that the lower one of smaller dimensions than the upper shall be entirely immersed in the water when the ship is freighted or ballasted. The sides or bottom of the upper hull project on each side of the lower hull in consequence of its increased breadth, its bottom being at the level of the water line of the lower hull, the weight of which in the water will be very much diminished, at the same time giving the ship the draught desired.—Patent completed.

2529 J. G. TONGUE. *Improvements in the manufacture of garments for male and female attire.* (A communication.) Dated September 6, 1867.

This invention relates to the manufacture of body garments either for under or outer wear, such as skirts and mantles, or cloaks, whole or in one piece, by felting the material of which they are composed, and giving the article during the felting or "planking" process its desired form or shape ready for use, or so that it will only be necessary to split or cut it open to make a skirt or cloak complete without basting or separate felting of parts together, only if desired trimming it or binding the edges whole or in part and attaching suitable fastenings thereto.—Patent completed.

2530 T. COOK. *Improvements in sewing machines.* Dated September 7, 1867.

As regards the driving gear, this invention consists of a worm wheel and two worms or askew gear mounted on axes working in one end of a suitable casting, the other end carrying the needle bar, and other parts. The worm wheel is placed in a line with the casting, and the worms are situated one above and the other below the centre of the worm wheel; the upper worm is for working the needle bar and feed, and the lower worm for working the looping motion, which may be effected as follows:—The upper worm is fixed thereon with a cam formed on the back thereof; this disc is embraced by the circular recessed part of a rocking or vibrating lever, the upper and lower ends whereof carry the needle bar, which is connected to the aforesaid disc by a short connecting rod. This rocking lever is mounted on a fulcrum about midway of its length, and the effect of this arrangement is to cause reciprocating motion of the needle bar and needle fixed therein, and by the rocking or vibrating motion of the needle bar carrier produced by the action of the cam thereon and spring below to cause the needle to work the feed—a movement well known to sewing machine makers. As regards the looping motion, the improvement consists in causing the spindle employed to carry the thread round the bobbin to move in an universal joint or socket, so that the spindle does not rotate, but its extremities have a circular movement imparted thereto by a crank arm driven by the worm and worm wheel motion above described. The aforesaid crank arm is connected to one end of the aforesaid spindle, and the other end of the said spindle has a hook fixed therein for catching hold of the thread—a movement well known to sewing machine makers. This hook always remains upright, and in that position thus carries the thread round the bobbin. Last, as regards the tension of the sewing material from the bobbin, to prevent overrunning of the same, the patentee proposes to effect this by the following means:—At the upper part of the bobbin carrier he forms an opening, across which, and in a line with the sides of the bobbin, he passes a wire having a long hole in it, through which the sewing material from the bobbin is to be passed, and by turning this wire partly round so as to place the hole in the wire sloping, instead of upright, the edges of the hole will impede the free passage of the sewing material, and thus produce the required degree of tension; or the aforesaid wire may be turned entirely round when much tension is required.—Patent completed.

2531 J. J. HICKS. *Improvements in means or apparatus employed for lighting gas and other jets or lamps, candles, cigars, and other articles.* Dated September 7, 1867.

Here the inventor employs a tube closed at one end and open at the other. An opening is provided at any convenient part, through which the tube is supplied with any suitable liquid for burning; this opening may be closed in any suitable manner. In the open end of the tube or reservoir he places a cotton wick, which extends down into the tube or reservoir, the end of which may be curved or shaped to any suitable form. When the wick is lighted the apparatus is ready for use, and, if desired, will continue burning for a considerable period.—Patent abandoned.

2532 J. COCKSHOOT. *Improvements in the manufacture of carriages, coaches, and other vehicles.* Dated September 7, 1867.

This invention relates, first, to that portion of carriages, coaches, landaus, &c., called the "door framing," which has been hitherto made of wood, and secured together by wooden plugs or pegs. The improvements consist, first, in constructing the two upright pillars of the door frame (that is the hinge pillar and the latch pillar) of thin metal, and securing the other part of the frame and the panels (if necessary) thereto, and casting or forming the "male" part of the door hinge on such hinge pillar so as to constitute one piece, the hinge being constructed as in the specification of letters patent granted to the inventor, dated January 3, 1867 (No. 17). A second part of the invention relates to carriages wherein the door and window casing are in two parts, upper and lower, and the improvements consist in the application of a curved spring within the window space of the door, upon which spring the window falls when suddenly lowered.—Patent abandoned.

2533 J. SMITH. *Improvements in machinery for combing or dressing silk, flax, China-grass, cotton, or other fibrous substances.* Dated September 7, 1867.

This invention consists in the use of three or more endless card belts, or toothed or spiked endless aprons, placed and arranged side by side, and operated so that two adjoining surfaces of these belts are caused to travel in the same direction and parallel to each other. Also in the use of a series of travelling nippers or nipping jaws which are placed in a parallelogram of grooves, and caused to slide or travel in betwixt the said surfaces of the card belts, or toothed or spiked aprons, but to move in a contrary direction. Fibre being fed to these nippers intermittently in succession by ordinary feeding apparatus, they open and receive it, then close and move away from the feed apparatus detaching tufts of the fibre which they carry in betwixt the card belts or toothed or spiked aprons, the protruding ends being traversed in contact with the card, teeth, or spikes which comb or dress it; the jaws of the nippers are then opened, and the fibre is delivered on to a creeper or other receptacle.—Patent completed.

2534 J. B. ROGERS. *A projectile anchor and block for launching of the lifeboat and other boats in rough weather, and for ships' use in cases of loss of anchorage.* Dated September 7, 1867.

This apparatus consists of a trifluked hinged or folding anchor, so constructed that the shank can be so formed and so made that it can be fired from a mortar or other piece of ordnance. Attached to this anchor is a block of

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a peculiar make for preventing its becoming choked in beds of sea weed, or such like obstructions, and to allow ropes of different sizes to pass freely, or wind kinks or knots that may occur in the transit; this block also has a swivel or swivels to allow for rotary motion. The connection of the block to the anchor can be either chain, hemp, rope, manilla rope, green hide, or other suitable appliances. A double line can be fired out by means of this block by being rove in the same, and can be fired from pin boxes or lines faked down.—Patent completed.

2535 J. Armstrong and E. Eccleston. *Improvements in steam engines.* Dated September 7, 1867.

This invention consists in certain arrangements of the parts of steam engines whereby the exhaust steam is compressed and re-introduced several times into the steam chest, until it is finally condensed by the usual surface condensers, by which method of using steam as a motive power great economy in fuel and boiler space is effected.—Patent abandoned.

2536 E. Hubner. *An improved rotary, steam, or gas engine, also applicable for pumping and measuring liquids.* Dated September 7, 1867.

Here the inventor makes use of a wheel of large diameter, in the circumference of which he makes a rectangular hollow groove turned on each face, within which he places a heavy semicircular metallic ring, adjusted to slide easily within the groove. This semicircular ring acts both as a piston and a cylinder bottom, and its object is to counterbalance by its weight the pressure of the steam introduced in the hollow groove. A certain number of sluices are adapted so as to intersect transversely the hollow part of the groove; they are put in motion by an eccentric loose on the shaft of the wheel, and maintained in the requisite position by a worm. The rods which unite the sluices to the eccentric are each provided with a piston working in a cylinder. The object of these pistons is to regulate the introduction of the steam, its expansion and its escapement.—Patent abandoned.

2537 D. Payne. *Improvements in priming machinery.* Dated September 7, 1867.

This invention is not described apart from the drawings. —Patent completed.

2538 J. and T. Bayley. *Improvements in the manufacture or production of leather.* Dated September 7, 1867.

Here the patentees obtain shavings of Russian leather, and when they have extracted the fragrance or perfume therefrom, they immerse the hides or skins in the extract or liquid, or other agent employed, containing the extract, in order to impart to the hides or skins the fragrance or perfume thus obtained; or they place the Russian leather in convenient layers between hides or skins, whether before or after the hides or skins are converted into leather, and the hides or skins are then placed in water, or other liquid or agent, where they remain any required period. They then apply oil or its equivalent agent to the hides or skins by rubbing them with it, or otherwise.—Patent completed.

2539 B. F. Stevens. *An improved illuminating roof and roof pavement.* (A communication.) Dated September 7, 1867.

This invention is not described apart from the drawings. —Patent completed.

2540 H. Woods. *Improvements in presses for extracting liquid from hops, seeds, and other substances.* Dated September 7, 1867.

Here the inventor inserts in the interior of the box, the centre by preference, a tube or chamber (of a conical or other form) perforated with holes, which tube or chamber communicates with the outside at either end, so that when the material in the press box is acted upon, the liquor or extract can be pressed out and escape, not only by the holes or apertures, or grooves in the box, or the casing of the box, but also by and through the tube or chamber formed or inserted in the interior of the box.—Patent abandoned.

2541 J. Whitham. *Improvements in machinery for puddling, and in puddling and other furnaces.* Dated September 7, 1867.

The patentee claims arranging puddling machinery substantially as described. He also claims mounting the jib or arm on which the bar or holder for the rabble or puddling tool swings on a hollow upright axis, supporting within it the axis with which the bar or holder is connected, and from which it receives its swinging motion. He also claims communicating a partial rotary motion to and fro to the jib or arm by means of a crank on an upright axis. He also claims the arrangement of arresting the motion of the jib or arm at either end of its course. He also claims constructing firebars, as described, with arms having slotted air passages in them, and so arranging such bars that the arms interlock, and so that the bars are capable of being rocked, all as described.—Patent completed.

2542 R. W. Ewer. *Improvements in winders suitable for folding or making up ribbon velvets for the market.* Dated September 7, 1867.

According to this invention, in place of winding or doubling the ribbon velvet on itself, the patentee employs winders with ends rounded, so as to avoid the production of sudden bends in the fabric, from which blemishes result. —Patent completed.

2543 C. Burn. *A new mode of propelling railway or other carriages.* Dated September 9, 1867.

This invention consists in the application of one or more friction wheels to the flanges of the railway carriage or other wheels, which friction wheel or wheels is or are pressed against and made to bite the flange of the carriage wheel by means of levers, weights, screws, eccentrics, or other mechanical contrivances, and when in contact with the carriage wheels the friction wheels are caused to revolve by manual power, thereby causing the wheels of the railway carriage to revolve, and by these means propelling the carriage.—Patent abandoned.

2544 E. J. C. Welch. *Apparatus for producing artificial ice, parts of such apparatus being also applicable to other purposes.* Dated September 9, 1867.

This invention mainly consists in the construction and arrangement of certain apparatus whereby ice can be artificially produced in an economical and simple manner, the refrigerating effects being produced by the evaporation of ether, or some other similar or analogous and suitable hydrocarbon, and the condensation of the resulting vapour.—Patent completed.

2545 A. Paul. *Improvements in stoppers or controllers for ships' cables.* Dated September 9, 1867.

This invention consists in constructing a stopper or controller for a ship's cable with a barrel, in contact with which the cable passes, which revolves with the cable, and to which frictional or other holding or controlling contrivances are applied, instead of gripping or compressing appliances being applied to the cable itself, as in ordinary stoppers.—Patent abandoned.

2546 W. E. Gedge. *Processes for extraction of the colouring matter of indigo from the waste textile fabrics which contain it.* (A communication.) Dated September 9, 1867.

Here the textile fabrics, or picked or torn waste, are filled in a vat having a false or double bottom, and there soaked with a solution of caustic soda at 1deg. Steam is then introduced at a pressure of three atmospheres, and after about five hours' boiling the liquid is drawn off charged with the whole of the colouring matter, which, precipitated from its solution by an acid, gives indigo as pure as the finest from India.—Patent abandoned.

2547 W. R. Lake. *An improved cartridge holder.* (A communication.) Dated September 9, 1867.

This invention is not described apart from the drawings. —Patent completed.

2548 C. E. Brooman. *A new process for producing hydrogen.* (A communication.) Dated September 9, 1867.

This invention consists in, and the patentee claims, the employment of the alkaline and alkaline terrous hydrates named, mixed in a chemically defined proportion, or without a determined proportion, with various mineral or vegetable combustible matters, in order to produce, at a red heat, in contact with these matters, hydrogen suitable for lighting and heating, and this in such apparatus of distillation and calefaction as it may be found convenient to employ, such as retorts, crucibles, and the like.—Patent completed.

2549 F. Tolhausen. *An improved process and apparatus for instantaneously disinfecting fecal and manuring matters, improving the same, and also rendering them fit for feeding domestic animals.* (A communication.) Dated September 9, 1867.

This invention relates to a process and apparatus for disinfecting instantaneously fecal and stercorous matter, and dejections of every description, by mixing or combining them as soon as produced with various disinfecting powders, consisting of mineral and vegetable substances The details of the invention are voluminous.—Patent completed.

2550 G. Clark. *Improvements in cartridges.* Dated September 9, 1867.

This invention consists in an improved mode of making cartridges, of which the principal feature is the application and use of paper or cloth chemically prepared, so as to ignite readily and burn rapidly without leaving a residuum, for the purpose of containing the gunpowder charge.—Patent abandoned.

2551 D. C. Brown. *Certain new and useful improvements having reference to wire heddles for loom harness, and particularly the construction, manufacture, and support of such.* (Partly a communication.) Dated September 9, 1867.

This invention is not described apart from the drawings. —Patent completed.

2552 J. Marsden. *Improvements in looms for weaving Scotch or ingrain carpets.* Dated September 9, 1867.

This invention consists, first, in obtaining a dwell to the batten during the throw of the shuttle by causing the crank to work in a curved slot formed in the connecting rod or arm, one end of the rod or arm being attached to the lathe sword, and the other end working in a socket or universal joint. Second, in a new combination and arrangement for working the shuttle boxes, and effecting the necessary changes required for throwing in the different coloured wefts. Third, in additional means for preventing damage to the shuttle when the latter fails to enter the box. The patentee cuts away that part of the lathe sword which usually projects above the shuttle race, and to which the hand-rail is ordinarily fixed. Fourth, the improvements relate to the picking motion, and consists in the use of what the patentee terms a double clutch box, working as described. Fifth, the improvements relate to a new form of "frog," which the patentee mounts so as to turn on a centre, and he attaches to an arm forming the lower part of the "frog" a spring which keeps it in proper position against a fixed stop; but when the shuttle does not act properly, and the "stop rod" consequently comes in with the "frog," it overcomes the action of the spring, and causes the lower arm of the frog to strike a little lever connected with the motion for stopping the loom, and, at the same time, another part of the frog coming in contact with the same fixed stop beforenamed, prevents the frog being driven too far back. Sixth, the improvements relate to an improved letting-off motion.—Patent completed.

2553 J. Eichharn. *Improvements in furnaces for melting iron and other metals, and for smelting ores.* (Partly a communication.) Dated September 9, 1867.

The patentee claims constructing furnaces for melting iron and other metals, and for smelting ores, in the manner described. He also claims constructing furnaces for melting iron and other metals, and for smelting ores, with an upright body or shaft carried on one, two, or other number of sides by arches or supports, underneath which in each case the fuel is able to issue from the shaft, and form a heap in an enlarged or outer chamber or hearth, to which air is admitted, and which air is then free to play over the whole of the upper surface of the ignited heap, and has, before it can ascend the shaft, to penetrate under the said arch or support of the shaft, as described. He also claims constructing furnaces for melting iron and other metals with two or more erect shafts combined with a common lower chamber or hearth, as described.—Patent completed.

2554 J. Turnock. *Improvements in cask stands.* Dated September 9, 1867.

The patentee claims constructing cask stands substantially as described. He also claims arranging the frame or cradle to tip on a centre, together with forming it with a projecting edge or parts at one end to assist in raising the cask, as described. He also claims locking the frame or cradle in position by a screw, pin, or bolt, passing through it, and through slotted openings in the side standards, and receiving a screw nut, as described.—Patent completed.

2555 J. Medhurst. *Improvements in fitting ships' rudders.* Dated September 9, 1867.

Here the patentee provides at the stern of the ship a rudder trunk of such a size that the rudder can be raised up on to the deck through it, and afterwards again lowered into its place; and in place of fixing the "braces" or the sockets which receive the pintels of the rudder to the sternpost, as is usual, he makes them capable of moving up and down a guide fixed in the sternpost. This guide he prefers to be a casting or forging fixed to the sternpost, and with a dovetail or undercut groove in it, and the braces are formed so as to fit into this guide, and be securely held by it. The pintels and braces are modified in form, so that they cannot escape the one from the other. He prefers to make them to form with each other ordinary hinge joints. When the rudder is in its place, the upper end of the trunk may receive a chock or filling piece; or a hinged port may be fitted at the bottom of the trunk and secured by a lashing, the top of the trunk being fitted with a hatch.—Patent completed.

2556 J. Jordan. *Improvements in the construction of stuffing boxes, slide valves, and steam jacketings.* Dated September 10, 1867.

This invention has for its object the construction of stuffing boxes, slide valves, and steam jacketings applicable to engines worked by the vapour of water, ether, methylated spirit, alcohol, or other suitable spirit vapour, and consists, first, in the use of two complete stuffing boxes having a chamber between them to receive any vapour which may escape from the cylinder through the inner stuffing box; the chamber is connected by pipes to suitable condensers or pumps, by which means the vapour is re-conveyed to the boiler or vaporizer and saved. The second part of the invention relates to an improved arrangement of slide valves, and consists in fitting four plain blocks of metal in suitable positions upon the cylinder, two at the top, and two at the bottom. The third part of the invention consists in surrounding the cylinder with two separate jackets or casings, forming two annular chambers around the cylinder, distinct from each other, and quite tight.—Patent abandoned.

2557 C. J. Spencer and F. Ware. *Improvements in steam boilers.* Dated September 10, 1867.

This boiler is of cylindrical form, and is similar in appearance to the ordinary vertical boiler, having an inside cylindrical firebox, at the bottom part of which are placed the firebars. Within this firebox is another cylinder closed at both ends, and suspended at a proper distance above the bars by horizontal flanged tubes of different sizes riveted to it and the firebox casing, thus forming passages in which the water circulates between the inner cylinder and the space enclosed by the firebox and the outer shell. Connecting the top plate of the inner cylinder and that of the firebox are smaller tubes, also for the passage of water and steam, and one or more large tubes are inserted between the top plate of the firebox and the top of the shell for the passage of flame and smoke. From the firebox top are also suspended tubes with their lower ends closed, dipping into the annular space between the firebox and inner cylinder. The flame plays on the outside of all the tubes while the water is contained within them. The form of the boiler obviates the necessity of staying except where the diameters are very large, and the tubes being all placed transversely to the direction of the flame, their heating surface is of the most efficient kind.—Patent abandoned.

2558 J. Dicken. *An improved yielding fish-plate employed upon railways.* Dated September 10, 1867.

This invention relates to that class of metal plates employed for securing the ends of rails on the permanent way of railways, termed "fish plates," and more particularly to those fish plates which are employed for joining the ends of the rails which form the points, and consists in the construction and arrangement of a yielding plate attached to the rails by bolts screwed perfectly tight, in contradistinction to an ordinary rigid or immovable fish plate, as now employed. For this purpose the inventor constructs a plate in two halves, joined vertically down its centre by a strong hinge or other equivalent. This joint is placed just at the point where the two ends of the rails to be joined meet, each half being firmly secured to its respective rail by bolts which, by preference, he forms with a conical hollow head provided with a split or opening which will allow, when tightened up, a greater latitude for expansion before becoming loose or ineffectual. The jointed plate when thus secured will allow the points to move with the greatest freedom, and at the same time obviate the constant attention of the platelayer.—Patent abandoned.

2559 J. H. Brown. *The production and manufacture of compressed leather, and articles of leather.* Dated September 10, 1867.

Here the patentee reduces shoemakers' shavings and the refuse cuttings of untanned hides to pulp, in a papermaker's engine, and adds thereto (say) 10 per cent. of untanned fibres to 100lb. of tanned leather fibres, and introduces about 4lb. of dissolved glue; he amalgamates them in a rag engine. He then takes wire moulds, and uses therewith woollen felt, and, by pressure, while the fibrous materials are in a soft plastic condition, forms them into sheets of the required thickness.—Patent completed.

2560 J. Holliday. *Improvements in fringes.* Dated September 10, 1867.

Fringes are often provided with ornamental tips, and other ornaments covered with silk and other material of costly manufacture, and sewn or stitched to the fringe. This invention consists in employing tips or other ornaments formed of wood, or other material, for the ends or other parts of fringes, gilt, or otherwise ornamented.— —Patent abandoned.

2561 C. E. Brooman. *An improved thermometer.* (A communication.) Dated September 10, 1867.

This invention consists in the construction of a metallic thermometer of great simplicity and economy of manufacture. It is based on the dilatation and contraction of a bi-metallic spring band according to variations of temperature.—Patent abandoned.

2562 J. Eichharn. *Improvements in steam boiler and other furnaces.* (A communication.) Dated September 10, 1867.

In constructing a furnace suitable for a steam boiler, a chamber is formed which is enclosed at the sides by the side walls of the boiler setting; at the top by an arch spanning the interval between the walls, and at the back the chamber is partly enclosed by a wall supported by another lower arch. At a short distance from and below the crown of this arch is the lower end of an inclined grid of firebars forming a partition in the chamber. The bottom of the chamber may be a cast-iron plate supported on the side walls, and the front is enclosed by doors; there is one door over the firebars for the introduction of fuel into the chamber, and another door opening into the space below the firebars, by means of which the air draft

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through the bars may be regulated. The back of the chamber is open below the arch which supports the back wall, and the fuel descends out of it on to another or third arch or platform immediately beneath that just mentioned, and which forms a continuation of the bottom of the chamber. The fuel on this arch or platform is from time to time pushed back by the stoker, so as to cause it to fall over the back of the arch or platform on to the firebars beneath, on which a fire is thus maintained. It is supplied with air from an ashpit below the bars, which has a regulating door, and there is also a firedoor above the level of these firebars to admit of the workmen clearing the fire from time to time. The furnace is so regulated that a slow combustion is maintained in the fuel chamber whilst a bright and rapidly-burning fire is kept up on the bars below, and over this fire the smoke and products distilling from the fuel in the chamber have to pass, and so are effectually burnt.—Patent abandoned.

2563 C. SUTTON. *Improvements in optical apparatus designed to demonstrate the persistence of vision.* Dated September 10, 1867.

Here the inventor employs a metal frame with a suitable handle on which is mounted a toothed wheel and axis capable of being rotated by a crank; with the toothed wheel there gears a pinion, the axis of which is also carried by the frame, from which it projects so as to be able to receive upon it a number of suitably prepared models or forms, each of which is made with a socket to fit the end of the axis of the pinion. These models or forms, which may be very various, consist in each case of a strip of metal or other material bent to such a shape and so coloured that, when rapidly rotated (every point in the object describing a circle, which, in consequence of the rapidity of the motion, is visible to the eye), the illusion is obtained of a symmetrical solid of a circular section. According to the shape given to the model or form so the illusion will vary.—Patent abandoned.

2564 J. RAE. *Improvements in portable apparatus for cleansing and filtering water for army and other purposes.* Dated September 10, 1867.

This apparatus consists of a double cistern of metal carried on a suitable framing or cart body mounted on wheels for the purpose of transportation. The bottom of each half of the cistern inclines downwards, and has a central well or channel provided with a pipe or cock at the bottom for drawing off the sediment. The cistern is supplied with water from any source, such as from a pond, when on the march, for instance, either by a hand pump placed on the ground, or fixed at any point on the cart outside the cistern. In the well or bottom of the cistern the patentee places a filter open at top and bottom, and enclosed in a casing in such manner that the water entering from below will pass through the filter, and then into the casing with which delivery pipes extending at the back of the cistern are connected provided with taps for drawing off the cleansed and purified water. The cistern may be mounted on two or more wheels, and fitted with one or more filters.—Patent completed.

2565 J. WHITTOME. *Improvements in baling presses for pressing cotton and other substances.* Dated September 10, 1867.

The patentee claims the mode set forth of constructing and arranging the several parts of the apparatus for compressing cotton, and of applying the pressure of steam in combination with hydraulic pressure to compress cotton and other substances into bales for convenient transport. The down pressure is given to the follower for compressing the cotton, &c., by steam power, and the up pressure is given to the hydraulic follower by hydraulic power.—Patent completed.

2566 A. KINTON. *Improvements in the construction of water wheels.* Dated September 10, 1867.

Here the inventor proposes to construct the floats or boards of the wheel in such manner that they shall be capable of opening and closing in two sections, instead of forming, as hitherto, a fixed or constant float, the object being to free the ascending floats of the tail water.—Patent abandoned..

2567 J. POTTLE. *A new or improved cucumber box.* Dated September 10, 1867.

Here the patentee forms the box of glass, or wood and glass combined, or of glass, wood, and metal combined; the box is to be about 2ft. long and 2½in. wide, and the same in depth, interior measurement. The wooden sides and bottom of the box are to be made of deal about ¾in. thick, and feet may be attached to the base of the box to let it rest clear of the ground; or the box may be suspended by suitable supports, such as arches or standards, and pendants of wire or cord for the same purpose. The sides and floor or base of the box are to be secured or based together by zinc or other metal bands about ¼in wide. Grooves are cut on the interior of the sides of the box close to the top for a glass lid to slide within. This lid is to be formed in two parts, so as to be drawn out from each end of the box, meeting in the middle.—Patent completed.

2568 C. MATHER. *Improvements in machinery for washing ores, grain, wool, and other mineral, vegetable, and animal substances.* Dated September 11, 1867.

The patentee claims the application of a revolving cylinder, with internal screw or worm and buckets or lifters, and either with or without perforations at the discharging end, for washing ores and other substances, as described.—Patent completed.

2569 E. K. DUTTON and S. MASON. *Improvements in the bearings of hydro-extractors, and in the method of supplying lubricating matter to the same; applicable also to the lubricating of the bearings of other machinery.* Dated September 11, 1867.

These improvements in the bearings of hydro-extractors relate to the bearings in which the journals of the cage shaft run, and consist in forming the bearings of three or more blocks or pieces of hard wood suitably formed to be fitted into recesses formed in appropriate portions of the hydro-extractor, or its framing, the said blocks of wood being arranged at equal distances around the centre of the shaft, taper keys screwed at one end and fitted with nuts being employed to force the blocks nearer to the shaft as they wear. The bearing formed by the blocks of wood is preferably bored to fit the "journal," as is usual. In the case of an "upright bearing," an oil case or dipper of a circular form is fitted below the bearing in such a manner as to revolve with the shaft, and to "catch" the oil as it runs from the bearing, the circumference of the said oil case forming a circular channel in which the oil collects when the case is revolving. A stationary pipe or tube is fitted or formed at its lower end with a curved scoop having an open mouth, which is immersed or partially immersed in the oil, the upper end of the pipe being suitably formed to deliver the oil to the upper part of the bearing, the motion imparted to the oil causing it to enter the mouth of the curved pipe and to ascend the pipe until it runs over at the upper end of the pipe. The mouth of the pipe is curved in a direction contrary to the direction of the motion of the oil.—Patent abandoned.

2570 S. BROWN. *An improvement in the method of ornamenting bottles, vases, and jars used for perfume or toilet purposes.* Dated September 11, 1867.

Here the inventor combines for the purposes of ornament and utility a locket or case to contain a portrait or device with a perfume or toilet bottle, vase, or jar, and for that purpose he causes the bottle, vase, or jar to be made with a cavity in the side or stopper, and in this cavity he fixes by cement or otherwise a locket or case capable of being opened and closed, and of having a portrait or device inserted or withdrawn.—Patent abandoned.

2571 W. BAKER. *Improvements in the manufacture of iron, and in furnaces used in the manufacture of iron.* Dated September 11, 1867.

This invention relates to the puddling process, and the essence of the first part of the invention consists in melting the hammer slag or flux apart from the iron, and introducing the melted slag or flux into the bed of the pudding furnace in a melted state, and mixing it with the melted iron when the iron has ceased, or nearly ceased, to give off gas. The improvements in furnaces used in the manufacture of iron consist in forming a second or supplementary small bed in the furnace at the back of the flue bridge in which to melt the hammer slag or other flux used in the puddling process, and also in forming a passage in the flue bridge through which the melted hammer slag or flux may run to the bed of the furnace. The said passage may be temporarily closed by a plug of red iron ore.—Patent abandoned.

2572 A. M. CLARK. *Improvements in machinery for polishing, grinding, and edging slabs of marble, slate, and other minerals.* (A communication.) Dated September 11, 1867.

This invention is not described apart from the drawings. —Patent completed.

2573 W. BAIRD. *Improved apparatus to be used for registering the number of passengers entering vehicles.* Dated September 11, 1867.

At the entrance to the vehicle a movable step is placed constituting the lid or cover of the box wherein the registering mechanism is, by preference, contained, so that in entering the vehicle each passenger walks over or upon the movable step, the weight of the passenger causing the step to be depressed to an extent sufficient to actuate the registering mechanism. This mechanism comprises a ratchet wheel and pawl, teeth, index, &c., and springs for forcing up the lid of box in readiness for next registration.—Patent abandoned.

2574 F. WEINTRAUD. *Improvements in purses and other like articles.* (A communication.) Dated September 11, 1867.

This improved purse possesses the advantages of both a porte-monnaie and money bag. The inventor employs a purse frame, the halves of which are jointed to each other (at or near the bottom of the purse at the ends), and he leaves the joints free, that is to say, unattached to the leather or other material composing the body of the purse, so that, when the frame and purse are opened, the joints rise at the ends of the purse without raising the bottom of the purse, and therefore without diminishing its capacity, as is the case when the joints of the frame are secured to the bottom of the purse in the ordinary manner. The two sides of the purse are made in one piece of leather or other material passing under the bottom, and having the necessary fullness to give to the purse the desired capacity.—Patent abandoned.

2575 J. DAVIES. *Improvements in apparatus used in the manufacture of salt.* Dated September 11, 1867.

This invention consists, first, in applying mechanism to actuate rakes for raking the salt in salt pans of a rectangular form. The patentee attaches the rakes in rows to bars which reach across the pans from side to side, and the ends of these crossbars are attached to endless chains. There is one of these endless chains on each side of the pan, and they pass round suitably formed pulleys or chain wheels fixed on a shaft. An intermittent or continuous motion may be imparted to the shaft, and thence to the chains and rakes by ordinary mechanism. In the next place, the improvements consist in applying machinery for withdrawing the salt from raking pans of a rectangular form.—Patent completed.

2576 L. M PREWITT. *Improvements in stays, bodices, or corsets.* Dated September 11, 1867.

In the material of the stay openings are made in the front in a diagonal direction from shoulder to waist; these are to be drawn together or partially closed by the introduction of a piece of elastic webbing or cord; a gusset-shaped opening is made also in the back, extending only a short distance down from between the shoulders; this is also fitted with elastic web or cord. A pair of straps of elastic material, or fitted with elastic ends, are attached to the breast of the stays, and, passing over each shoulder, are crossed at the back, whence they are passed under the arms, and are secured to a stud in front upon the stay busk; another pair of similar straps or band is secured at the back, and by preference on the inside of the stay, passing through eyelets at the side, pass thence round the waist, and, meeting in front, are similarly secured upon a stud.—Patent abandoned.

2577 H. R. LUCKES. *The manufacture of artificial or compressed fuel in the treatment of coal, sawdust, and woody fibre, whereby those substances can be utilized when in a state of powder and converted into a serviceable fuel.* Dated September 11, 1867.

The object here is to produce bricks or blocks of fuel from small coal, &c. The cohesion of the divided particles of the carbonaceous substance employed is effected by incorporating with them a mucilage obtained by boiling or otherwise from the common descriptions of seaweed.—Patent abandoned.

2578 W. E. NEWTON. *Improvements in anvils.* (A communication.) Dated September 11, 1867.

This invention is not described apart from the drawings. —Patent completed.

2579 W. E. NEWTON. *Improvements in saws.* (A communication.) Dated September 11, 1867.

The patentee claims, first, perforating saw blades with a number of holes in rear of the teeth, as set forth, for the purpose of admitting of the lengthening of the teeth when the latter are worn away by use, without the process of "gumming" or re-cutting the throats or spaces between the teeth. Second, the use of male and female dies constructed and arranged, as shown and described, for the purpose of cutting out the teeth or the throats, or spaces between the same, and also the holes in rear of the teeth, at one operation, and admitting of the adjustment of the parts which cut out these holes in such a manner that the latter may be cut or punched in straight or curved lines, as may be required. Third, securing the handle sockets to the saw blade by rectangular slots in the ends of the saw blade, and the screw bolts provided with the taper portion, as set forth.—Patent completed.

2581 J. B. MELDRUM. *Improvements in printing textile fabrics.* Dated September 12, 1867.

The patentee claims the application of aniline dyes for printing of jute fabrics, or fabrics in which jute is a component part, for the purpose of rendering the appearances produced more brilliant and durable than hitherto.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated November 22, 1867.

3313 J. H. Brown, Exeter Hotel, Strand. A new game, to be played with balls and cues or other media for propelling the said balls, and also for the peculiar construction of the table on which the same is played, together with the several mechanical appliances and figures.

Dated January 1, 1868.

1 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in apparatus for regulating the speed of steam and other engines, and for indicating the power of the same. (A communication.)

Dated January 18, 1868.

180 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in ribbon looms. (A communication.)

Dated February 12, 1868.

482 J. Towle, Cold Harbour, near Oxford, Berkshire, justice of the peace. Improvements in the arrangement of sewers and drains for the collection and distribution of sewage matters.

Dated March 2, 1868.

709 F. Neiber, Vienna, Austria, manufacturer. Improvements in fastenings for glove boxes, cigar cases, necessaires, and other articles.

Dated March 3, 1867.

718 J. Barker, Todmorden, Yorkshire. Certain improvements in the method of consuming smoke from the fuel used in furnaces, and in the method of supplying fuel to furnaces, and in apparatus connected therewith.

Dated March 4, 1868.

747 G. Davies, Serle-street, Lincoln's Inn. Improvements in the manufacture of gas for lighting and heating. (A communication.)

754 A. V. Newton, Chancery-lane. Improved apparatus for measuring spirituous liquors. (A communication.)

Dated March 5, 1868.

760 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in mechanism for preparing soles, and for sewing the same upon boots and shoes. (A communication.)

Dated March 6, 1867.

777 J. Eastwood, Blackburn, Lancashire, machine maker. Improvements in machinery for preparing size, and in machinery or apparatus to be employed in the sizing of yarn and other fibrous materials and fabrics.

783 T. Atkins, Fleet-street, City, engineer. Improvements in feeding bottles for infants and invalids.

785 J. Houston, jun., Glasgow, soap and candle manufacturer. Improvements in the manufacture of composite candles, and in the machinery or apparatus employed therein.

Dated March 7, 1868.

787 H. Hargreaves, Barnley, Lancashire. Certain improvements in looms for weaving.

791 H. Symons, Kentish Town, hardware manufacturer. Improvements in fireguards and firescreens.

793 C. E. Brooman, Fleet-street, City, patent agent. Improvements in combing machinery. (A communication.)

795 W. Berry, Bradford, Yorkshire, machine makers. Improvements in foot-steps for upright spindles and shafts.

797 R. M. Chevalier, Beresford-terrace, Notting Hill, W., civil engineer. An improvement in the manufacture of the blinds usually called Venetian blinds.

799 W. H. Warner, Ross, Herefordshire, and R. C. Murray, Jermyn-street, Middlesex. Improvements in stereoscopes.

801 F. J. Baynes, Holloway-terrace, Holloway-road, Islington. Improvements in kitchen ranges and parts connected therewith, which improvements are also applicable to other cooking stoves.

803 P. Koch, New Haven, Connecticut, U.S., machinist. Machinery for making metallic nuts.

Dated March 9, 1868.

805 J. Jeavons, Sheffield, iron maker. Improvements in the manufacture of tyres for railway and other wheels.

806 W. Hartley, Heywood, Lancashire, cotton spinner. A machine for preparing and conditioning yarn.

809 L. Blumfeld, Wood-street, Cheapside, City. Improvements in the construction of cigar tubes and pipes, when used in combination. (A communication.)

811 W. Piddin?, Brunswick-square, Middlesex. Improvements in pockets formed in gloves, and in the mode of securing railway tickets, money, or other contents deposited therein for safe keeping.

813 P. W. Barlow, Blackheath, Kent. Improvements in machinery for constructing tunnels.

815 W. H. Halsey, Hoboken, New Jersey, U.S., manufacturing jeweller. A new and improved process for making articles from hard rubber, and from other substances capable of being moulded in dies, and at the same time inlaying and attaching to such articles metallic plates for ornamental purposes.

817 P. F. Halbard, Burton-on-Trent, Staffordshire. Improvements in stench traps.

Dated March 10, 1868.

819 J. Slater, Catherine-terrace, Lansdowne-road, S.W., Surrey, engineer. Improvements in heating the feed water for steam engine and other boilers, to economize the consumption of fuel and feed water, and in apparatus therefor.

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820 W. B. Kinsey, Cannon-street, City, engineer. Improvements in apparatus for carburetting or increasing the illuminating properties of coal gas.

821 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the production of brown colouring matters for dyeing and printing. (A communication.)

822 S. Desborough, Staining-lane, City. Improvements in apparatus for cleaning and polishing knives, forks, and other articles.

823 J. Jones, Durham. Improvements in finishing, straightening, and punching rolled, railway, and other bars of iron and steel.

824 R. Meldrum, Pittormie, Cupar, Fifeshire. Improvements in apparatus for raising water.

825 J. G. Douglas, Cork, engineer. Improvements in valve motions for oscillating cylinder engines.

827 A. Bourdon, Boulevard du Prince Eugene, Paris, engineer. Improvements in looms for weaving.

828 A. V. Newton, Chancery-lane. Improved apparatus for lubricating machinery. (A communication.)

829 J. Wallis, Greenwich, Kent, miller. An improved mode of, and apparatus for, dressing millstones.

830 C. Attwood, Wolsingham, Durham, iron master. Improvements in the production or manufacture of steel and iron of a steely character.

831 H. E. Smith, Herefordshire, engineer. Improvements in steam engines and boilers.

Dated March 11, 1868.

833 S. Brooks, Union Works, West Gorton, Manchester, machine maker. Improvements in machinery for preparing, spinning, and doubling cotton and other fibrous substances.

834 E. and J. Broadbent, Manchester, paper manufacturers. Improvements in machinery for manufacturing paper bags.

835 F. Winser, Manchester, and I. Swindells, Kegworth, Leicestershire. Improvements in the utilization of the waste products arising from esparto grass and other fibrous materials used in the manufacture of paper and other purposes.

836 F. Winser, Manchester, and I. Swindells, Kegworth, Leicestershire. Improvements in the manufacture of sulphate of magnesia.

837 B. Browne, King William-street, City. Improvements in the construction of girders or rails, railway chairs, sleepers, switches, points, and crossings, and in the mode of laying, fixing, and working the same on lines of railways, and in other situations. (A communication.)

838 T. Walker, Robert-street, Chelsea, engineer. Improvements in the construction of electric telegraph cables and lines, and in the mode of, and apparatus for, or connected with the transmission of electric currents.

839 S. Naylor, Ravensfleet, East Stockwith, Lincolnshire, engineer. Improvements in apparatus for raising water.

840 M. T. Shaw and T. H. Head, Cannon-street, City. Improvements in rolling iron and steel, and in wrought girders and joists, and in machinery for producing the same.

842 W. Hawthorn, Newcastle-upon-Tyne, engineer. Improvements in steam generators and other boilers.

Dated March 12, 1868.

843 F. A. Paget, Seymour Chambers, York Buildings, Adelphi, Strand, civil engineer. Improvements in constructing ships' compasses and their binnacles, and in preventing the deviations of compasses in iron or steel ships.

845 F. Ryland, West Bromwich, Staffordshire, mechanical engineer. Improvements in the manufacture of pulleys for suspending window frames, and for other like purposes.

846 W. Thompson, Rathbone-street, Canning Town, Barking-road, Essex. Improvements in the manufacture of iron castings.

847 H. Fletcher, Old Hall-street, Liverpool. An improved method of obtaining and applying motive power.

848 W. A. Lyttle, of the General Post Office, London. Improvements in the means and apparatus for supplying boilers with water.

850 T. Barnes, How Gill, near Gisburne, Yorkshire, cotton waste spinner and manufacturer. An improved method of, and machinery for, preparing rovings from waste and other inferior fibrous materials.

851 A. P. Stephens, Brooklyn, New York. Improvements in vises and similar clamping mechanism.

852 J. Hodgeson, Latchford, Chester, railway signal fitter. Improvements in railway and other signals, and in mechanism for actuating the same.

853 W. E. Newton, Chancery-lane. Improvements in ballasting vessels. (A communication.)

854 A. and E. Geary, Horsfield-road, Bristol, ironmongers. Improvements in cinder sifters.

855 B. Britten, Red Hill, Surrey. Improvements in the manufacture of manure.

Dated March 13, 1868.

858 S. Bates, lace manufacturer, and W. Redgate, draughtsman, Nottinghamshire. Improvements in the manufacture of lace in twist-lace machines.

860 G. F. Lyndon, Birmingham, manufacturer. Improvements in rotating shafts and axles and their bearings, and in the means of lubricating the same.

861 M. Rowand, Lewisham, Kent. Improvements in the treatment or preparation of the ingredients employed in the manufacture of fermented liquors.

862 W. M'Naught, Rochdale, Lancashire, engineer. Improvements in steam engines, steam boiler and other furnaces, and in apparatus for heating the feed water.

863 C. S. Moller, Philpot-lane, City. An improved portable side weapon adapted for the use of the army more particularly. (A communication.)

864 H. Kershaw, Laister Dyke, Yorkshire. Improvements in apparatus employed in spinning worsted and other fibres.

866 S. H. Salon, Regent-street, optician, and T. Field, Vine-street, Westminster, machinist. An improved apparatus or instrument for clipping the hair of horses and other animals.

Dated March 14, 1868.

868 W. G. Beattie, South Bank, Surbiton, Surrey, engineer. Improvements in steam pistons.

869 S. Holness, Ufton-grove, Southgate-road, Kingsland. Improvements in, or additions to, speaking tubes for intercommunication in railway trains and buildings.

871 W. Bellhouse, jun., cotton spinner, and R. Ashworth, mechanic, Manchester. Certain improvements in carding engines.

872 J. B. Handyside, Glasgow, engineer. Improvements in apparatus for applying springs to railway rolling stock and otherwise.

873 J. P. Knight, New Cross, Kent. A new or improved indicator lamp and semaphore for cabs and other public carriages, and for floating vessels, also for regulating the traffic in the public thoroughfares and rifle practice.

875 F. Mulliner, Northamptonshire, carriage builder. Improved apparatus to be used in connection with the poles and splinter bars of carriages.

876 J. Clay, Yardley, Worcestershire, saddler. Improvements in harness, saddles, and harness pads.

877 J. Carter, Birmingham, boat builder. Improvements in machinery for the manufacture of nails and spikes.

878 W. A. Lyttle, of the General Post Office, London. Improvements in apparatus for closing and securing boxes, bags, and other packages.

879 P. F. Gubault, shoemaker, Rue Milton, Angers, France. Improvements in machinery for finishing boots and shoes.

Dated March 16, 1868.

880 J. Norman, Glasgow, engineer. Improvements in apparatus for dressing millstones.

881 E. V. de Forville, Prairie au Duc, Nantes, department of the Loire Inferieure, France, merchant. An improved machine for crushing and sifting flour.

882 F. A. Baumann, Heilbronn, Wurtemberg, civil engineer. Improvements in the construction of rotary engines.

883 T. S. L. Beech, Charlton, Kent. Improvements in engines for obtaining rotary motion by means of steam, water, gas, or other fluids.

884 H. F. Griffiths, mechanical engineer, and A. Beard, jun., manager of works, Wolverhampton. Improvements in apparatus for puddling iron and steel.

885 W. Arthur, Upper Kennington-green, Surrey, and W. Arthur, Albany-street, Regent's Park. The support and cure of hernia by means of a new and improved form of truss.

888 H. A. Bonneville, Sackville-street, Piccadilly. New and improved apparatus for manufacturing cartridges. (A communication.)

890 D. Greig, Leeds. Improvements in traction engines and other engines to travel on common roads.

891 W. E. Newton, Chancery-lane. Improvements in the manufacture of illuminating gas in the distillation of hydrocarbons. (A communication.)

892 W. E. Newton, Chancery-lane. Improvements in telegraphic apparatus. (A communication.)

894 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of wheels for vehicles, and in the machinery or apparatus employed therein. (A communication.)

895 P. J. Livsey, Manchester. Improvements in machinery for combing cotton and other fibrous materials. (A communication.)

896 J. S. Gee, Gloucestershire. Improvements in ornamenting slate and such like materials to be afterwards enamelled.

Dated March 17, 1868.

897 R. Sims, Bedford Leigh, Lancashire, agricultural implement maker. Certain improvements in horse rakes.

899 W. Hulse and E. Williams, Birmingham, manufacturers. Improvements in the manufacture of metallic bedsteads and other articles of metallic furniture.

901 W. E. Gedge, Wellington-street, Strand. Improved fuel. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated March 19, 1868.

930 C. E. Green, Blandford-street, Portman-square, and J. Green, Windermere Cottage, Winchmore Hill, Edmonton. Improvements in the manufacture of cartridges for breech-loading firearms.

944 H. F. Shaw, West Roxbury, Norfolk, U.S. Improvements in machines for overcoming resistance.

Dated March 23, 1868.

970 V. A. Deaubeuf, Maindy, Cardiff. Improvements in machinery for the manufacture of compressed fuel from small coal and other material.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," March 31, 1868.

3265 E. T. Hughes. Knitting machines. (A communication.)

3266 W., J., and J. Busfield. Preparing slivers of wool for spinning.

3267 W. J. Hanson and J. C. Ellison. Method of dyeing textile fabrics.

3270 G. Fitt. Artificial manure.

3281 C. Mole. Manufacturing soles and heels for boots and shoes.

3286 J. Oppenheimer. Telegraph posts.

3287 H. Greene. Safety lamp.

3288 Baroness C. de Lavenant. Coating metals.

3293 W. R. Lake. Packing for the piston heads of steam cylinders. (A communication.)

3300 W. Blundell. Cowls for chimneys.

3310 T. G. F. Dolby. Apparatus for warming solid and liquid food.

3316 G. H. and E. Bolton, W. Whitthead, and T. Robinson. Obtaining motive power.

3318 P. Salmon. Manufacture of gas.

3320 W. Macnab. Marine steam engines.

3321 C. E. Brooman. Steam generators. (A communication.)

3324 J. H. Johnson. Breech-loading firearms. (A communication.)

3326 T. Barton. Cribbage board.

3327 F. Brown. Kitchen ranges.

3328 G. Turner. Packing cases.

3332 R. Ward. Machinery for spinning tobacco.

3333 T. Chalmers. Machinery for producing seamless tubes. (A communication.)

3334 A. V. Newton. Rotary steam engines. (A communication.)

3337 W. Sim. Apparatus for watering streets.

3342 C. E. Penny. Envelopes.

3356 W. Fowler and J. Griffiths. Tyres of railway wheels.

3380 J. R. Pratt. Construction of articles of earthenware.

3383 J. R. Towers. Bedsteads.

3387 J. Fraser and G. Duncan. Machinery for printing.

3394 A. Turner and W. E. Newton. Carpets.

3396 A. M. Clark. Chronometers. (A communication.)

3402 W. Starkey. Obtaining motive power.

3414 G. Heiron. Castors for containing pepper and salt.

3443 N. Grew. Apparatus for cleaning cotton.

3445 C. Paley. Elastic material.

3495 E. Keirby. Elastic packings.

3517 A. M. Clark. Process for the reduction of tin. (A communication.)

3559 J. Hargreaves. Manufacturing soda.

3589 F. L. and C. L. Hancock. Propellers.

3604 H. H. Murdock. Apparatus for propelling canal boats. (A communication.)

3610 J. Atkins. Metallic bedsteads.

3611 J. Clay. Saddles.

3613 E. Breffit. Glass bottle house pot carriages.

3622 G. Davies. Knitting machines. (A communication.)

3636 E. and A. Ludlow. Machinery for the manufacture of cartridge cases.

3710 G. M'Culloch. Thread-polishing machines.

1 W. R. Lake. Apparatus for regulating the speed of steam engines. (A communication.)

141 T. Travis, W. H. Prince, and J. Tomlinson. Machinery for clearing yarn.

489 C. Blyth. Machinery for measuring cloth for bags.

519 A. H. Brandon. Breech-loading firearms. (A communication.)

609 J. Macintosh and W. Boggett. Manufacture of elastic goods.

731 T. Johnson. Treating ores.

759 W. Hunt. Treating certain compounds of copper and iron.

830 C. Attwood. Manufacturing steel and iron.

880 J. Norman. Dressing millstones.

886 H. A. Bonneville. Jacquart looms. (A communication.)

891 W. E. Newton. Manufacture of gas. (A communication.)

930 C. E. and J. Green. Cartridges.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed March 27, 1868.

2744 M. Hamer
2751 W. James and W. Hill
2752 J. Donald
2765 R. Fletcher
2778 H. Haschke
2787 G. Townsend
2794 J. Gutmann
2848 T. Blacknurst
2807 A. Bradburn and S. T. Marsh
2904 W. E. Newton
2924 H. Sharp and F. W. Webb
278 G. Kellogg
442 W. R. Lake
443 W. R. Lake

Sealed March 31, 1868.

2759 J. G. Jones
2760 G. Allibon and A. Manbre
2766 T. E. Clarke
2767 W. and S. Smith
2768 R. H. Taunton
2769 F. Parkes
2773 J. H. Nelson and T. Briggs
2776 F. J. Jeffery
2777 C. Mace
2780 W. Spence
2789 A. T. Becks
2801 J. Anderson
2810 J. Piddington
2820 H. Trotter
2821 T. Ollis
2834 R. Reid and E. H. Craigie
2839 J. James and T. Jones
2845 W. Warren
2870 R. F. Bare and J Thomson
2877 J. H. Johnson
2901 F. D. Frost
2910 E. Shaw
2942 A. F. Jalourcau and C. L. Lardy
3019 F. M. Smith
3042 E. B. Wilson
3091 T. B. Cutts and F. W. Brooksbank
3107 W. E. Newton
3138 C. L. Hett
3469 P. G. L. G. Designolle and J. Casthelaz
3501 H. Bessemer
98 J. G. Tongue
109 J. G. Tongue
150 W. Betts
376 J. Dewar

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

828 W. Simons and A. Brown
844 H. C. Hurry
850 J. Dodd
856 J. Todd
863 J. Bruckshaw and W. S. Underhill
864 F. Le Roy
876 F. A. Mocquard
882 J. Wright
884 W. Irlam
898 W. Savory
900 A. A. Croll
923 R. A. Brooman
945 J. R. Wigham
996 W., E., and J. Gray
1004 A. Homfray
1043 J. Walker
1344 R. and H. Harrild

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

759 T. Davison and R. Paterson
778 W. Sorrell
788 W. D. Napier
795 R. Ridley and J. Rothery

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending March 28, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1731	0 10	2322	1 4	2250	0 10	2371	0 8	2386	0 4	2407	0 4		
1889	0 4	2323	1 4	2252	0 8	2372	0 8	2387	0 4	2411	0 4		
2102	0 4	2324	0 8	2259	1 4	2377	0 4	2388	0 8	2417	0 4		
2220	0 8	2325	1 4	2360	1 2	2378	0 4	2390	0 8	2416	0 4		
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THE

MECHANICS' MAGAZINE.

LONDON: THURSDAY, APRIL 9, 1868.

LONG *VERSUS* SHORT SPAN BRIDGES.

THE introduction of railways, it must be admitted, imparted a stimulus to engineering sufficient to raise it to the dignity of a profession, a position it can hardly be correctly stated to have previously attained. With the practical development of the new system of locomotion arose the most extravagant ideas respecting its ultimate destiny. An unparalleled velocity of transit was implicitly believed in, and confidently relied upon. Bridges of surpassing dimensions were considered merely subsidiary adjuncts to the construction of a line, and an arm of the sea, or a chain of mountains, was regarded as a troublesome but a very trifling difficulty. How have these expectations been answered? how have these ideas been realized? It is true that something has been done, something effected, but how little in comparison with what was anticipated. We have crossed the Straits of Menai a second time, we are more than half way through the Alps, and we have pierced the Isthmus of Suez. But we have not connected England and the Continent; the sea still rolls, unspanned, between Europe and Asia, and an inland route to our vast Indian possessions is as much a question of the future as when the subject of the Euphrates Railway was first thrust upon the notice of the Government and public. In our present article we propose to direct attention to the complete change of opinion that has taken place with regard to bridges possessing very long spans. So soon as the employment of wrought iron demonstrated the advantages it possessed over the older materials used for constructive purposes, it was imagined by some that all our rivers, over which it was necessary to carry a bridge, would be crossed, not by successive leaps but at a single bound. It is well known now that some of the few railway bridges really existing as examples of a long span could have been built in a more economical manner had a different principle been adopted.

Disregarding the somewhat treacherous nature of the material, the limits of cast-iron girders, especially for railway purposes, are soon reached. The arch may be perhaps considered an exception to this rule, particularly when we have before us the instance of that at Southwark Bridge, the centre span of which equals 240ft. It must, however, be borne in mind that this bridge is only used for road traffic, although the real objection to the general employment of the arch form upon a large scale is the impossibility of affording a sufficient amount of rise to enable a curve to be obtained endowed with the property of correct equilibration. The failure of the horizontal cast-iron girders, or rather that of what may be appropriately termed the compound cast-iron girder, constructed of cast-iron beams trussed with wrought-iron rods, demonstrated that even for moderate spans, when intended for steam traffic, this principle was inadequate to fulfil the conditions of strength and safety, conditions which were speedily stringently insisted upon by the Board of Trade in the interest of the public. To wrought iron, therefore, engineers began to look for the accomplishment of their stupendous designs; but, curiously enough, the arch was abandoned at the very introduction of the new material, it being impracticable in railway bridges to employ that form generally. The centre spans of the new Blackfriars Bridge, which are 185ft. across, will, we believe, be the representative of the largest example of a wrought-iron arch. Those of the Victoria Bridge over the Thames do not exceed 175ft. in the clear. The horizontal girder appeared to offer, more especially in the matter of headway, considerable advantages over the arch form, and consequently the first specimens were instances of that principle. It was this latter consideration that determined its application to the crossing of the Menai Straits, which contains at present the longest single span of any railway bridge in the world. The centre spans of Brunel's stupendous erection at Saltash fall short of its dimensions by several feet, and the subsequent structures in America and our own country do not approach it in magnitude. The question has frequently been asked, are bridges of enormous span, engines of extraordinary weight, ships of gigantic proportions, and guns of unparalleled dimensions, costly blunders? Were we to regard the matter solely in one point of view, we fear the answer would be in the affirmative; and with the facts before us it is difficult to arrive at any other conclusion. The broad gauge, the design of one of the greatest engineers that ever lived; the "Great Eastern," the offspring of the same master mind, have both proved failures; the weight of our present engines, and the enormous disproportion it bears to the mass set in motion, is not dictated by design or economy, but is simply the result of an unscientific necessity. So with our bridges. That over the Menai Straits has never been equalled, much less eclipsed, and there is no question but that the multi-span principle has proved itself in point of economy superior to the system of crossing an intervening space in one gigantic leap.

The first engineer who laid down this principle, and adhered to it most rigidly in practice, was Colonel Kennedy, the engineer to the Bombay, Baroda, and Central India Railway. Throughout the whole of this line, with one or two solitary exceptions, which were occasioned by the nature of the river bed, a uniform span of 60ft. has been adopted, and the construction of the bridges is that of a wrought iron Warren girder supported upon cast-iron screw piles. The destination of the girders, and the difficulties attending their erection, had, no doubt, some influence upon the selection of the method put into practice, but at the same time the whole principle was submitted to a thorough investigation before the system of short spans *v.* long ones was finally decided upon. The whole question rests upon the relative economy of piers balanced against superstructure; but there is this point to be noticed which bears somewhat favourably upon the long span system, that the cost of sinking a pier, or even a number of piles, is always an unknown quantity, whereas the erection of the superstructure can be estimated to a few pounds. It is rarely the latter item that delays the progress of a structure, but the former is a common source of vexation and expense, whenever the foundations have to be got in under water. So far as the modern arched bridges across the Thames are concerned, the multiplicity of spans into which they are divided does not enter into the comparison, since the exigencies of the over traffic do not now permit of anything beyond the minimum rise. But the adoption of small spans for the three new railway bridges is an indisputable testimony to the superior economy of that principle. In the case of the Charing Cross structure, it might have been supposed *primâ facie*, that as there were a couple of existing piers and abutments which merely required widening, nothing would have been simpler than to have utilized them at once, and replaced the old suspension bridge by another having the same spans, and differing only in form and dimensions. It is true that the centre span would have exceeded in length that of any other existing similar structure, but still there was the Britannia Bridge as a precedent, and it would be a great injustice to our engineers to suppose that any insurmountable difficulty would have been experienced upon that point. The argument that tells most strongly against the long or single span principle is that the cost of constructing a girder increases in a far higher ratio than that of the mere augmentation of its span. With piers it is different, for, *cæteris paribus*, the cost of any number of piers in the same situation will, upon the average, be in simple arithmetical progression. Occasionally there are departures from this law, as in the foundations of the piers for the new Blackfriars Bridge. It has been necessary in one case to sink the caissons nearly 20ft. below the ordinary depth; but this is quite an exceptional occurrence. The London, Chatham, and Dover Railway Bridge over the Thames is another example of the employment of the short span principle, and it may be fairly concluded that in England, at all events, we shall not witness many future rivals to erections so magnificent as the Britannia and the Royal Albert Viaducts. Across an impassable gorge, a precipitous ravine, or a furious torrent, it may be impossible to employ any other than a bridge of single span, and the importance attached to the connection of the opposite sides must determine whether the necessary outlay is justifiable or otherwise. For the future, it may be asserted, judging from the data we have adduced, that short spans will be the rule, long ones the exception.

MAGNETIC PHANTOMS.

A CONTEMPORARY gives a very learned account of the magnetic figures produced in iron filings, in the following words:—"Magnetic phantoms produced by sprinkling iron filings on a sheet of paper laid on the poles of an electro-magnet, have for some years past been regarded as curiosities, and made the subject of popular demonstration. But it is now known that they have a scientific value, inasmuch as they indicate the condition of the magnet; whether, for instance, the poles are isonomal or antinomal, isodynamic or hetrodynamic, with points consequent or not, or bifurcated, trifurcated, circular, and so forth . . . ." These are *prave orto*, and, it may be, do stand for something; but we are obliged to confess "we don't see it." Although we have made many hundreds of experiments both with electro-magnets and permanent magnets, and iron filing figures, still we never met with anything in electro-magnets that we could apply such names to. We take it to be quite easy to make an electro-magnet that shall have apparently isonomal poles; but we should like to say poles of the same name, that is, having two external N. or two external S. poles. Still we hold it to be impossible that any magnet can exist with two poles of the same name, whether it be electro or permanent, any more than a walking-stick can be imagined with only one end.

Now, if the coil on an electro-magnet be divided into two portions, and the current of electricity be sent through these halves in opposite directions, or if one half be a right hand coil and the other a left hand coil, and the current be sent through them in the same direction, then there will be exhibited at the external ends poles of the same name; but this is not an electro-magnet with poles of the same name, but really two electro magnets, one for each half coil, and it is possible to make an iron bar into as many separate and distinct magnets as reversed coils can be put upon it; but it is not possible to make one magnet with poles of the same name; therefore, iron filings cannot show it, and it is a wonder to us how anyone knowing anything of the matter can imagine such a thing. So much for isonomal and antinomal. Then

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come isodynamic and hetrodynamic. One is at a loss to know what the writer means to convey by these terms as applied to magnetism. Magnetism is a static force as exhibited by a magnet, there being motion in the magnetic sphere of the magnet only on the instant of making or unmaking of the magnet, or in the increasing or diminishing of its sphere by means of the connecting or unconnecting of its poles, or otherwise; but a magnet once made can exist in a perfectly static state. If this dynamic state of becoming a magnet is meant, then what nonsense to talk of iso- and hetro-dynamic power in a magnet. The motion must be in one direction, for X — X = 0; therefore, no dynamics at all.

Then, as to the consequent and inconsequent points, what are we to make of these? Really, we are at a loss; however, this point is of no consequence. But the bifurcated, trifurcated, polifurcated, and circular points, they are quite away in the clouds beyond mathematics and human reason, or, at least, our poor human reason. Clearing away all this beautiful second-hand scientific language there is something under it. These iron filing magnetic figures are, and, as we believe, have always been, of scientific use. For example, in magnetizing steel bars for permanent magnets, in what other way are we to detect faulty bars. Though the steel may be selected with the greatest care, and very carefully hardened and tempered, and they may appear to be perfectly similar, yet on being magnetized it is probable that not more than 30 per cent. will be good; at least, we have always found it so. If the fault be in defective tempering that is easily rectified, but if it be through internal flaws, iron filings only will detect these. Let the bar be magnetized and covered with a stout sheet of paper on to which sift iron filings, and if they arrange themselves round several vacant points along the bar it may be concluded that under these there is an internal flaw, and in all cases it will be found to be so on breaking the bar: such a bar is of no use for a magnet. The cracks in the bar divide it into a series of small magnets.

This is the use that these figures have been put to for many years—at least, we have used them for this purpose, and no doubt others have done the same; but latterly the principle has been put to a most valuable use in a manufacturing and engineering point of view. It has been applied to testing the soundness of manufactured iron, for the detection of internal flaws and unsound welds. For the testing of chain cables and anchors it will be invaluable, so much property and so many lives depending on their soundness. Though these may look sound and perfect externally, they may have internal flaws which will surely cause them to give way when the stress comes upon them. For testing chains and anchors experimentally, it has already been applied, and doubtless it will be soon brought into universal practice, and also for testing the material of which bridges are to be made, and also railway wheels and tyres, and, in fact, manufactured iron of every kind which is required to resist great strains or shocks.

TECHNICAL EDUCATION. — MR. WHITWORTH'S BENEFACTION.

A VERY important and highly praiseworthy and practical step has just been taken by Mr. Whitworth to further the object of scientific education. While so many have been talking, that gentleman has been doing, and has set an example well worthy of imitation by those large employers of skilled labour whose interests will be so directly and materially served by the improved education of their men. On the 18th of last month Mr. Whitworth wrote to the First Lord of the Treasury offering to found thirty scholarships of the annual value of £100 each, to be applied for the further instruction of young men, natives of the United Kingdom, selected by open competition for their intelligence and proficiency in the theory and practice of mechanics and its cognate sciences, with a view to the promotion of engineering and mechanical industry in this country. Mr. Whitworth proposes that these scholarships should be tenable on conditions to be defined by a deed of trust regulating the administration of the endowment fund during his life, and that thereafter the management of this fund, subject to the conditions specified therein, should rest in the Lord President of the Council or other Minister of Public Instruction for the time being. We have not yet the details of the exact way in which Mr. Whitworth wishes his intention to be carried out; this, of course, will be made known after a while. In the mean time, however, let those who are in a position to follow Mr. Whitworth's munificent example, give the matter their very earnest attention, and see how far the union of local and private efforts can be made to aid in the movement. Provision should undoubtedly be made in several large centres of manufacturing industry for affording to all classes opportunities for acquiring instruction in the sciences which are applicable to productive industry. To carry this out, our leading manufacturers should act in concert and follow the example of Mr. Whitworth. Their combined efforts, supplemented by State assistance, would undoubtedly have the effect of substantially promoting technical education. Whilst we conceive that it is but proper that those having the deepest interests in its results should be the initiators of the movement, we must say that Mr. Whitworth has performed one of the most munificent acts on record. Looking to the results which may be expected to flow from it, this must be regarded as one of the most useful gifts ever offered to the nation.

THOMAS'S PHOTOGRAPHIC RESEARCHES.*

MR. R. W. THOMAS, F.C.S., a well-known photographer and photographic chemist, has just published a book called "The Modern Practice of Photography." The work contains some useful information for beginners, and here and there touches upon points of interest to advanced students, a chapter upon the permanency of silver prints being perhaps the best in the book. The advice to beginners is on the whole very good, with the exception of the directions how to prepare the nitrate bath. The author recommends that the free acid in the nitrate of silver be neutralized with oxide of silver, then that the bath be rendered slightly acid; also that iodide of potassium and alcohol be added to it before use. Though, by carefully going through these operations, a good bath may be produced, it is unwise to hamper beginners or older hands with such chemical manipulations. Much the best plan is to buy perfectly pure nitrate of silver in sealed tubes, in the first instance, and then there will be no trouble from the presence of free acid. With most samples of collodion, pure nitrate of silver dissolved in distilled water, and filtered, will give good pictures at once without further doctoring. Occasionally it is necessary to add a faint trace of acid to get clean pictures at starting. In some rare instances, new baths of plain nitrate of silver have a tendency to eat away some of the iodide in the film, and the best remedy is to iodize a plate, and leave it in the bath for three or four hours, when the liquid will satisfy its appetite for iodide of silver, and not injure plates afterwards immersed. The bath is continually taking up iodide of silver and alcohol from the collodion: hence it is a bad plan to put these substances in purposely at starting, unless the eating away of the iodide renders the additions necessary. The less iodide of silver and alcohol the bath takes up, the longer will it continue in working order, and the best plan of making a bath is simply to dissolve pure triple-crystallized nitrate of silver in distilled water, working the bath thus prepared with collodion rendered a light straw colour by the addition of a drop or two of a solution of iodine in absolute alcohol. The remainder of the instructions in the book are good.

On the question of the best method of securing permanent positive photographic prints, photographers are divided into two great classes, namely, into those who recommend the abolition of silver prints altogether, and into those who, by varnishing and analogous operations, seek to make the present pictures on albumenized paper more durable. Mr. Thomas thinks good silver prints to be more permanent than is generally believed. He thinks that the present large number of fading pictures has been brought about by the excusable chemical ignorance of photographers in the early days of the art; by the present great demand for cheap prints at unremunerative prices; and by the following of a beaten track in photographic printing, instead of striking out in a more original and philosophical path. After pointing out how greater permanency in silver prints has already been secured by the adoption of alkaline toning, freshly dissolved hyposulphite of soda, and thorough washing, he says truly that "the misdeeds of a former epoch are still a thorn in the flesh, and the confidence of those who would be buyers and collectors has been decidedly shaken."

The author next criticises the latest attempts to give permanency to silver prints, by impregnating them with varnish or collodion, and says that there is little chance of photographers using varnish either of known or unknown composition, especially as all varnishes sooner or later acquire colour, to the injury of the purity of the whites of the photograph. Moreover, photographs have been varnished before the present time, yet have faded in spite of the protection. The instability and perishability of collodion make it a very unsuitable substance to protect silver prints from the action of deleterious gases, and "fallacious experiments with sulphide of ammonium have been made for the purpose of proving the superiority of collodion over varnish, and for rendering prints permanent. This test is a mere snare and a delusion; it is not possible to anticipate the effect of time on such substances." This last remark strikes at the root of the matter, for it is evident that a waterproof varnish of collodion or gum may, when freshly applied, protect a photograph from the action of destructive vapours, yet at the end of a year be useless for any such purpose. Herein lies the cause of the little practical faith evinced by photographers in the schemes recently brought before the photographic societies, to try to protect the present prints by means of varnishes.

In order to secure greater permanency than at present, Mr. Thomas suggests that prints properly taken and washed in the first instance should be passed between steel rollers before instead of after being mounted on cardboard. He says:—"Consider for a moment the state of the paper, and the arrangement of the metallic particles forming the picture. The paper has been by the various operations loosened in texture, the size made more spongy—perhaps partially dissolved out—and the precipitate of silver salt, reduced by light, is in as divided a state as it is possible to conceive. But how easy, by means of suitable pressure, to alter this condition, and, not only to restore the paper to its original compactness, but, by compression of the silver particles, bring about a change of structure which shall then more nearly represent a compact metallic layer, no longer

* "The Modern Practice of Photography." By R. W. THOMAS, F.C.S. London: Harrison, Pall Mall. 1868.

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absorbent, and easily acted upon by every deleterious breath." He then points out a few familiar illustrations of the fact, that substances in a state of fine division yield more readily to chemical action than when in a compact state. Enough pressure to produce the desired result can evidently not be applied to the photograph after it is mounted on cardboard.

The writer next recommends that the photograph shall be mounted with india-rubber in solution, and not with paste or glue, so that the pores of the paper may be filled up with an insoluble material. Lastly, he recommends that the surface of the photograph shall be waxed. He does not like the application of the numerous solutions of wax which have been recommended for the purpose, as the liquids give a flat and unctuous appearance, very disagreeable to the eye. He says that "a cerate, composed principally of oil of lavender and wax, sufficiently firm to admit of its being conveniently rubbed into the surface of the print with a suitable brush, is by far the best and most convenient preparation to use. Half a minute's application for a small picture is enough. It should be rubbed perfectly over the surface of the photograph. Sufficient may be used to leave a slight excess unabsorbed; it need not be made to penetrate beyond the layer of albumen, although it should be well rubbed in; the print is not, therefore, rendered translucent by its application. Let the photograph so prepared remain half an hour before removing the excess with a suitable rubber. Before applying the cerate take care that the photograph be thoroughly dry." A photograph so treated may be polished, when dry, by means of a tuft of cotton wool.

The foregoing directions are about the best that could possibly be given, in the present state of photographic knowledge, to secure greater permanency in the silver print, and it is not impossible that pictures so protected may last nearly a lifetime without change, though exposed daily to air and light. Nevertheless, all past experience warns us to place no trust on the stability of any silver print, where the possessor desires to secure a photograph as permanent as the writings of the monks of old, who, for the most part, employed carbon inks. The most permanent prints upon paper which photography can at present produce are those taken by the carbon process, but this process is better adapted for large than small pictures. The system of silver printing is so deeply established by time and custom, that the real remedy for fading photographs rests principally in the hands of the general public, who may secure permanent prints by creating a demand for carbon pictures, and expressing a willingness to pay for the same at higher rates. The supply will soon follow the demand.

HARBOUR WORKS IN THE NORTH.

VERY recently it has been stated, upon good authority, that the shipbuilding trade, and the numerous minor branches of industry connected with it, are migrating in a northerly direction. Business is leaving the shores of Old Father Thames to establish itself upon those of the Clyde. The causes, of what appears to be true in the main, we need not now inquire into, but if the fact is palpable, and the departure permanent, it is evident that those who are likely to suffer from the circumstance should make up their minds to go after the work, provided the work is really there for them to do. It is futile to remain in a place with the hope of obtaining employment, when that very employment has betaken itself to another locality, and more especially, when there is, at any rate, no immediate prospect of its return. Whether it is, that the more northern parts of the kingdom possess peculiar advantages with respect to site, facility for acquiring land, and obtaining material, or that for other reasons labour is cheaper and more abundant, yet it seems to be acknowledged that work can be carried on there with greater economy than in the immediate proximity of the metropolis. From early times the Clyde has always been renowned for its reputation in connection with shipbuilding and shipping matters. Some of the largest as well as fleetest vessels have received their baptism on its shores, and taken their first plunge in its waters, and but for the skill and industry of its shipwrights, our privateers would not have been so fortunate as they were during the days of legalized buccaneering.

It is but yesterday that the new Millwall Docks were opened, and as if it were with the intention of keeping pace with any new harbour or dock works here, we find that large and important additions are to be made to the existing marine accommodation upon the Firth of Clyde. The trustees of Greenock Harbour have determined upon carrying out several extensive works, which have for a long period been considered almost indispensable to the shipping interests of that port, which at present is unable to adequately provide for the reception of vessels exceeding 1,500 tons register. It is proposed to construct a couple of wet docks or tidal harbours and a large graving dock, the latter requirement being the most urgent. Its dimensions will be considerable, and if the proposed extension be ultimately carried out, it will be capable of berthing the "Great Eastern." At present, however, it is not intended that the length should be greater than 500ft., a further length of 250ft. being left to the future. The breadth at top will be 90ft., and at the level of the gates about 66ft., and the depth at the top of the blocks not less than 18ft., at high water. The new graving dock at Millwall has a length of 420ft., and a breadth of 65ft., and is not entered directly from the river, but lies to one side of one of the wet docks. In the present instance, a direct communication with the Clyde is objected to by the Greenock harbour trustees, and there is very little question that, wherever it can be done, a basin or dock should separate a graving dock from the immediate foreshore. The wet docks or tidal harbours will have a depth, at high water, of at least 25ft., and those interested in the success of the proposed undertaking have not forgotten that it is imperative to bring it into direct communication with its near neighbour the Caledonian Railway. Harbours and railways are close allies, and it is only by effecting a junction between them that a country can hope for a prosperous exchange of imports and exports.

NOTICES OF BOOKS.

AMONGST the numerous benefits conferred on patentees and inventors by the Literary Department of the Patent Office, first and foremost stands that of enabling those who require to consult the specifications to do so with comfort and convenience, and without loss of time, either in their own offices or in the Patent Office Library. This is effected by means of a series of abridgments which have been made under the able direction fo Mr. Bennet Woodcroft. In these admirable conpilations the subject-matter is classified and treated chronologically, thus enabling anyone to search through a subject continuously without having to consult each separate specification. By these abridgments the reader is at a glance placed in possession of the pith of the invention; should he wish to enter upon the details, of course he will refer to the printed specification, where he will have the matter *in extenso*. The volumes before us contain abridgments of inventions under the several heads of "Preparation and combustion of fuel;" "Raising, lowering, and weighting;" "Railways," and "Hydraulics." These books are invaluable to inventors and others to whom the "Indexes to Patents" have become indispensable, inasmuch as the indexes are now very numerous and proportionately expensive, whilst the abridgments are compact and as cheap as they can be produced. The only thing we cannot understand about them is that the volume on the preparation and combustion of fuel, which contains 1,407 pages, should be charged 17s., whilst that on hydraulics, which contains 1,440 pages, can be had for 15s. The specifications are charged for according to amount of matter and size of drawings, and we should have thought similar conditions would have governed the prices of the abridgments. Each of the volumes before us, except that on railways, has an appropriate and well-written introduction, giving an outline history of the subject it precedes. Each has also an ample index, and each should have the subject-matter noted on the back for readier reference when placed on shelves.

Mr. John Timbs' "Year Book of Facts* in Science and Art" is now so well known and appreciated, that the simple announcement of its appearance might suffice for the majority of our readers. But as there are always some to whom a little detail information is welcome, we will give them the general scope and features of the work. In the well-arranged volume before us, Mr. Timbs embodies the most important discoveries and improvements of the past year. These are culled from various sources—our own pages amongst the rest—the authority in each case being duly acknowledged. The range of subjects is very wide, embracing mechanics and the useful arts, natural philosophy, electricity, chemistry, zoology and botany, geology and mineralogy, meteorology and astronomy. The volume for this year contains an interesting memoir of Sir Samuel Baker, an excellently-engraved portrait of whom faces the title page. Notices of the Royal Albert Hall of Arts and Sciences, the Paris Exhibition, the Alexandra Palace, and the Albert Memorial in Hyde Park, are followed by a series of judiciously-selected articles on the various subjects we have enumerated. Mr. Timbs is very happy, both in his selection of subjects and condensation of matter. With such a wide field as he has to work upon, it is no easy task to make a proper choice of material. Mr. Timbs, however, succeeds well in every respect, giving a large amount of varied information, and bringing each subject within a very small compass. If anyone wishes to know what progress science has made, or what has been done in any branch of art during the past year, they have only to turn to Mr. Timbs' pages, and they are sure to obtain the required information.

Our opening remarks upon the previous book apply also to the fifth volume of "Engineering Facts and Figures"† which is now to hand. This work is similar to the last in design, although in its detail arrangement it widely differs from it. In the present instance we have strictly a record of engineering facts, indeed, the volume purports to be an annual register of progress in mechanical engineering construction. It is ably compiled from various engineering journals, and includes papers read before the scientific societies. A special feature this year is a series of useful notices of several of the departments of the Paris Exhibition, and these occupy a considerable portion of the volume before us. The value of this work consists in its entering widely into detail upon a select branch of engineering science—the mechanical—the knowledge of the previous year being gathered up and classified under the various heads to which it pertains. The illustrations this year are in advance of those of past volumes, and include a number of lithographed drawings besides wood engravings.

* "The Year Book of Facts in Science and Art." By JOHN TIMBS, F.S.A. London: Lockwood and Co. 1868.

† "Engineering Facts and Figures for 1867." London and Edinburgh: A. Fullarton and Co. 1868.

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The question of the petroleum discoveries in Italy has been made the subject of an interesting treatise,* by Mr. E. St. John Fairman. It is the result of a geological tour through Italy taken by the author in 1865, in the course of which he particularly turned his attention to petroleum. Mr. Fairman has collected a large amount of evidence which favours the prosecution of the petroleum enterprise in Italy. He has explored the petroleum zones between the south of Milan and the south of Bologna, and along the confines of Modena, and has detected the undoubted presence of petroleum. In other parts he has been equally successful, having found even the sandstone of Monte Baranzone and other mountains to be strongly impregnated with oil. With regard to the commercial value of Italian petroleum, it is to be observed that Professor Chandler, of the School of Mines, Columbia College, New York, gives the following report of its analysis:—While the Pennsylvania oils contain on the average 10 per cent. of gasolene, 10 per cent. of naphtha, and only about 75 per cent. of illuminating and lubricating oils, the Italian oils are remarkable for the entire absence of gasolene, and in many cases of naphtha, the yield of illuminating and lubricating oil reaching from 88 to 97 per cent. This is greatly to the advantage of the Italian oils, as gasolene and naphtha bring very low prices in the market. The Italian oils are also distinguished by the absence of the offensive odour which characterizes most of the American petroleum. Not one of the ten samples is disagreeable, while several of them are almost odourless, a circumstance which will tend to simplify the process of refining. The light colour of most of the samples is equally striking. In the reports of the analyses, all the oils having a density below 36deg. Baumé have been recorded as lubricating oil; the skilful refiner has it in his power to convert a great part of this into lighter illuminating oil by 'cracking' (re-distilling very slowly) it, whenever the comparative market prices of the two oils make it profitable to do so. It must not be supposed, therefore, from the analyses, that the Italian oils will not yield much illuminating oil, for, on the contrary, they possess a great advantage in their weight, which makes it possible to obtain from them an unusually large yield of either illuminating or lubricating oil at pleasure." Professor Ansted also reports very favourably of the Italian petroleum. Mr. Fairman's treatise will be found very interesting, especially to those who may be able to promote the development of the petroleum question in Italy. The author believes in the feasibility of this, and that it will yet prove to be the most fruitful source of revenue to that country.

Mr. Watts' valuable contribution to chemical literature—"The Dictionary of Chemistry"†—is fast nearing completion, parts XLII., XLIII., and XLIV. being now before us. The subjects range from the article on terbium to that on water. There is an excellent article—or, rather, a series of articles—on thallium, by Mr. Watts, in which all its compounds are fully dealt with. An article on tin, by Professor Field, is well worthy of perusal, drawings of the furnaces being given. The compounds of this metal are thoroughly considered in succeeding articles. The subject of tungsten is also exhaustively treated, and is well worthy the notice of the producers and users of iron and steel. Chemists will find much to interest them in an elaborate article, by the editor, on uric acid, no artificial method of producing which has yet been discovered. Vanadium and the vanadates—so far as they have been examined—are also considered at length by Mr. Watts, to whom too much credit cannot be given for the excellent manner in which the whole work is being brought out.

Amongst the minor productions of the press, we have before us the second annual report of the Aeronautical Society of Great Britain for 1867 (S. Richardson, Greenwich). It has been prepared by the indefatigable hon. secretary, Mr. F. W. Brearey, and contains an account of the proceedings of the Society, and a selection from the papers and communications read and received during the year. The concluding remarks bear upon the present state of aeronautical science, which is certainly defective, and which it is hoped may be improved by the forthcoming exhibition at the Crystal Palace. A warning voice is uttered by "An Engineer" to the people of England on the present crisis, in the form of a series of letters reprinted in pamphlet form from "The Engineer," by Mr. Waygood. He attributes the badness of times to exhibitions and bad legislation, and suggests remedies, discussing the subject of technical education at some length. Mr. A. W. Cunningham contributes a treatise on the history, methods, and technological importance of descriptive geometry (Edmonston and Douglas, Edinburgh). The object of the writer is to enforce the importance of study in this direction in connection with the important and all-absorbing topic of technical education. We commend this pamphlet to all who are, or who may presently be, engaged in carrying out the details of this imminent step in the right direction. Mr. Edward Thornton propounds a method of finding a square exactly equal in area to a given circle. All those of our readers who wish to prove the question with the author will do well to obtain his pamphlet from Mr. Stanford, of Charing-cross. Of course, Mr. Thornton squares the circle exactly.

It is very pleasant to turn from the harder and more abstruse points of science to its simpler phases, as depicted in "Hardwicke's Science Gossip" (Hardwicke, Piccadilly). Month by month this interesting work comes to us full of fresh wonders and pleasing facts. Its illustrations, too, are both improving and increasing, and the spirited proprietors leave "students and lovers of nature," to whom the work specially appeals, nothing to desire—except the next number. The enterprising firm of Cassell, Petter, and Galpin are bringing out a new edition of their "Popular Educator," which has been revised to the present time. It is now some twenty years since this work was first issued from the press, during which time it has enjoyed a well-merited popularity. It has rendered efficient services in the promotion of national education, and we wish it that success in the future it so thoroughly deserves. If any wish to know the aim of the work, they here have it in the words of the proprietors. In their introduction they say:—"To amuse, to instruct, to elevate, will be our constant endeavour. To render the workman more perfect in his vocation, the soldier and sailor better fitted for the higher positions of his profession, the naturalist more conversant with the beauties of Nature, the politician further acquainted with the important events in the history of his country, and to place at the command of the student for the Civil Service or University examinations all the branches of education necessary for his advancement, no effort will be wanting. Our ambition is to place in every English home an educational encyclopædia, invaluable as a manual of study and a work of reference, which, whilst simple, progressive, and interesting in its style, shall be powerful for the improvement and the advancement of its students."

To those of our readers who take an active interest in the social improvement and moral elevation of their workpeople and dependants—and who does not?—we heartily commend the popular illustrated works of Messrs. Partridge and Co., of Paternoster-row. Foremost amongst these we would place the "British Workman" and the "Band of Hope Review." These publications are marvels of cheapness, and our wonder is how such engravings—spirited and bold in conception and finished in execution—can possibly be given for the price. These papers are calculated to do, and we believe are doing, much good amongst the working classes, and we gladly recommend them to notice. We cannot conclude without noticing a plan for a central Courts of Justice palace, which has been designed by M. Vericchio. The plan is very simple in its arrangement, being nothing more than a square divided and subdivided, *ad infinitum*. But how far the design meets the requirements of the case, or how far it is compatible with the site to be covered, we leave to those who have closely and patiently studied the matter to say.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

THE EXAMINATION OF ARTIFICIAL FUELS—VELOCITY OF THE PROPAGATION OF SOUND IN TUBES—THE ANALYZATION OF NOISE.

A METHOD of examining chemically artificial fuels is described in the "Bulletin de la Société Chimique de Paris," and may be worthy the notice of some of our readers. Its object is to determine the nature of the agglomerating material which may add little or much to the heating power of the fuel, according to the nature of the substance employed. The author assumes that some sort of pitch or bituminous material will be used; but this is not the case, at all events, in all English artificial fuels. In the course of the investigation described the author first reduces a brick of the fuel to a fine powder, and exhausts a given weight with bisulphide of carbon. In this liquid all sorts of pitch and bitumen are completely soluble, and the solution carefully evaporated will give the whole amount of agglomerating material. For the information of any reader not acquainted with bisulphide of carbon, we must add that the evaporation should be carried on over a water-bath, and in a good current of air, the vapour being highly inflammable, and igniting at a comparatively low temperature. The residue left after the complete evaporation of the bisulphide having been weighed to ascertain the whole amount of the pitchy matter present, is next heated carefully to 300deg. or 400deg. Fah. Any loss of weight at this temperature will indicate the presence of the lighter coal products, and show that gas tar has been used to bind the coal-dust. If no loss of weight is found at the temperature mentioned the heat is carried to 600deg. Fah., and the loss then will be the heavier oils, and it may be inferred that a so-called "fat pitch" has been used. The above outline will serve to show the course of investigation pursued, which will give some idea of the calorific power and value of the fuel.

Kundt has made an elaborate investigation into the various circumstances which influence the velocity of the propagation of sound in tubes, the results of which may have some interest to the makers of wind instruments. He has established, in the first place, that the velocity diminishes with the diameter of the tube. The diminution, however, only becomes sensible at a given diameter, which is equal to one-fourth of the length of the wave of sound or note yielded. Above this diameter, and in all larger tubes, the velocity remains invariable. Starting with the diameter we have mentioned, Kundt finds that the diminution of the velocity of sound in tubes full of air increases with the length of the wave of sound employed. He made further the curious observation that fine powder in the interior of a large tube had no effect on the velocity of transmission, but that in tubes of small diameter the velocity decreased in proportion to the quantity of powder, and that the lighter the powder the greater was the retardation. The substance which had the greatest effect on the velocity he found to be the extremely light powder obtained by drying gelatinous silica. Lastly, the author has found that the velocity of

* "A Treatise on the Petroleum Zones of Italy." By E. ST. JOHN FAIRMAN, F.G.S., &c. London: E. and F. N Spon. 1868.]

† "A Dictionary of Chemistry and the Allied Branches of Other Sciences." By HENRY WATTS, F.C.S., &c. London: Longmans, Green, Reader, and Dyer. 1868.

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the propagation of sound in a tube is not at all influenced by the intensity of the sound, and that roughness or smoothness of the interior has no effect in either retarding or accelerating the rate of transmission.

While writing on the subject of sound, we may mention the curious instrument, invented by M. Daguin, which he calls an "analysing cornet." What we describe as noise is, of course, made up of an infinite number of notes, which it is the business of M. Daguin's instrument to disentangle and separate, as a prism analyses a ray of white light, and displays its coloured components. Full details of the instrument are yet wanting; but the one exhibited to the Academy of Sciences appears to have been in shape something like a guard's horn with a nozzle to fit into the ear, instead of a mouth-piece, and furnished with holes like a clarionet. With an instrument like this in his ear, or with one in each ear, the listener practised in the necessary fingering, may sit, and from the roaring of the cataract or howling of the storm, extract a soft melody, which is heard only by himself. Delightful, but selfish enjoyment!

THE INSTITUTION OF NAVAL ARCHITECTS.

THE annual meeting of the Institution of Naval Architects commenced on Thursday last at twelve o'clock, and concluded on Saturday. The meetings were held in the hall of the Society of Arts. In the absence, through illness, of the Right Hon. Sir J. S. Pakington, Bart., M.P., &c., President of the Institution, the chair was taken by J. D'Aguilar Samuda, Esq., M.P., treasurer. Among those present were Sir Ed. Belcher, Mr. Scott Russell, Earl Lauderdale, Dr. Woolley, Admiral Halsted, Mr. E. J. Reed, Mr. Rochussen, &c.

Mr. Merrifield, the Hon. Secretary of the Institution, then read the following report of the council:—"The council have great pleasure in congratulating the Institution on the useful work which it has done during the past and previous years. The volume of the 'Transactions' which has just been published, contains, in addition to the usual store of valuable papers and discussions, an index arranged under the names of the authors of the papers and of the gentlemen who took part in the discussion. The financial position of the Institution has received the serious attention of the council. Application has been made to her Majesty's Government for an annual grant in aid of the funds of the Institution, and although no official answer has been received it is understood that it is still under the consideration—it is hoped the favourable consideration—of the Treasury. The offices of the Institution still remain at 7, Adelphi-terrace, but the council are informed that their tenure is only temporary, in consequence of the alterations which the completion of the Thames Embankment will involve in the approaches and adjacent buildings. But due notice will be given when a removal becomes necessary. The School of Naval Architecture and Marine Engineering, at South Kensington, is still watched with great solicitude by the council. They are happy to state that it progresses favourably, and that the number of ordinary students is increasing year by year. Her Majesty's Government have not thought fit to appoint the commission of inquiry into the safety of ships, for which the council of the Institution had applied. But it is understood that an Amendment Bill for the Merchant Shipping Acts is to be submitted to Parliament this session, and the recommendations of your council will doubtless receive due consideration."

The chairman then delivered the following inaugural address:—Gentlemen,—It is a matter of duty that I feel obliged to intrude myself upon you on the present occasion. I deeply regret that you should have been prevented from having the presence of our president here to-day, and I regret it the more on account of the circumstances which have caused our disappointment. And I regret, in common with you all, that we are prevented through his absence from having the advantage of that address which he no doubt would have given, and which he on all previous occasions has so ably laid before us to guide our proceedings and to direct us in these matters. I still hope, however, from a letter which has been received from Sir John Pakington, that the Institution may not be altogether prevented from having the advantage which it has in previous years received at the hands of our president. He still in his letter expresses a hope that he will be well enough by Saturday to be among you, and I hope that you and I shall not be prevented on that occasion from having the advantage of hearing his address, and that all the shortcomings which must necessarily attend that which I would make to you to-day will be on that occasion supplied by our president. I must crave your indulgence on many points—one more especially, because as I have been asked to preside only within a few minutes of entering into the room, many of the matters which are coming before us are somewhat strange, and of course I am less intimately acquainted with them than I could have hoped to be before venturing to speak to you upon them. The first thing which calls for our especial attention is the financial position of the Institution. The financial position of the Institution, you are most of you aware, has never been in a particularly flourishing condition; but there are circumstances connected with it which leads me to hope that it is far from retrograding at the present moment. Without troubling you with any figures, I may state that the general position seems to be this—that the deficiencies which we had in 1867 were somewhat short of £200, while from the estimated financies of the present year, taken very carefully, it appears as though the receipts would very nearly, if not quite, balance the expenditure. There are expectations, which I hope will be realized also, of some advantages with regard to assistance from Government, but as those are at present only in an embryo state I think it would be well not further to refer to them.

The next matter which I have to enlarge upon to some extent is one of a very much more satisfactory and favourable character—that is, the School of Naval Architecture. Now, the School of Naval Architecture appears to be progressing very favourably. The increased number of private students this year has been five; the total number of students altogether is forty-two. The Admiralty are making some change in their arrangements for sending the pupils here, which therefore may, perhaps, if referred to the mere comparative numbers of this year and last, lead to an erroneous idea as to the advantage which is being taken of the Institution; but it will be sufficient to say that so far from that being diminished—so far from there being an under estimating of the value of the school—the Admiralty are seeking to avail themselves of it in a larger degree than previously, and that the operation which is taking place at this present moment is merely that of changing a certain number which was fixed on in the first instance, to a rateable and regular number to be supplied every year; and it is the intention of the Admiralty by this equalizing process to send ten new students, each of them to be engaged for a course of years; and, consequently, the Admiralty students at the establishment will be maintained generally or entirely at the point of thirty. The references which we have had show that a considerable number of those pupils which have left the school, and who are now in the service of the Admiralty, are giving the greatest satisfaction to their officers; and there is generally equally satisfactory information received with regard to those who go into private yards; and when, as in the present day, so much importance is attached, both by the Legislature and by the public, to the advantage of practical, or what is called "technical education," I think that this Institution may take some credit to itself for having to a very great degree pointed out the direction which that technical education should follow. Now, for my own part, if by "technical education" is to be understood that which is by a great many of its advocates understood, namely, education in a particular and a single direction for the purpose of following a special profession or trade, then I believe that technical education will entirely fail and miss its object; but if by "technical education" is to be understood that which I think we do accomplish in this Institution—namely, upon a sound education in the first instance, the superadding the opportunity of practically working at that trade or occupation which it is intended you should acquire proficiency in, then I believe that technical education is one of the highest advantages that you can give the learner. Now that is accomplished in this Institution, for I believe the Institution are fully aware that all the students at this college have the means given to them, wholly apart from the instruction which they receive in the establishment, of visiting the dockyards and working in the dockyards at the works there to be performed—the practical works—not at models or theoretical works, but at the practical works that are going on for the country, exactly the same as all the other artizans there employed. That is a point to which I would address my observations, as being, in my opinion, of such a highly important nature, namely, that of superadding to a general education nothing short of the real and absolute work which is to form the staple part of a man's life.

The next subject to which to draw your attention in the report of the council is that which has reference to the interesting subject of the safety of ships, which this Institution will recollect arose in consequence of a reference made by our president, at the previous annual meeting, to the disastrous effect that had occurred from the loss of the steamship "London," and of the admirable recommendation which followed his observations on that catastrophe of the great desirability of seeing whether the professional knowledge of this country, as concen- in this Institution, could recommend such means as would practically avoid future disastrous results. The council of the Institution met, and at very considerable length, and with a very great amount of care and attention they investigated the whole matter. Many of the members engaged in that inquiry looked at it from one point of view and some from another, but all with the same object—that of seeking, if possible, to arrive at some means by which the public could be protected against similar catastrophes. The result of the inquiry is to be found in the elaborate report which is given in the volume of "Transactions" which is now in your hands, and I think it is not too much to say that there is scarcely a paragraph in that report but what is pregnant with suggestions of the very greatest value for reflection and thought. The only thing which appears to me upon the face of this report to require consideration—and that probably, I may say, a balanced consideration—one which has considerable advantages and disadvantages—is whether, having arrived at all these recommendations, those recommendations should be allowed, on the one hand, to weigh in the minds of persons engaged in marine construction, and to guide them in such conclusions as, having the advantage of that information before them, they may come to, or whether they should be embodied by the Legislature in a stringent legal provision compelling persons to follow some particular rule that may be laid down for them. Now, I must say that I am one of those who consider that it would be a great misfortune for the country if we attempted by legislation to restrain the exercise of that amount of thought and that amount of responsibility which make, in the main, the character of all those who are engaged in any very great professional works; and, I think, therefore, that instead of being a subject to be regretted, it is, probably, one that should be looked upon from another point of view, when we find that her Majesty's Government have not up to the present moment embodied any such instructions in a legislative or an authoritative and directing form. We do infer the fact that there is to be an amended Shipping Bill. What that amended Shipping Bill contains we do not profess to know; neither do I apprehend that we at all wish to convey to you that we wish in that Shipping Bill to find an absolute and restrictive plan laid down by the Government for all constructions as rules to be followed. At any rate, I will venture to do this—to disengage myself from that observation so far as to point out my own views upon that subject. I should hope that whilst every care was taken by the Government at all times to protect the public from the possession of that which is bad, the greatest care would be taken by them to avoid that direction of construction which might lead to a very much worse result in the long run by removing the responsibility which now exists, and which in my opinion ought to exist, solely upon those professional parties who undertake the responsibility of these works.

I think, now, that having passed by our report I might be permitted perhaps just to glance at the programme which is now before us. On that programme, judging by the titles of the papers which we have to discuss, will be found, I think, some of the most interesting and some of the most important subjects that can be brought before us as naval architects. The very first one that we have to discuss may be treated, and I hope will be found to be treated—I have not myself seen the paper at all—in a way to engage the most serious attention of this Institution. I conceive that there are few things at the present time that are of more importance in the consideration of naval constructors than a proper appreciation and a proper use of what I may call the new material, steel. Of course we know that in one sense steel is no new material. In one sense it has been known from the most ancient periods of history and almost of the world. But the production of steel lately has taken such a form from that which it took formerly as to enable it to come within that compass of price that will render it an ingredient of great value in shipbuilding, and I do not think that its value is even at the present moment sufficiently appreciated. This may probably result from the fact that some

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difficulties have occurred, and may not perhaps be altogether overcome even at the present moment, in the production of it. But I do think that the advantages to be gained from steel are so great that they ought to be fully and entirely recognized, and I believe that in that, as in all similar cases, when these advantages are once fully recognized by the public, the little difficulties in the manufacture that exist at the present moment, if they have not been already overcome, will be overcome, and that the advantages of this material will tend immensely for the public good.

I may probably just be allowed to say that, so long ago as immediately after the close of the Crimean war, nine or ten years ago, I had occasion to build in steel. At that time steel was beginning to recommend itself by what was called "puddled steel." Well, puddled steel was a very doubtful description of material. The process was one which necessarily involved a great deal of risk in the production of the finished material, as time was an ingredient, which time could be measured in practice only in the working of the iron converted into this steel. In fact, I should say that I had tried puddled steel, seeing the great advantages that were to be obtained by using a lighter material with a very much greater amount of strength for its comparative weight; and I had found these difficulties attending puddled steel, namely, a want of uniformity in its texture and strength. But having had my attention directed to it, I went at once to what I conceive to be the only way of dealing with a case where the absence of weight was absolutely necessary—that is to say, where steel could be used which could be absolutely relied upon for its strength; and I had to pay for the steel which I used in a sea-going vessel which I then constructed £50 a ton. But the whole of the steel was cast steel, manufactured by the usual process in which the ordinary cast steel bars are manufactured in little charcoal pots, and it could not be produced at that time for a smaller sum. It is a satisfactory thing to know that though that price would have put the use of the material completely out of the range of all commercial persons for ordinary purposes, the vessel then constructed (a vessel of 500 tons) has been working from that time to the present in a very rough sea—that is to say, the Black Sea; and there was not a single plate in this vessel of 500 tons greater in thickness than 3-16in. I have most accurate reports of the state and condition of the material in that vessel at the present time; and if these reports are true (and I have every reason to believe them to be accurate), the vessel is as perfect now as it was at the time it left England. Well, the introduction of the different processes which have been devised—Bessemer's process, for instance—has so materially reduced the price of this material that you are able to get an equally good material for £20 a ton with that for which I then had to pay £50. Now, this material which at this present moment you get at £20 a ton may generally and roughly be compared with iron in this way—that its general tensile strength may be taken to be at least twice as great. One may be taken as 40 tons to the inch, whilst the other may be taken at 20 tons to the inch. And the ductility of the steel, when properly produced, is very much greater than that of the iron. Therefore, you really have this great advantage laid before the constructor for his consideration—and it is in this view especially that it interests us as naval architects—that after you have made all allowances—and I put this suggestion to prevent you from jumping too quickly to the conclusion that you can in all circumstances adopt it—after you have made due allowances for the difficulty of obtaining uniform perfection throughout this steel, you have a field open before you to encourage the steel manufacturer to produce perfection with the knowledge that if he does so he can relieve the vessel by one-half of the weight of the iron put into it, and thus he can enable you as a commercial man to utilize the difference of weight by the carriage of extra cargo. Or, if your object be speed, he can enable you to attain the same rate of speed with a lower amount of power, or, what is equivalent, a much higher speed with the same amount of power. Therefore, any paper which brings before us the importance of steel is of vast importance to the "Transactions" of this Institution.

The next subject which we have upon our paper is also one of very great importance. It seems that the general subject which we have to discuss on these occasions is, in one shape or another, the further development of the construction of ships of war. This has always been since the time of its birth—now some ten or twelve years ago—a subject of great importance, and one which is far from flagging in its interest. I think the general admission will be that it is one which grows daily in importance, and daily attracts more and more attention, particularly of those engaged in marine operations. I should hope that these papers that we have before us, attached to which I see names which are an earnest that they will convey to us most valuable information, will not only repay us the opportunity and the time that we shall devote to listening to them, but will very considerably add to the general knowledge on this important subject. Finally, gentlemen, I hope I may be excused for having kept you so long in dealing with those subjects, and I hope that you will further excuse what I feel bound at the present opportunity to tell you, which is, that not having been aware that I was going to be asked to fill the honourable position in which I find myself this morning, I had made those engagements which I now find it absolutely impossible to avoid; in fact, they are connected with parliamentary duties—and, therefore, after the reading of the first paper I shall be obliged to crave your indulgence to allow me to retire; but I have an opportunity of saying that on this occasion Lord Lauderdale has kindly consented to take the chair for the remainder of your meeting.

INSTITUTE OF CIVIL ENGINEERS.

AT the meeting of the Institution of Civil Engineers, held March 31, 1868, Mr. C. H. Gregory, President, in the chair. The paper read was on the City Terminus Extension of the Charing Cross Railway, by Mr. John Wolfe Barry, M. Inst. C.E.

This line was authorized by Act of Parliament, dated June 28, 1861, and the works comprised (1) a bridge over the river Thames, (2) the Cannon-street Station, and (3) viaducts south of the river, for connecting the bridge over the Thames with the main line of the Charing Cross Railway.

The bridge over the Thames had been constructed to carry five lines of way from the south abutment to the pier next to the Middlesex shore, at which point the five lines branched out, and were connected with nine lines of way in the station. There were two footpaths, one on each side of the bridge, intended for the use of the public on payment of a small toll, but they had not yet been opened for traffic. The extreme length of the bridge between the abutments was 706ft. This length was divided into five spans, the two side openings being each 125ft., and the three centre openings being each 136ft. in the clear on the centre line. The width of the straight portion of the bridge outside the footway parapets was 80ft., and the width of the railway portion between the inside parapets was 61ft. 8in. The fan, which extended over the Middlesex opening, was widened out to 202ft. at the abutment, and accommodated, in addition to the lines of way, portions of two passenger platforms, engine sidings, foreman's offices, &c. The height of the soffit of the bridge above Trinity high-water level varied from 24ft. 8in. at the abutments to 25ft. 4in. in the centre span. The object of this arrangement was to prevent the bridge appearing depressed at the centre. The height of the rails above the soffit of the bridge was 9ft. 10in.

The southern abutment was built on cast-iron caissons, sunk side by side, partly by means of divers working in helmets, and partly by dredging inside the caissons with a bag and spoon dredger. In the case of the north abutment, neither caissons nor cofferdams were used; short lengths of ground were excavated at low water, a small "stank" dam of clay was employed, and the water being pumped out as the tide ebbed, the excavation was continued and the footings were got in. The piers were each formed of four cast-iron cylinders, placed in a line at right angles to the longitudinal axis of the bridge, and connected by two wrought-iron transverse girders at the top. The outside diameter of the cylinders was 18ft. below and 12ft. above the bed of the river; a conical reducing ring being introduced to effect the junction between the two diameters. The cylinder plates were fluted from 5ft. below Trinity high-water mark up to the level of the ornamental cap mouldings. In sinking the cylinders, the bed of the river was first smoothed by dredging; then the two bottom rings, together 13½ft. in height, which was equivalent to the greatest depth of water at low tide, were put together on timbers, between strong timber guides, exactly over their destined position. This portion of the cylinder was next raised by a travelling crane so as to permit the removal of the supporting timbers, and was afterwards lowered into position. A third ring of plates was then added, and a bag and spoon dredger was employed inside the cylinder, to take out the mud and gravel As the cylinder descended additional rings were bolted on until the London clay was reached, when the sinking was continued by ordinary excavation until the final depth was attained, which was from 59ft. to 65½ft. below Trinity high-water mark.

The cylinders were filled with Portland cement concrete up to the level of the bottom of the reducing ring, and on this, brickwork, also in Portland cement, was carefully built for the full height of each column, being capped with large bed stones 2ft. thick. Each of the cylinders was weighted at the testing line with 850 tons of iron. This weight was calculated to represent the dead weight of the structure above that line, a rolling load of one ton per lineal foot for each line of way supported by the cylinder, and a moving load on the footpaths. The order to remove the load was not given until it was ascertained that no subsidence had taken place for seven days. The greatest subsidence under the full test load was 2⅜in., and the least ⅛in. The heaviest weight on the London clay at the bottom of any of the cylinders was 5·84 tons per superficial foot, with a rolling load as stated; and the heaviest weight on the brickwork in the cylinders was about nine tons per superficial foot.

The particulars were next given in detail of the bed-plate girders, of the outside main girders, and of the intermediate main girders. The girders for the two side openings were independent of the other spans, but those for the three centre spans were continuous over the three openings. The flooring of the bridge was composed of flat plates of wrought iron ½in. thick, which were riveted to the top flanges of the main girders, and were further strengthened by angle or T irons; for as the floor of the bridge formed the station yard, and was occupied by cross roads, as well as by the through lines, it was necessary that it should be capable of carrying the rolling load in any direction. Upon the flooring plates asphalte was laid, which was covered with an average thickness of 5in. of ashes, as ballast, and on this the ordinary permanent way was placed.

The piers of the bridge, from the bottom of the cylinders to the bed-plate girder, contained in all about 2,500 tons of cast and wrought iron. The superstructure contained about 4,200 tons of wrought iron in girders, floor-plates, &c., and about 1,100 tons of ornamental castings. The cost of the Cannon-street Bridge, including the abutments, signal bridge, and all things connected with the work, with the exception of the permanent way, signals and signal apparatus, gas and water mains, amounted to £193,000. This sum gave £2 15s. as the cost per superficial foot, and £250 per lineal foot, or £50 per lineal foot for each line of way, including the fan and footpaths.

The length of ground occupied by the Cannon-street Station, between the river Thames and Cannon-street, was 855ft., distributed as follows:—The forecourt was 90ft. wide, the booking-offices were 85ft. wide, and the length of the covered portion of the station south of the booking-offices was 680ft. The width of the station outside the walls was 202ft., and inside the walls, at the platform level, it was 187ft. The whole of the station was built on a substructure of brick piers and arches, excepting the booking-offices and the part which was over Upper Thames-street. At the crossing of this street, which passed underneath the station at about midway of its length, wrought-iron girders were used. Openings were left in all the piers, to allow tramways to be worked throughout the basement if necessary; and provision had been made in the arches for an hydraulic lift to raise and lower the waggons. The cross openings north of Upper Thames-street were mostly carried up through the springing of the large arch, and were groined into it. The groining, which was 27in. thick, was built in Portland cement, and the keystone was of Bramley Fall. It was adopted in consequence of the height of the ground not allowing communication between the different main archways, by transverse arches below the springing of the large arch. Without intercommunication the value of the vaults would have been commercially much diminished, and they would not have been available, as they were now, for parcels offices, stores, and railway purposes. The station walls were almost entirely of brickwork in mortar—the only exceptions being the arch over Upper Thames-street, and a few courses at the top of the walls, which were laid in cement.

The main trusses of the roof consisted of segmental ribs with a tie-bar looped up. The clear span of the trusses was 190ft. 4in. The rise of the rib at the centre was 60ft., and the rise of the tie-bar was 30ft. The truss was, therefore, 30ft. de

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at the centre. The particulars of the different members were then given in detail. The ordinary distance from centre to centre of the trusses was 33ft. 6in., being the same as the distance between the centres of the piers of the substructure. In crossing Upper Thames-street, however, the distance apart was increased to 35ft. 1½in., in order to suit the abutments of the bridge over that street. The weight of a single truss was 47¼ tons. The parts of the roof not glazed were covered partly with zinc and partly with slating. A lantern, 22ft. wide, extending nearly the whole length of the roof was glazed on the top, and had the sides fitted with louvres, which afforded means of ventilation. Two movable timber stages, designed by Mr. J. Phillips (Assoc. Inst. C.E.), were used in the erection of the roof. One was as high as the top of the segmental ribs, and was employed in the erection of the trusses; the other was smaller, being low enough to pass under the tie-bar, and was used for painting, glazing, and finishing. The cost of the roof of the Cannon-street Station had amounted to £49 10s. per square of 100 superficial feet of area covered, measured between the walls. The cost of the roof of the Charing Cross Station was £39 per square. In both instances the price of iron was high, the contract price for wrought iron in place in the roof being £24 5s. per ton.

The booking offices, waiting rooms, refreshment rooms, &c., were at the north end, at right angles to the lines of way, and were chiefly situated on the ground floor of the building which, above and below them, formed the City Terminus Hotel. The parcels offices, stores, cellarage, &c., were in the basement of the station, access from the rail level being given by means of stairs; while hydraulic lifts were provided for raising and lowering the parcel trollies. There were nine lines of way in the station, of which eight lines were alongside platforms, one line being set apart for spare stock and standing room. The eastern and western platforms were each 13½ft. wide at the centre, the general departure platform was 19ft. wide, and the general arrival platforms were 12½ft. wide opposite the cab road, and about 30ft. wide beyond. The principle of having a line of railway on each side of the platform, instead of a platform on each side of a line, was believed to be the most economical in space, and, relative to the space occupied, the most economical in working. The area of the platforms which were alongside trains was 43,877 superficial feet, and the length of the trains accommodated was 4,778 lineal feet, giving about 9 superficial feet of platform for each lineal foot of train.

The station-yard and signals were then described; and it was stated that the arrangement adopted was, that every line should approach every platform without back-shunting, excepting only the platform on the western side, which was to a great extent devoted to the short traffic to and from Charing Cross. This principle had been carried out by means of about forty pairs of points. The signal-box was 42ft. long by 9ft. wide; there were four posts, with twenty-four semaphore arms, eight arms being for "out" trains, and sixteen for "in" trains. The signal-box contained sixty-seven levers, of which thirty-seven worked signals, and thirty worked points. The signals locked the points and each other, so that no contradictory signals could be given; nor could the permission for ingress to or egress from any platform be given, until the points were arranged in accordance with the signal for that particular platform. An idea of the duty performed by this apparatus, which was erected by Messrs. Saxby and Farmer, might be formed from the fact, that seven hundred and seventy-five trains have passed under the signal bridge in a single working day. One morning, lately, thirty-five trains were signalled and passed in or out of the station in thirty-five minutes. Mr. Walker's electric telegraph apparatus, which worked a miniature semaphore distance-signal in each box, was used for signalling the trains on the block system.

The cost of the works of the City Terminus Extension was £505,336, and of the whole Charing Cross Railway, including the extension, £1,160,118, or including land, somewhat more than three millions sterling. In this sum, it was to be remembered, were included about 4½ miles of railway for a double line, two large bridges over the Thames, a considerable number of expensive street bridges, and two of the most extensive metropolitan termini. The importance of the traffic, which was not at present fully developed, might be gathered from the fact that, during the year ending January 1, 1868, being the first year since the City Terminus Extension Railway was opened, about eight million passengers used the Cannon-street Station, of which number about three million and a-half were local passengers between Cannon-street and Charing Cross. At the present time about twenty-six thousand passengers used the Cannon-street Station daily, and the South Eastern Railway now conveyed about fifteen million passengers annually.

RAILWAY BRIDGE AT ST. LOUIS.

SOME particulars of the Railway Bridge at St. Louis are afforded by a correspondent of the "New York Tribune." He states that the bridge will cross the Mississippi from near the foot of Washington Avenue to the dyke on the Illinois shore. The breadth and central position of Washington Avenue, the narrowness of the river at this point, and height of the banks, give this locality the highest advantage of situation. The distance between the extreme piers will be 1,584ft., but the length of the bridge, including the stone approaches, will be about 3,700ft. The bridge will cross the river on three arches. The central span will be 515ft. between abutments, and the other two 497ft. each. The piers will rest upon the solid rock which underlies the bed of the river. No other foundation would be secure against the action of the currents. Of the two central piers, one will be 170ft. high, and the other 195ft. At the base the piers will be about 100ft. by 50ft.; at the spring of the arches, 87¼ft. by 37¼ft.; and at the top, 75ft. by 25ft. The piers will be faced with Eastern granite. The erection of these piers will be a vast and arduous work. To construct immense coffer-dams in the middle of a rapid and powerful stream, to excavate the earth at the bed of the river to the depth of 60ft. or 80ft., and to build towers of solid masonry nearly 200ft. high, will test the utmost resources of modern engineering. The stone for the construction of the piers will be procured from the quarries at Grafton, Illinois. These quarries lie on the bank of the Mississippi, forty miles above St. Louis. A contract has been made for about 200,000 tons of stone. The material is a compact and durable limestone. The superstructure will be supported by ribbed arches of cast steel. Each span will be composed of four arches, placed side by side with a lateral interval of 12 ft. between the arches. Each arch will consist of two steel ribs, one above the other, with a vertical distance of 7ft. between them. Both arches and ribs will be strengthened with diagonal brackets of wrought iron and crucible cast steel. The height from the spring line to the crown of the central arch will be 51½ft., and the height of the other two arches will be 47 5-6ft. The width of the superstructure will be 52ft., from railing to railing 50ft. On each side of the bridge there will be a raised footway 7ft. wide. A Nicholson pavement, 36ft. in width, will afford ample room for cariages, and a double track for street cars will furnish passengers with additional facilities for crossing.

The railway bridge will be directly underneath the carriage way. Its distance from the upper works, to which it will be attached, will be 16ft. Two double tracks, each having a double gauge of 6ft. and 4ft. 8½in., will accommodate all the railways that converge at this point. The weight of the bridge will be three tons per lineal foot, and its capacity of sustaining burdens four tons per foot. The bridge will be 50ft. above high water; but at the ordinary stage of the river it will be from 60ft. to 75ft. above the water. The City Directrix very nearly corresponds with the curbstone at the corner of the Levee and Market-street. In 1844, the river rose 7·58ft. above the Directrix, and in 1863 it fell 33·81ft. below the Directrix. This is the extreme range of high and low water. The ordinary difference of level is less than one-half of this amount. The bridge will cross each Levee on five stone arches, each having a span of 28ft. On each side of the river there will be at the outward end of the stone-work a spacious and elegant toll-house, containing the offices of the company. On the west side of the bridge the railway will enter a tunnel at Third-street, extend under Washington Avenue as far as Ninth-street, then curving broadly to Olive-street, pass along under Eleventh-street till it emerges in the bed of the old Chouteau Pond. On this spot it is proposed to erect a grand central station for all the railways that intersect or terminate at this point. The average height of the tunnel will be 20ft., its width 24ft. and its length about 5,000ft. The mean depth of the tunnel below the surface will be about 25ft., and the height of the base above the Directrix 33ft. Two tracks of rails will be laid in the tunnel. The estimated cost of the bridge and its approaches, including incidental expenses, is:—

	Dollars.
Arches	1,665,039.00
Piers and abutments	1,387,163.60
Approaches	457,568.00
Tunnel	668,292.00
Land damages	705,736.00
Ten per cent. for contingencies	488,439.86
Total	5,372,838.86

These were the original estimates. Later changes in the plan of the structure will probably reduce the aggregate to 5,000,000 dollars. The officers of the St. Louis and Illinois Bridge Company are:—Charles K. Dickson, President; Barton Bates, Vice President; James B. Eads, Chief Engineer; John A. Dillon, Secretary. Board of Directors—Charles K. Dickson, James B. Eads, Wm. Taussig, Thomas A. Scott, Amos Cotting, Barton Bates, Josiah Fogg, John R. Lionberger.

The company act under special charters granted by the States of Missouri and Illinois. Their franchises are liberal and ample. The members of the company are men of character and wealth. They are in earnest in this undertaking. They mean to push it forward to an early consummation. The time allotted for completion of the bridge is three years. The initial labour is already begun. The coffer-dam for the western pier is finished, and the excavations for the foundation are far advanced. New York, Philadelphia and Baltimore are deeply interested in the success of this undertaking. The great trunk lines of travel will cross the continent on the parallel of St. Louis. Economy of time is the supreme demand of commerce. The shortest distance and the least obstruction are the conditions which will determine the route of the highway to the Pacific. A straight line from Philadelphia to San Francisco passes very near St. Louis. In the mild climate of this southern latitude, the snow which barricades the northern routes will oppose no serious obstacle. The constantly increasing, and almost insuperable difficulties which would attend such an undertaking at any point lower on the river, render it extremely probable that no bridge will ever cross the Mississippi below St. Louis. Hence the great cities of the Atlantic frontier should be virtually interested in the erection of a bridge which, lying virtually upon their own parallel, and at the lowest available point on the Mississippi, will afford them the most direct, least obstructed, and only unbroken southern route to the Pacific.

IMPROVEMENT IN NAUTICAL COMPASSES.

THE prevention of oscillation in compasses and magnetic needles on board ship in heavy seas forms the subject of a patent lately taken out by M. Pierre Laurent, of St. Nazaire, late of the Imperial Marine. His invention can also be applied to render magnetic needles or compass cards more sensitive when sluggish. That which characterizes the present invention, and distinguishes it from all others having the same object, is that the stability of magnetic needles and compass cards is obtained by loading them with weights placed as far as possible from the point of suspension, and that, on the other hand, more sensitiveness is obtained by loading the compass cards or needles with weights as near the centre as possible. Carrying out this principle, M. Laurent has devised the following methods. To give more stability to compass cards, or magnetic needles, he diminishes as much as possible the weight at the part adjoining the point of suspension, either by thinning the needles at this part, or by changing their form by making the cap lighter, and diminishing the weight of the central part of the compass card, or by suppressing this central part, and increasing the weight near the circumference by giving to the extremities of the needle or needles an enlarged form, and, if necessary, by adding near the extremity of the needles an additional weight, such as a piece of metal, or a ring of metal on which the card is fastened. To render the needles or cards more sensitive, M. Laurent diminishes as much as possible the weight at the parts most distant from the point of suspension by thinning the needles at their extremities, and increases the weight near the point of suspension by enlarging the needles at this part by increasing the weight of the cap, and, if necessary, by the addition of pieces of metal.

The foregoing are the principal modes by which compass cards or magnetic needles are rendered more sensitive, or more steady, but for rendering steady a needle, or a set of needles, or a compass card already constructed, the following methods are adopted:—Suppose, for example, that it is required to render a compass card, or a set of magnetic bars or needles more steady, weights are placed on opposite sides of and as far as possible from the point of suspension, care being taken to place the weights equally, so as to maintain the horizontal position. The heavier these weights (which are termed inertia weights), the more steady will be the card or needle; the farther these inertia weights are placed from the point of suspension the greater the stability, from which it follows that the degree of stability of the cards and needles is regulated according to the requirements of the weather and the sea. When, on the contrary, the inactivity or sluggishness of the compass card or needles necessitates an increase of sensitiveness, it is obtained by weighting the card or needles as near as possible to the point of suspension. Thus, to increase the stability of a compass card, or a magnetic needle, or a set of magnetic needles, they are weighted as far as possible from the point of suspension to increase the momentum of inertia, while, for increasing their sensitiveness, they are weighted as near as possible to the point of suspen-

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sion to diminish the momentum of inertia. The weights are of a form to suit the arrangements of the instrument, and they are made of any substance which does not possess magnetic properties to influence the compass card or needle.

A NEW ANÆSTHETIC.

SCIENCE, like history, seems to revolve in circles. The fertile idea of efficient anæsthesia in surgical operations, which has been so pregnant with blessings to mankind, was thrown out by Sir Humphrey Davy in experimenting with protoxide of nitrogen—laughing gas. The American dentist, Wells, actually applied it in practice without encouraging success; his partner, Morton, pursuing the research, was led to the use of sulphuric ether, and became, in fact, the great discoverer of practical anæsthesia, and the benefactor of his race. The desision adverse to the use of protoxide of nitrogen gas seems, at least, to have been hasty, for the "British Medical Journal" states that Dr. Thomas W. Evans, of Paris, has just given a series of demonstrations of its use at the Dental Hospital of London, and at the Central London Ophthalmic Hospital, to crowded circles of dentists and surgeons, and has produced results hitherto unknown here. Given by his and Colton's method, the period required to produce unconsciousness has been less than 45sec.; the operations have been harmless, the sensations of the patient agreeable, and there has been no struggling or distress. The recovery has been almost instantaneous, and without headache, giddiness, sickness, or prostration, such as so frequently followed chloroform. In fact, in many instances, three minutes after the patient has expressed a willingness to submit to operation he has been standing chatting gaily by the chair, the tooth having meantime been painlessly extracted, and he having passed through a period of total unconsciousness without any disagreeable sensations. But it has yet to be shown how far the unconsciousness can be protracted, as is necessary for prolonged surgical operations. And great caution must be enjoined in using this agent, even by Dr. Evans's method, until we have more of our own experience to guide us. But taken with all qualifications, the results are very surprising, deeply interesting, and of great promise as supplying that important desideratum—a painless and rapid anæsthetic suited for those who have to pass under the hands of the dentist, and for the quicker operations of surgery, and of which the effects are entirely transient.

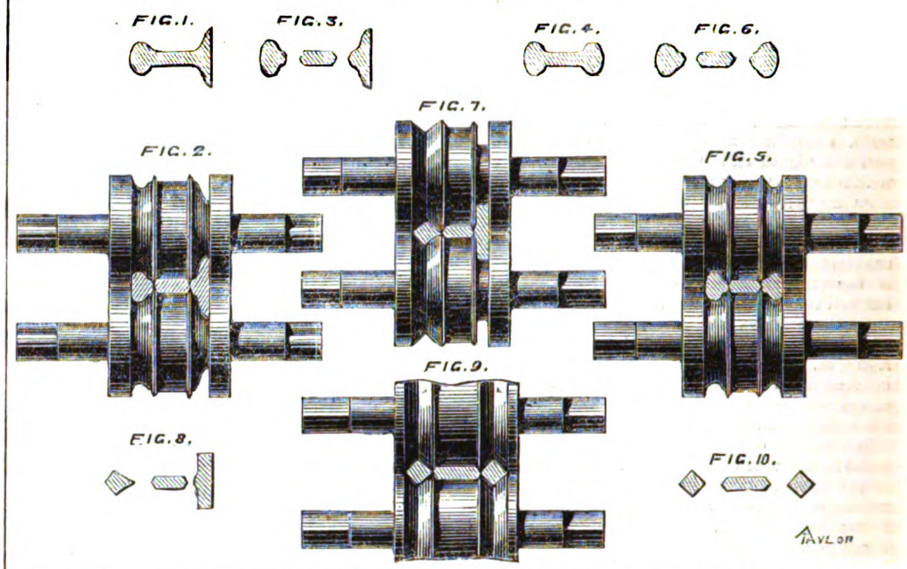
THE LIME LIGHT.

THE arrangements for supplying Perth Barracks with the lime light are being rapidly proceeded with, and before long we hope to see it demonstrated there that this beautiful illumination is as applicable on private buildings, and in a small way, as it has hitherto proved to be on an extended scale. Its principle is exactly the same as that known as the "Drummond light," but some slight improvements have recently been introduced into its working. Three substances are concerned in the production of the light—viz., two gases, oxygen and hydrogen, and a solid—lime. The "London Scotsman" states the mode in which these are used to be as follows:—A jet of hydrogen being lighted, a jet of oxygen is turned on so as to mix with it, and the solid incombustible lime being so arranged as to be exposed to the intense heat, it emits a light so pure and so powerful, that it is only rivalled by that of the sun. The method of using and lighting the jet is precisely the same as with a common gas burner; so that no special knowledge or instruction is requisite for its management. Where the consumption of the lime light gases does not exceed 1½ft. per hour, the light produced is equal to four gaslights, each burning 5ft. per hour. Three feet per hour give a light equal to fifteen gaslights, each burning 5ft. per hour. Six feet per hour give a light equal to sixty gaslights, so that 6ft. are equal to 300ft. of gas. The two gases may be easily produced, and a very small main would be sufficient to convey them through the streets for the lighting of dwelling-houses, a purpose for which this light is singularly well fitted, as its products of combustion are quite innoxious, and have no tarnishing effects. Another advantage is, that it exercises no changing influence on colours, every tint being as distinctly observable by its assistance as in the light of the sun. Various towns in Scotland are adopting the light, and if, as will doubtless be the case, the experiment at Perth proves satisfactory, it is expected that the lime light will gradually supersede the use of gas.

THE Newspaper Press Fund dinner will take place this year on Saturday, the 6th of June, at Willis's Rooms, under the presidency of the Duke of Cambridge, and the arrangements which are being made by the committee for the occasion lead to the belief that the forthcoming festival will present as great an attraction and prove as successful as any of the previous anniversaries.

MACHINE FOR CUTTING UP RAILS.

BY MESSRS. MARTIN AND DYSON.



MACHINE FOR UTILIZING BESSEMER STEEL RAIL ENDS.

THE question has often being asked, what is to be done with all the Bessemer steel rail ends. This has never been satisfactorily answered, but many attempts have been made to work them up, such as cutting the flange rail end up for scrap entirely or cutting the top off with ordinary shears, rolling it into rods or wire, and leaving the remaining two-thirds for scrap, or cutting the projecting flange off level with the head and then rolling it in the ordinary way into rods, or perhaps more generally into sheets, the same as double-headed rail ends are done. But there has always been great difficulty attached to these methods, and they have failed to produce good rods without an enormous amount of waste. We have, however, to notice a patent which has just been granted to Messrs. S. Martin, jun., and Company, of Sheffield, in conjunction with the Messrs. Dyson, also of Sheffield, by which the above expensive and objectionable processes are dispensed with. In the new plan, either a flanged or a double headed rail or rail end is cut by circular cutters longitudinally at two given points, viz., at each side of the web, and thus three bars are obtained composed of the head, the web, and the flange bottom or the second head. Each of these pieces can be rolled at the same time that they are cut into pieces, bars, or rods by any ordinary machinery. By the above method it will be seen that a great saving is effected in the amount of scrap made, because it often happens that a rail end is unsound on one side only, and by the old process the whole would have to be cut up into scrap, but by this patent it will be seen that this defect would only render one-third of the rail end useless, inasmuch as a good head and web would be obtained from it.

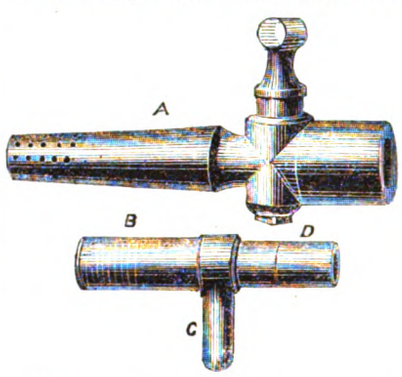
The circular cutters can be made from chilled metal and turned up to the desired shape, as shown in our engraving, or they may be formed by wrought-iron shafts with collars and steel cutters bolted thereto, and regulated by markers to suit any section of rail ends. A large quantity of rail ends have already been used up by this process with very satisfactory results, inasmuch as the patentees declare that a saving of at least 25s. per ton is effected over and above the old processes, and we need not remind our readers that in these times of competition this is a consideration.

In our engraving, fig. 1 represents a single-headed or flat-bottomed rail, and fig. 2 represents the same after if has been cut by the cutters shown in fig. 3. Fig. 4 represents a double-headed rail, and fig. 5 represents the same after it has been cut by the cutters shown in fig. 6. In some cases the cutters or rolls are made of such form that they roll the head or the bottom, or both the head and the bottom, into square and flat bars at the same time that they slit or cut the rails. Fig. 7 represents a pair of rolls or cutters which will cut and roll the single-headed rail shown in fig. 1 into the form represented in fig. 8; and fig. 9 represents a pair of rolls or cutters which will cut and roll the double-headed rail shown in fig. 4 into the form represented in fig. 10. The cutters or rollers are, of course, driven by any convenient arrangement.

A GENERAL meeting of the members of the British Horological Institute, for the election of a trustee, in place of the late Mr. Valentine Knight, will be held on the 21st inst., at the Institute, 35, Northampton-square, E.C., at 8.30 p.m.

SELF-ADJUSTING TAPPING COCK.

THE ordinary method of connecting the pipe leading to the beer engine with the newly-tapped barrel is by means of a screwed collar and washer. Publicans well know this to be a very inefficient joint, occupying time to make, and often being attended with leakage. We are, however, glad to tell them that a very simple remedy has been devised by Mr. B. Haynes, of No. 90, Broadwall, Blackfriars. This invention, which Mr. Haynes has patented, consists in the self-adjusting tapping cock shown in our engraving. In this apparatus Mr. Haynes takes advantage of the cohesion of two closely-fitting surfaces. The cock is made in two parts, A and B. The part A is, of course, tapped into the cask, the part B is then placed in the mouth of the cock,



in which it is instantly fixed by a smart blow from a hammer on the stud C, which is cast with it. The inner surface of the mouth of the cock A being carefully bored, and the outer surface of the piece B being turned, an accurate fit is obtained, and no pulling force will part them when once set. A tap from the hammer, however, immediately separates them, and the pipe, which is soldered on at D, is readily transferred to another cask. Mr. Haynes has had this tap in use for some time, and it proves a great success. In fact, it is such a decided improvement upon the old method of tapping, that we cannot expect otherwise than that it will come into general use.

THE fifth exhibition of the Society of the Friends of Art, of Pau, is now open, and will remain so until the 27th of April. Considering the remoteness of this fashionable resort in the Pyrenees, the number of works exhibited is very large, namely:—361 pictures and drawings, and twenty-one pieces of sculpture, the latter including a charming statuette, entitled "Concordia," and a bust of Richard Cobden, by a well-known sculptor, M. Megret. Twenty-two works have already been purchased by amateurs, but the selections of the Society itself are not yet made; the Museum of Pau and the English Club there are also expected to be purchasers. Altogether, this exhibition promises excellent results.

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SOCIETY OF ENGINEERS.

AT a meeting of the Society of Engineers, held April 6, Mr. Baldwin Latham, president, in the chair, the following practical paper on the Redhill sewerage works, was read by Mr. Sydney A. Reade, M.A., C.E.

These works were designed and carried out by Mr. Baldwin Latham, C.E., president of the Society of Engineers, for the Town Council of the borough of Reigate, the author being appointed by Mr. Latham as resident engineer of the works. The first contract for the works has just been completed by Mr. Joseph Brown, of Croydon, under the author's supervision; and it is now proposed to bring before the notice of the Society of Engineers the general character of these works, as regards both their design and execution, in the hope that, as the subject of sanitary engineering has been this year presented for their consideration by the president of the Society in his inaugural address, a brief and plain account of what may be called a particular case of this branch of the profession may not prove uninteresting to some of the members; he will also venture to make such general remarks on the subject as seem to him to arise out of this particular case.

The town of Redhill, in the county of Surrey, is about twenty miles south of London, and must be well known to all travellers on the Brighton and South-Eastern Railways, it being the junction of these two main lines together with the branch of the South Eastern, which runs westward to Reading; it forms part of the foreign of Reigate, and is governed by the mayor and corporation of that borough, who, having adopted the Local Government Act a few years ago, soon turned their attention to the sanitary improvement of this rapidly increasing village, and took measures to provide for its complete main drainage, and a profitable disposal of its sewage. The town is situated at the junction of two valley lines at right angles to each other, one running (approximately) north and south, the other east and west. A stream runs through the former, falling southward at the rate of about 8ft. to 10ft. per mile, and as the latter rises considerably westward, the surface drainage of that part of the town has a rapid fall towards the stream, which sometimes occasions the flooding of a large area on each side during the winter months.

The geological strata of the whole of the drainage area included in the present scheme belongs to the lower green-sand formation, underlying, however, in the river valley a deposit of peat of variable thickness, reaching in some places to a depth of 15ft. and upwards; this, as may be imagined, forms a perfect quagmire in wet seasons, and even at the driest time of the year is in a state of complete saturation at a small depth from the surface. About seventeen or eighteen years ago the road from London to Brighton was carried through this bog, the foundation being formed of faggots and brushwood, and the portion of this road nearest to the railway station was chosen as the "high street" of the future town, without regard being paid to the probable difficulties of drainage, health of the inhabitants, or even stability of the houses, which are all built on the surface, in most cases, without any kind of foundation, the town hall excepted, which is built on piles. Such being the position of the town the course that must necessarily be taken by the outfall sewer, which is to effect its drainage, is obviously determined by the direction of this lower valley line. It is kept nearly parallel to the stream, and empties itself into it at the temporary outfall, which will hereafter be abolished and the main sewer carried on to the proposed irrigation fields. This land forms part of Earlswood Common, and is situated about $1\frac{3}{4}$ mile south of the town, and at a level sufficiently low to allow a fall of about 1 in 600 to be given to the outfall sewer. The area over which it is proposed to send the sewage contains sixty-three acres, and the area of supply contains about 500 acres, on which there are now but 750 houses, and a population of 4,500. As this would only be seventy-one individuals for each acre of irrigation land it is probable the whole of the sixty-three acres will not be laid down at first, but the area gradually extended as the population increases.

The Lord of the Manor (Earl Somers) has agreed, with the consent of the copyholders, to give up this part of the common to the Board of Health gratis, on the condition of their purchasing sixteen acres of land on a higher level, to be kept as a recreation ground for the inhabitants of Redhill: the Corporation have arranged to purchase this land for the sum of £4,000. They will thus obtain seventy-nine acres for that sum, or at the rate of £50 per acre, which is less than 1-6th of the value of average land in the neighbourhood. The common at the surface is stiff clay, not more than from 4ft. to 8ft. deep, overlying the sand before alluded to, but not containing any admixture of sand; part of this clay is used for brickmaking, and the author found the bricks produced from it of very superior quality. The south side of this ground slopes gently towards the south, the north side is nearly flat; it will probably be laid down for irrigation on both pane and gutter and bed systems; and from its favourable position, open towards the south, and sheltered by the hills on the north, the author would anticipate heavier and more frequent crops of rye grass than are now obtained at South Norwood, where the soil is very similar. The first great requisite for the successful prosecution of sanitary improvements having thus been fortunately obtained, the next thing to be considered was the size of the outfall sewer; this, of course, is determined by 1st, the maximum quantity of fluid matter it is designed to take; 2nd, by the maximum inclination it is possible to give it. As regards the former it is not the author's intention to go into any minute calculations respecting the probable amount of rain falling on this drainage area per annum; what amount of it will find its way to the sewer; how long it takes to do so; what proportion will fall in streets, roofs, and back premises, and thence to arrive at the dimensions of the outfall sewer. It would, no doubt, be an easy matter to take some of the published tables, and run the finger down the columns for the figures answering to Redhill, its area, population, &c.; but conclusions based on this sort of arithmetic are as likely to be wrong as right. To use Mr. Rawlinson's words, "You may as well say that all sorts of diseases may be cured with one set or sort of pills, as that tables of strength of materials and dimensions of sewers can be relied upon without the experience of practice." In answer to questions of this kind, he gives a list of towns drained by him, with their population, area, &c., and the dimensions of the outfall sewers in each case, and the author would add Redhill to the list of practical examples, which, after all, are the best guides in assisting the judgment of young engineers. It will, however, be generally admitted, that in towns where the existing sewers are sufficient to take off the greater part of the rainfall, they need not be interfered with; but the new sewerage is designed to take all foul matter and a certain proportion of the rainfall. With this end in view the outfall sewer at Redhill is designed. It is egg-shaped, 3ft. 9in. × 2ft. 8in., sectional area 7·64 square feet, perimeter 10·12ft., a hydraulic mean depth, therefore, when running full of 0·755ft.; its capacity of discharge under these conditions would be about 1,400 cubic feet per minute.

It should be mentioned that the outfall sewer at present receives a small supply of water from the deep-seated springs in the sand. This amount the author has carefully measured, and finds to be thirty cubic feet per minute, and not perceptibly affected by the amount of rainfall at different times. Adding to this the average flow of a small brook which has been diverted from the roadside into the sewer, and which may be taken at fifty cubic feet per minute, and the probable maximum flow of sewage from the present population at 31·25 cubic feet per minute, we have a total of 111·25; to which may be added 1,000 cubic feet for the proportion of the maximum rainfall that will reach the sewer; leaving a margin for the extension of the population, which there is good reason for supposing will double its numbers in the next ten years. It is probable, also, that many of the shallow drains, which at present needed not to be interfered with, will, as houses multiply, necessarily be abolished, and the refuse water they now convey away be brought into the sewer.

Before leaving the subject of the dimensions of egg-shaped sewers, the author asks permission to submit to the notice of the members three general formulæ applicable to the construction of egg-shaped sewers, which he deduced for his own convenience in calculating the area and perimeters of the Redhill sewers and in constructing the templates for the bricklayers. These sewers deviate somewhat from the usual proportions, which are as follows:—B = equal diameter of circle forming invert; C = diameter of arch; R = radius of curve forming sides; D = depth; then B = $\frac{1}{3}$ D; C = $\frac{2}{3}$ D; and R = D. These are the proportions taken from Molesworth, and are those for which tables of areas, hydraulic mean depth, &c., have been constructed. They certainly offer great facilities to the draughtsman; but it will readily be admitted that circumstances may arise where a sewer having a greater proportional width to its depth than is given by this construction, may be desirable; for instance, the engineer, from the proximity of the surface of a road to the crown of his arch, or from other causes, may wish to reduce the depth of his sewer while still preserving the same sectional area, and retaining the advantages of the egg shape; and there is no reason why he should be compelled to use this particular form, and no other, merely because it has been the custom to do so. In the present case the main sewer was partially above ground for a considerable portion of its length, and it was desirable to reduce the mound in the field through which it passed as much as possible. Now, it is easily seen that if the proportion of B and C to D are altered, and also the proportion they bear to each other (as given above), R is no longer equal to D, and the two circles do not touch, the distance between their centres being no longer equal to the sum of their radii. It thus becomes necessary to furnish the draughtsman with a new value for R which shall be perfectly general in its application. This expression and the other two for the area and perimeter will be as follows:—

R being the radius of the side, r of the arch, and r_1 of the invert, and d the distance between the centres of the circles, obviously equal to D—$(r + r_1)$, we shall have

$$(1.)\ R = \frac{1}{2}\left(\frac{d^2}{r - r_1} + r + r_1\right)$$

$$(2.)\ A = \frac{\pi}{180}\left(\theta^\circ (R^2 - r_1^2) + 90\,(r^2 + r_1^2)\right) - d\,(R - r)$$

$$(3.)\ C = \frac{\pi}{90}\left(\theta\,(R - r_1) + 90\,(r + r_1)\right)$$

The above are easily deduced, and might prove useful to others, as I have found them. The angle θ deg. which is that subtended by the arc forming the sides, may be found from from its sine, or tan., for

$$\text{Sin. } \theta = \frac{d}{R - r}, \quad \text{tan. } \theta = \frac{d}{R - r_1}.$$

Up to the present only 220yds. of the outfall sewer have been constructed, and a temporary outfall formed into the brook. As there was some delay in obtaining the necessary borrowing powers from Government for the purchase of the land, the corporation thought it undesirable to postpone the construction of the sewers till that was obtained. Now, however, that the land question has been satisfactorily settled, and the greater part of the drainage scheme completed, there is no further hindrance to the continuation of the outfall sewer to the proposed irrigation fields. The bricks for the sewer were specified to be radiating, and at first the author had them made of two different forms, one to suit the exact mean radius of the arch, and another for the invert. This, however, was found to cause a delay at the brick-yards, and caused the author to substitute a mean brick, which answered all curves of the different sewers without making the outer joints objectionably wide. The inverts were cast in blocks in the usual way, and were allowed a week to set before being inserted in the work. The curve forming the sides of the sewers was built with ordinary-shaped bricks, the radius being large enough to allow this to be done. The thickness of the brickwork was 9in., and the compost composed of two parts sand to one of Portland cement, which was specified to be of such quality as to bear a tensile strain of 180lb. on the square inch, after seven days' immersion in water. Specimens were tested, from time to time, and answered the required test. In cases where rapidity of setting is important, it is, no doubt, of value, but to prove the actual strength of the cement when thoroughly set—*i.e.*, when at its best—it seems to fail. The author has found cement taken from some casks which were supplied by Messrs. Hall and Co. for these works set hard in a few hours, whilst other specimens would take as many days. One instance out of many he selects: in casting the blocks for the 2ft. culvert in the London-road, where the ground was very bad indeed, the foreman of the bricklayers complained that one or two casks of cement were so bad that they were obliged to reject them, as the cement would not go off at all. A specimen was mixed on a board and examined; after a few days it was found to be so soft that the impression of the finger could be made on it. A portion of the same cement was inserted in the testing-frame, and allowed to remain for three weeks, and was then tested by the author and Mr. Hornibrook (borough surveyor of Reigate), and found to bear a tensile strain of 367lb. per square inch, or more than twice the required strain; and its hardness was found to be about $3\frac{1}{4}$ on Moh's scale of hardness, as it easily scratched a specimen of heavy spar; although had it been subjected to the seven day test of 180lb. it must have failed entirely to bear it.

(To be continued.)

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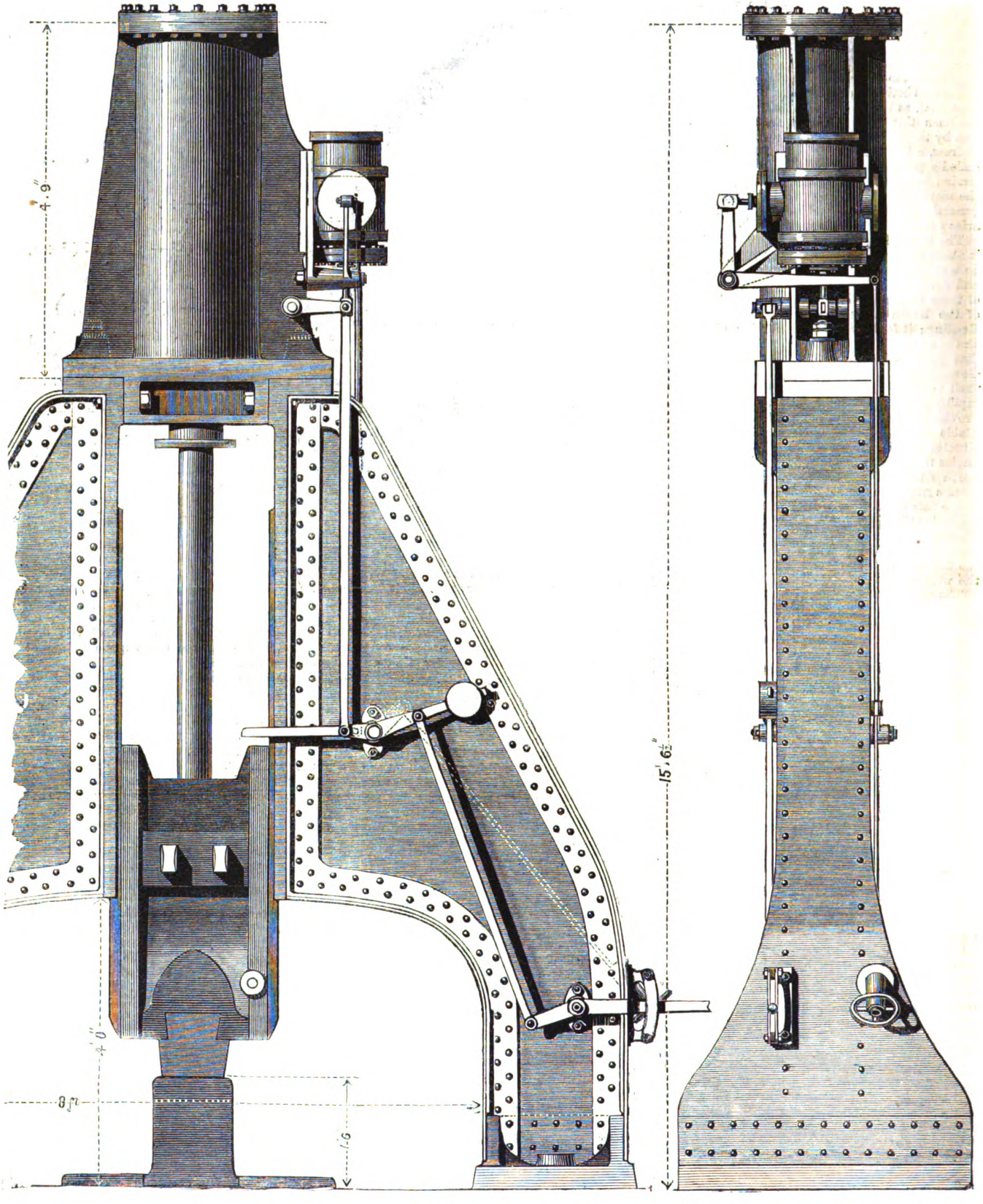
TWO-TON STEAM HAMMER.

BY MESSRS. THWAITES AND CARBUTT.



TWO-TON STEAM HAMMER.

IN the above engraving we give front and side elevations of a two-ton steam hammer, which was exhibited at Paris last year, by Messrs. Thwaites nd Carbutt, of Leeds. The form adopted in this example is at once elegant in appearance and sound in principle. The hammer has an 18in. cylinder and a stroke of 4ft. The frame is of wrought iron, and the workmanship is very superior, all the rivet-holes being bored out and the plates planed, so that the joints are nearly invisible. Wrought-iron standards have been employed before, especially in tilting steel, in which work the hammers are exposed to very severe strains. Messrs. Thwaites and Carbutt have an 18-ton hammer, very similar in construction, at work at John Brown and Co.'s, Sheffield, and the firm have made all the duplex hammers hitherto used by Mr Ramsbottom.

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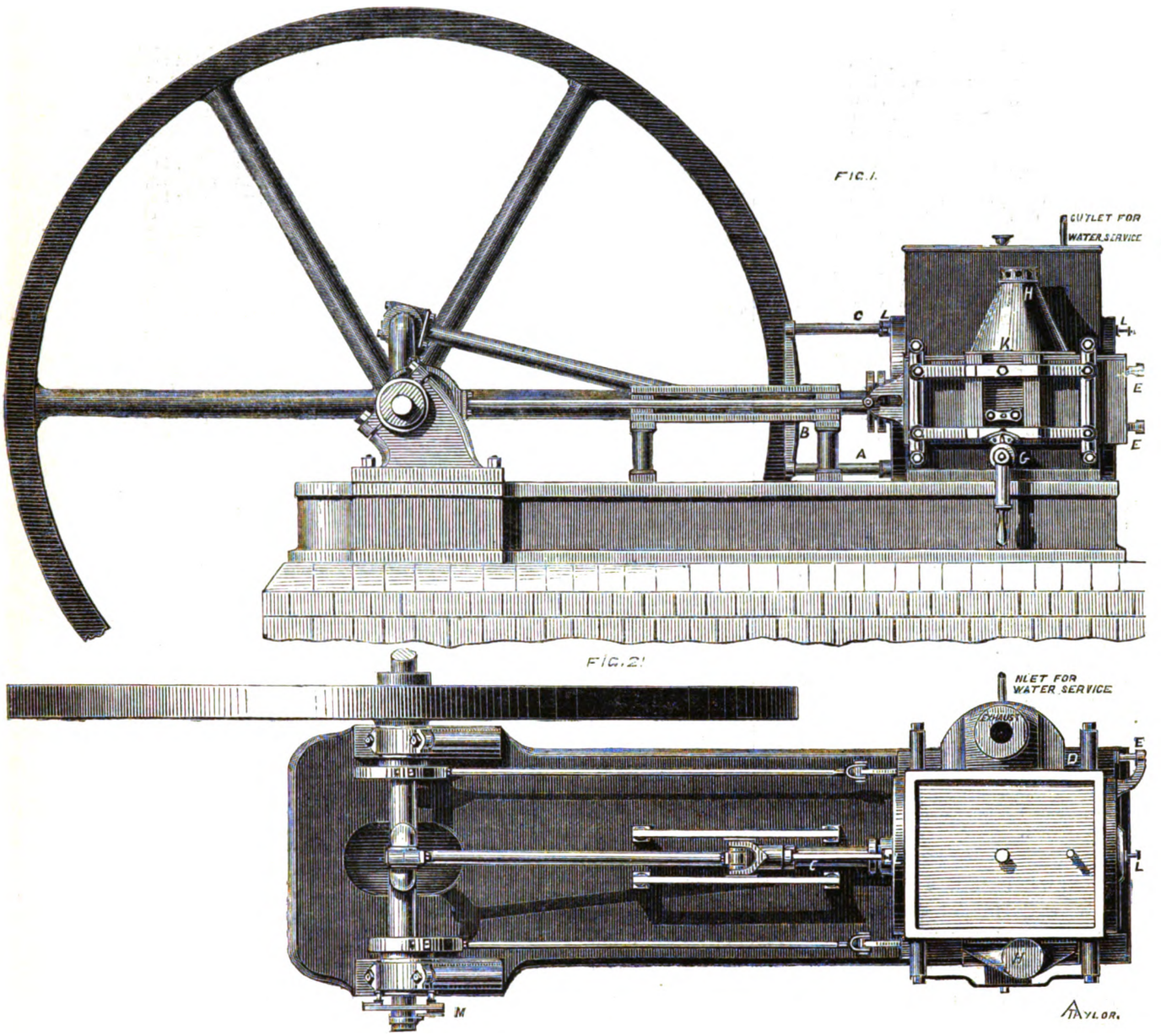
IMPROVED GAS ENGINE.

BY MESSRS. KINDER AND KINSEY.



IMPROVED GAS ENGINE.

MESSRS. KINDER AND KINSEY, engineers, of 92, Cannon-street, London, have lately patented an improved gas engine, which overcomes many of the difficulties hitherto found to operate against the successful working of these engines. This is shown in elevation at fig. 1 and in plan at fig. 2 of our engraving. It is an improvement on the Lenoir engine, which was brought out in England some seven years ago, and although many of these engines are at work and doing fairly, there has always been considerable uncertainty as to the power given off. It was found that the Lenoir engine, when freely supplied with the gas necessary to give off the power, became so intensely heated that distortion and abrasion set in, and it finally pulled up from excessive friction; this invariably happened when the engine was worked up to or beyond its nominal horse power, and hence the necessity of devising some means for getting the extra caloric quite under control. To effect this, Messrs. Kinder and Kinsey have placed the cylinder in a square closed tank, and use straight instead of the usual S-shaped passages; by this means the passages and cylinder are kept at a uniform temperature. The piston and piston rod are made hollow to allow the water to circulate through them. The piston rod is fitted with a horizontal diaphragm, which allows the water to flow from the bottom of the tank through the tube A into the crosshead B, and to the piston, returning back through the piston rod above the diaphragm, and through the tube C to the top of the tank. The tubes A and C work through stuffing boxes in the cylinder cover, and as the tube A is trumpet-shaped at the end, it gathers and forces the water through the piston and rod, and finally through the tube C, to the top of the tank. The exhaust valve D is made hollow, divided by a diaphragm, and is supplied with water by the tubes E, which work through stuffing boxes on the valve. By these means the cylinder, piston, and piston rod are kept at a uniform temperature, and no more water is required than is sufficient to make up the waste from evaporation, and the tank surrounding the cylinder is supplied with water either from a small cistern with a ball cock, or it may be made circulating from a large cistern. The lubrication required is only that of an ordinary steam engine.

The engine is worked by a mixture of air and ordinary coal gas. The gas enters at G with the force due to its pressure from the works, and is met by the air rushing in at H, in consequence of the vacuum formed by the piston. The gas and air then pass through perforations at K in the top of the valve, and thus become mixed. The mixture then enters the cylinder, when it is ignited, by means of an electric spark, from the inflamer L. The inflamers are connected by wires to the distributor M, which makes and breaks contact between either end of the cylinder and an ordinary Rumkorff induction coil, excited by a battery of two cells. There is very little trouble in keeping these batteries in order, as they only require a little fresh acid and occasional amalgamation of the zinc plates. There is an engine on this principle at the gas works, Ipswich, which works their exhauster and ammoniacal liquor pumps. It is found that an engine of 3-horse power will drive a 30in. circular saw through an 11in. deal at the rate of 8ft. per minute. The engine has been subjected to a twelve hours' test with the dynamometer, giving off 3½-horse power, with a consumption of 83ft. of gas per horse power per hour, and at the end of the trial the engine showed no symptons of flagging—in fact, increased the revolutions 50 per cent. with the same load. The Gas Engine Company (Limited) is now making and selling engines under Messrs. Kinder and Kinsey's patent, which, we understand, are giving great satisfaction.

Arrangements have been made for maintaining a direct weekly mail service between Suez and Zulla, instead of sending a steam vessel, as hitherto, to intercept the Indian mail packets off Jubbel Teer in the Red Sea; and the mails for the British forces serving in Abyssinia will, therefore, be forwarded in future to Suez, for transmission direct to Zulla. The correspondence addressed to persons serving on board transports engaged in the Abyssinian expedition, which has heretofore been sent in the mail to Aden, will in future be forwarded in the mails to the postmaster at Zulla.

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THE STATISTICS OF ACCIDENT.

WE are constantly reading or hearing of accidents, and occasionally seeing them, and all of us are agreed that there must be a great number during the year. But few of us are prepared for the startling announcement that two millions of persons receive injury every year from accidents of a more or less serious character. Of these it appears that ten thousand are killed or die from the direct effects of the accident; others are maimed for life, and nearly all are disabled for a greater or less time from following their avocations. We have these facts on the authority of the Accident Insurance Company, of 7, Bank-buildings, in a statement which gives a further insight into the nature of these accidents, and in which they are enumerated and classified under different heads. Taking, then, the list of claims paid by this company, during the year 1867, we find that 54 persons have been injured by railway accidents. Of course this is only a portion of the injuries that have really resulted from railways, but it is that portion with which this company has had directly to deal, as, indeed, are all we are about to notice. Accidents at home include the thousand and one casualties with which the youngest is familiar, and of these there are 226 enumerated. Of fire accidents there are 22, and of skating accidents 6. The carriage accidents number 104, the mining accidents 13, and the field accidents 49. Street accidents form a large item, there being no fewer than 250 of these, whilst cricket accidents number 21. Business accidents are rather numerous, there being as many as 273; whilst accidents arising from the bursting and accidental discharge of guns number only 9, but one of these cost the company £500. Horse accidents toll up again; indeed, this useful animal appears to be the most prolific source of accidents, having no fewer than 470 laid to his charge. Boat and water accidents number 43; dog accidents, 8; machinery accidents, 15; and, finally, cattle accidents, 19. We thus have a total of 1,582 accidents out of the two millions for which compensation has actually been paid by one company alone to the extent of £30,000. Now, the contemplation of this subject can only lead to one conclusion, and that is, that it is a great blessing to the community that by paying a small fee per annum—ridiculously small in comparison to the advantages it secures—each member of society may get cut, bruised, or burnt, much or little, and yet suffer no pecuniary loss, although his business powers be suspended; and should the accident result in death, his relatives or representatives will be compensated for the loss of his services.

NEW RUSSIAN TURRET SHIP.

AN iron-clad frigate is about to be constructed in Russia from the designs of Admiral Popoff; she is to carry two turrets and four guns of the heaviest calibre actually in use. Her length between the perpendiculars will be 310ft.; breadth over all, 55ft.; and when fully equipped for sea, her mean draught of water 23ft. 9in., and her tonnage, 4,457 4-94 tons, builder's measurement. She will be provided with twin screw, and two sets of engines of 500 nominal horse power each. All the materials used are to be of native production, either Russian or Finnish, with the exception of a certain amount of teak and mahogany. Three years will be granted for building the frigate, which is to be armour-plated with plates 12in. thick., to be rolled at the Government works at Kolpino. Tenders were sent in by three builders, and that of Messrs. Carr and Macpherson, of the Baltic Works, for 1,295,000 roubles, was accepted. The vessel is to be built at one of the Government yards.

WE understand that arrangements are in progress for giving practical effect to the resolutions of the conference of working men, held on the 14th ult., under the auspicies of the Working Men's Club and Institute Union, and the presidency of the Earl of Lichfield. The consents of Dr. W. B. Carpenter, F.R.S., and Professor Warrington Smyth to deliver lectures, together with conditional promises of co-operation from several equally distinguished men of science, have been obtained. A sub-committee is charged with the duty of ascertaining what are the existing means of technical instruction available to working men; and steps have been taken for the representation of the artizans in the course of the inquiries to be prosecuted by Mr. Bernhard Samuelson's parliamentary select committee.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

THE members of this institution met on Saturday, the 4th inst., at the George Hotel, Aldermanbury. The chair was occupied by Mr. Joseph Newton, president, and the attendance was large. After the disposal of matters of a routine character, Mr. J. Matthias Hart, of Cheapside, and other gentlemen, were elected as honorary and ordinary members. A discussion followed as to the propriety of relaxing the rule which constitutes "a hard and fast line" against the admission of members over fifty years of age. Several gentlemen slightly beyond that period of life, but otherwise thoroughly eligible, desired admission. Their cases were finally referred to the committee.

The Chairman next took occasion to refer to the munificent conduct of Mr. Whitworth in proposing the foundation of thirty scholarships for the promotion of technical education and the study of mechanical science. The proposed use of the princely donation made by that gentleman, Mr. Newton said he considered was as admirable in conception and intention as it was important in a material sense. He sincerely hoped that the management of the fund would be effected in exact consonance with the enlightened and liberal views of its donor. It might be that some of the members of their own association had sons or other near relatives who were or would become qualified for partaking of the advantages derivable from the realization of Mr. Whitworth's grand scheme. At all events, he (the chairman) felt that foremen engineers, and especially those who, like themselves, had long since united together for mutual instruction and the cultivation of technical and practical knowledge, might hope to have their claims fairly considered. Their own association had certainly rendered good service both to employers and employed, and in presiding at its anniversary lately, and then joining it as an honorary member, Mr. Whitworth had evinced his appreciation of its value to both those classes. He trusted it would go forth to the world that the associated foremen engineers of London gladly recognized the noble conduct of Mr. Whitworth in founding the scholarships in question, and that they yielded to no section of the community in the sincerity of their gratitude to that gentleman.

A short description was then given of a new speed and distance indicator, or counter. As the apparatus itself was also exhibited, it may not be improper to state that it appeared to be in every way well adapted for its purpose—that of registering the speed of machinery, or the distance traversed by vehicles. It certainly embodies in itself several important characteristics. It is small in size, simple in construction, contains no springs, and is not costly. Mr. Hay, of 83, Lombard-street, is the agent for its introduction. The apparatus consists of a combination of several series of repeating discs. The first, cut in the form of a Maltese cross, has ten concave sides, on which are inscribed the numbering figures. The second disc has ten teeth which catch into the preceding, and the third has a single tooth on its circumference, the radius of which is equal to the concavity of the sides of the first disc. The second and the third discs are joined together, their united thickness being equal to that of the first disc. This latter is shipped on an axle at a convenient distance, so as to allow the first disc to catch in with the two others. Disc No. 1 in making one revolution carries round Nos. 2 and 3, but when disc No. 1 has checked off the ten numbering figures, No. 3, which has only one tooth, has only travelled one-tenth, or a single space on the circumference of disc No. 1 of the second series of discs, and so on. The small apparatus shown on Saturday, and which is moved by a ratchet and pawl, registers up to 999,000,000, and is easily returned to zero. Its cost was said to be about £4, the whole of the material being gun-metal. The opinions of the contrivance, as expressed by those present at the meeting, were in the highest degree favourable; and really it appeared to be equally applicable for counting with exactitude the revolutions of shafts, or of machinery of any kind—those of the wheels of locomotives or carriages, or of registering the flow of fluids, gases, &c. The apparatus could scarcely be disarranged by any ordinary casualty, and, therefore, is the more worthy of notice. The sitting of Saturday closed after a few observations from the chairman as to the preparation of an uninterrupted succession of papers and subjects of discussion for future meetings.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

AT the last meeting of the above Society the following paper on "Power in Relation to Weight in Aerial Navigation," contributed by Mr. A. Alexander, C.E., was read by Mr. Fred. W. Brearey, the honorary secretary:—

Among the comparatively few in number who believe in the ultimate accomplishment of aerial navigation, i.e., in the discovery of principles or invention of methods which will enable us not only to rise in the air, but to move at will thereon from place to place, there is observable of late years a decided, and, doubtless, a wise disposition to base calculations and endeavours more and more strictly upon the proportions and constructive details observable in nature—upon the force, form, and arrangements which, in birds, are so combined as to solve this difficult, but, as their flight seems to show, not wholly impracticable problem. These bird proportions are, of course, chiefly interesting to those who look upon them as the prototypes of aerial machines, and who have little confidence in any advantage to be derived from the use of balloons, as such methods of acquiring buoyancy, involving as they do an immense displacement of air, will necessarily involve a large amount of power in propelling them against even a very feeble aerial current. It is very important, therefore, that the real source of bird flight should be fully understood and admitted, and that the most important data consented with the wing apparatus should be determined. I observe that in the number of "All the Year Round" for 29th February last, a writer on this very interesting subject criticizes rather unfavourably the views of the Duke of Argyll and Mr. Glaisher, both members of this Society, and it was the perusal of these remarks that chiefly induced me now to forward a few further notions on this subject. The writer above referred to does not approve the doctrine that a proper relation between power and weight is all that is necessary to achieve aerial flight, and introduces, as chiefly explanatory of this fact, the theory of gas inflation in the hollow cells and vessels of the bird. This idea has been frequently stated, but, so far as I am aware, it is not supported by any facts which prove that it is more than an idea.

We have yet to learn with what curious gas the cellular spaces can be filled, possessing a levity which will afford any appreciable buoyancy. The word "gas" seems to suggest some magical sort of power in the minds of some, while, in fact, the total buoyancy derivable from the use of any gas is measured simply by the difference between its weight and that of an equal bulk of air. The air channels of all warm-blooded animals are, we know, filled with gas, which is of an average composition heavier than the surrounding air; but even if we could imagine that much absolutely vacuous space existed in the interior of the bird's body, which would be more advantageous as regards buoyancy than its occupation by any gas, however light, the elevating effect would always be of the most trifling amount in relation to that required for the bird's support. If we take the whole displacement of a bird weighing 2lb. at about 1-12th of a cubic foot, as the weight of a cubic foot of air may be assumed at ordinary temperatures = 1¼oz., it is obvious that if we could conceive the whole outward envelope of the bird's form, enclosing an absolutely vacuous space when on the wing, the additional buoyancy thus obtained would only amount to 0·104oz., or 0·3 per cent. (say ⅓ of one per cent.) of the weight of the bird. This is not only altogether inadequate, even could it be realized, but might be entirely removed without practically affecting any powers of flight; and so far as we are aware there remains no other source of the powers of aerial motion possessed by birds and insects than the amount of dynamic force in relation to their weight with which their muscular system is endowed. This appears to be the case in exactly the same sense as the power of motion of a steam vessel up a rapid current is due to the dynamic efficiency of the engines on board in relation to the midship section and displacement of the steamer. When the relation between them is sufficient, the steamer can, at the velocity depending upon that relation, successfully pursue its upward and onward course, and until that relation becomes sufficient, all attempts at upward navigation of the opposed current will be unavailing. As in the case of the supposed steamer there are two directions in which a satisfactory relation between power and resistance can be established—either by increasing the power on board by improved machinery, while the midsec-

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tion and displacement of the vessel are retained unchanged, or by retaining the power constant, and reducing resistance by the employment of more suitable materials or improved methods of constructing the vessel. So we may suppose that the sufficient relation of power to weight for aerial navigation would be equally attained either by improved machinery which could develope a greater power in relation to its weight than that in use, or by the application of improved methods of construction in the flying machine. As regards the latter method, it is to be feared that there is very little prospect of surpassing the lightness, combined with strength and efficiency of the wing structure. But as this wing structure has to perform other functions than those of a mere propeller—as it is partly pervaded by muscular and nervous action—there is nothing to prevent a reasonable hope that an instrument considered merely as a propeller may be constructed as light in relation to the power transmitted through it, as even the wing of several birds. The direction, however, in which most progress is possible in establishing a satisfactory relation between force and weight lies in the improvement of any present mechanism for applying dynamic force—in reducing its weight and bulk, and increasing the tenacity of the several parts in relation to the power which can be developed.

The events of the last thirty years, the great strides which have been made in the art of transport both by sea and land in that period (accompanied as these have necessarily been by great advances in the very direction to which we now direct attention) with the greatly increased efficiency of a given weight of motive power mechanism, afford a very cheering hope that we are even now in the path which will ultimately lead, though perhaps by devious windings, to the application of force in a far more concentrated form than has yet been attained. In days not very long past, the great principles to be studied by those interested in land transport were those of MacAdam. The well-appointed stage coach, the pride of each district through which it passed, delivered its passengers and mails with something like planetary regularity, and seemed the very acme of what was possible in facilitating intercourse and disseminating intelligence. In these days it might have been said, and it was said, that it was hopeless to attempt to surpass Nature, and that it could hardly be imagined that man could ever build up any combination of mechanism to excel in results the wondrous organs already impressed into our service. Such was, in fact, a line of argument frequently pursued, and we all know that the expectations held out by those interested in steam transport were considered even by most competent and intelligent men as wholly chimerical. But the organs of living creatures owe much of their wondrous beauty and refined complexity to the performance of other functions apart from those of mere motors; and, in fact, we have, as is well known, in building machinery with only one function in view, greatly surpassed any thing of the kind to be found in the works of Nature.

In the locomotive we have a machine which not only surpasses the racehorse in speed, but has a tenacity and persistence quite beyond those of fleshy muscles and sinews. It can keep up its speed for hours together, while the horse, when urged to his utmost, cannot maintain it for more than a few minutes. But the superiority of the machine, considered merely as an instrument of transport, be it observed, is also very manifest when the ratio of weight to power is examined, and it is mainly on this account that attention is directed to the contrast as affording a hope by analogy that the same satisfactory contrast may yet be extended to other fields of progress. The power which may be exerted by a first-class locomotive at express speed is very frequently in excess of 300-horse power, *i.e.*, the pressure or tractive force applied to the train, combined with the speed of motion, are equivalent to the dynamic effect derivable from 300 horses, supposing these to work in the most favourable circumstances. As a horse at high rates of speed, such as those supposed, can exert no tractive power whatever, it is necessary to imagine an arrangement of mechanism by which the horses when moving at a few miles per hour can impart a rapid motion to the load. The weight of such a locomotive, supposing it to carry its own supply of fuel and water, will vary from 30 to 40 tons; while the weight of the horses, without taking into account the mechanism interposed between them and the load, will not be less than 180 tons. If, then, we are already so greatly ahead of natural phenomenon in one direction, there is surely nothing unreasonable in hoping that we may ultimately rival at least such natural phenomena in another direction, where the difficulties appear to be almost wholly mechanical.

As regards the actual power developed by birds in flying, further discussion is still required, and it is much to be desired that the principles upon which this is determined should be settled and adopted. I have observed in some cases, but it is very seldom one meets with any calculations on this subject, that the space through which the bird would fall during a given time, under the influence of gravity solely, is made the basis of calculation—this distance or a certain part of it depending on the velocity of wing stroke, a number of such per second being reckoned as the spaces through which the weight must be raised per stroke. The space passed through in a given time multiplied into the weight expresses the stored-up energy in consequence of the fall, and the mechanical power or units of work required to project the body from a state of rest to the height fallen. It would appear, therefore, but natural that the pulse of the wings at each stroke should produce a dynamical effect corresponding to that represented by the fall of the bird in the same time through the height due to the time of stroke. But when we take the time of stroke in large and slow-winged birds, the power required to be developed on this principle of calculation, in consequence of the great fall corresponding to each vibration of wing, becomes very great, and it seems obvious that the beat of wing upon so yielding a medium as air does not afford a means of storing up a supply of power corresponding to the energy of a heavy body which has fallen through a considerable space. An approximation to what appears to be nearer the correct power is obtained in the cases where the number of wing strokes is great in a given time, which leads us to the notion that the power must be supposed as applied constantly, and not by consecutive efforts, and that the terms upon which it depends are the weight of the bird multiplied by the space passed over in a given time by the centre of pressure of wing. We do not require to consider whether or no, or to what extent the upper stroke contributes to the buoyancy of the bird. It will not be disputed that if not contributing much to buoyancy, it is very effective in propulsion, and hence, in doing work which is equivalent in some ratio not yet ascertained, we have to deal with the bird in fact as we should do with our hypothetical steamer mentioned previously, supposing it were engaged in stemming a current. If just stationary, the force of the downward current on the hulls, being balanced by the reaction of the propeller, if the force of the current on the hull were known, this force multiplied by the velocity of the propeller would represent the dynamic force in action.

In like manner, as we know that the force to be balanced in the case of the bird must at least amount to its weight, this weight, multiplied by the space passed over by the centre of pressure of wing surface, will represent the power requisite to be applied to the medium of buoyancy and propulsion. As regards the power actually required in any source of power applied, we have also to bear in mind that none of our prime movers give out or apply to the mechanism on which they act, the amount of power due to the energy of the agencies of which they are the mere instruments, a certain amount being absorbed in friction and mechanical imperfections. The amount of power applied to a shaft by a steam engine, for example, can never amount to that recorded by the indicator in the cylinder, and yet, as comparative statements of the power of such engines are universally based on these indicator diagrams or records, it is necessary, when referring to them, to allow for a certain absorption of the power between the cylinder and its point of application. It is not likely that we can ever compete here either with the direct action of the muscular system in the wing, which, it is probable, is transmitted with very little loss; but if we suppose anything in the nature of a steam engine applied, it will not be safe to reckon upon a loss of less than 15 per cent. in transmission, and hence the necessary weight per horse power obtained at first, must be still farther reduced in the ratio of 85 to 100.

As an example, which is produced, however, not with a view of giving absolute results, but merely of exhibiting the method proposed, suppose a pigeon weighing 2lb. makes 180 completed strokes per minute, the centre of pressure of wings moving 9in., or, per complete stroke, 1ft. 6in., then 1·5ft. × 180 strokes = 270ft., and 270 × weight of bird, or 2lb. = 540ft.-lbs. This in a minute is 0·0163-horse power, and hence, if the proportion is to be maintained, 1-horse power must not weigh more than 122lb. This power, however, is that measured at the propeller, and, as explained above, the weight in relation to the power exhibited in the cylinder, supposing a steam engine, or any similar motor employed, must not exceed

$$122 \times \frac{85}{100} = 103{\cdot}7\text{lb.}$$

Some calculations of this kind, made several years ago, led me to the conclusion that a relation of power to weight approximately given by the above figures would suffice for the requirements of the aerial machine. The conditions did not appear to be at all the same with different classes of birds, or even with the same bird at different times. With the few I examined, which were only the ordinary pigeon, crow, and wild duck, the results seem to indicate a necessity for a motor with all accessories not exceeding from 80lb. to 150lb. in weight per horse power. On the whole, I arrived at the conclusion that with a power of one horse for every 112lb. weight, aerial navigation, in the true and comprehensive sense, ought to be possible. Now, it is to be remarked that in some of the most advanced cases, as in steam fire-engines, 1-horse power to the cylinder has been obtained from 112lb. weight, but it must be remembered that this is the weight of the lightest form of engine yet constructed with a pump and wheels for transport, certainly, but with no supply of water, no weight of passengers or parcels, no car for their conveyance, no propelling apparatus or mechanism connected therewith, while, in the weight suggested, it is obvious must be included the total weight of everything to be elevated. While, therefore, further progress appears to be necessary, there does not seem to be any insuperable difficulty in advancing so far that even the steam engine may be able to supply the power required.

It would be extremely difficult to arrive, in the present state of our knowledge, at any absolute statement, for it must be remembered also, as some former experiments showed me, that birds generally are not fully loaded, but can rise, though with difficulty, even when weighted to an extent equal to their own weight. This is also an encouraging circumstance, for while it is obvious that such a margin of power is necessary with sentient mechanism, in which exertion at full power leads to speedy fatigue and cessation of effort, such a margin is not required with inert mechanism, which continues indifferent to exertion so long as the elements of the energy it transmits (*i.e.*, fuel and water in the case of the steam engine) are regularly supplied. And this principle, if adopted, would, of course, lead to the conclusion that a yet heavier machine than we have supposed would be sufficient. There are certainly several elements connected with aerial flight which appear anomalous. The resistance of the air at the speed of wing observed, estimating by established rules, does not suffice for the reaction apparently necessary, but I am inclined to think that this may be at least partly explained by the fact that, so far as I am aware, no experiments have been made to establish the resistance of reciprocating surfaces, which it will probably be found is much greater than in the case of uniform motion in one direction.

The efficacy of a narrow blade of propeller, which is in favour of reduction of weight, has been illustrated in marine practice, not only by the fact that better results are obtained when only a small portion of the screw or spiral is used than with the fully developed thread, but also by the shape of blade found to give the best results. It was the custom (and still is in some quarters—I observe in the French marine—) to preserve a much larger amount of surface of blade at the periphery than near the centre. It is in reality found that the best results are obtained from a totally contrary arrangement, by reducing the surface or tapering the blade as we recede from the centre, and this is in fact the shape of the Griffith screw blades, now almost universally adopted in the Royal navy and the chief mail packet companies. The width of blade necessary is, in fact, smaller as its velocity increases, and it appears obvious that when the blade is just sufficiently wide to impart backward motion to the particles of the medium in which it works, any further development of it can only be injurious. There is also less development of blade necessary in a light than in a heavy medium, and hence even a much less proportion of breadth for all oblique propellers seems suitable in air as compared with water, and if we could suppose the density much diminished, as at great heights, the

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most effective breadths would probably resemble (especially for high speed) more lines.

The object of the present communication is not to dogmatize on any point whatever, but to elicit opinion and to direct attention (with a view of really determining valuable data) to the importance of adding to the records of the Society all information possible regarding the performances and actual structure and proportion of birds. It is to be hoped that some models, or perhaps machines, on a larger scale may be shown at the approaching exhibition of the Society. Should there be any of the latter description, they should be tested on a weighing machine, so that their actual elevating power may be noted, even though it fall far short of what is required for ascent. By experiments at different velocities, even with an imperfect machine, valuable information might be obtained as to the law of buoyancy connected with the peculiar propeller used. All such models or machines should be considered and examined in a spirit of genial and cordial criticism, for the thanks of all promoters of human progress are due to those who give such evidence of labour in the "uphill" field of effort.

(To be concluded in our next.)

FOREIGN FITTINGS IN ENGLISH HOSPITALS.

THERE has long been a sort of inarticulate growl like the muttering of distant thunder, speaking in tones of menace to the English workman, no less than to his employer—letters in daily papers, articles in scientific journals, unpleasant experiences on the part of manufacturers who have tendered for new works. It is questionable how far the public has realized the importance of the question. Whether Mr. Disraeli or Mr. Gladstone sits on the Ministerial bench is a matter of extreme interest to those gentlemen themselves, scarcely less so to their personal friends, not indifferent to any member of the House, but of almost inappreciable influence on the actual state of the mass of the population. But whether the girders of St. Thomas's Hospital be rolled in Staffordshire or in Belgium is a matter of vital interest to that mass. For it has actually come to this, that not in one, or in two, but in many departments of manufacture the foreigner is at this moment a successful competitor with the Englishman on English ground. The last twenty years have seen an amount of competition in this country which would delight any person who believes that the unquestionable principles of political economy are, further, the most imperative motives of human action. But the competition, as a rule, has been directed only to produce the cheap. It has taken less account of the good. Good enough means good enough to sell. Thus our manufactures have been deteriorated, and we are undersold in our own markets. By a free and open competition, in which more than a dozen English manufacturers joined, for the supply of some 1,200 tons of wrought iron work alongside of the River Thames, under the very windows of the Houses of Parliament, work framed and fitted in Belgium, after designs prepared by the architect of the buildings, will support the floors of our new hospital.

Nor is this all—or even the worst. The English manufacturers may say, and the Belgian manufacturers may deny, that the quality of the material contemplated by the lowest tender, is inferior to that contemplated by the English tenders. That question, in the present instance, may, no doubt, safely be left to the decision of the architect of the building. But if Belgium pushes us in price, Westphalia pushes us in quality. There we find large works, organized with the utmost system, with the mouth of the coal-pit opening with the very *enceinte* of the buildings, in which the whole energy of the establishment is devoted to the production of the best work. The managers are highly-educated engineers, the workmen are educated men, the children of the workmen are all being trained in the schools of the establishment to fill worthily the places now held by their fathers. If a boy shows talent, he is picked out, and care is taken that his special qualification shall be developed to the full. When a workman passes the prime of his strength, he is put to lighter work. When he passes the limit of this lighter demand on his energies, he is provided for by a fund augmented by the profit of the earnings of his youth. What chance has an establishment, including perhaps an absent capitalist, a semi-educated manager, foremen risen from the forge—and distinguished, very likely, as much for the number of gallons of ale they can swallow, or the downright blow they can deliver, as for any special mechanical skill—workmen who keep Saint Monday, and a rabble of untaught incumbrances in the way of non-productive consumers—what chance has such an establishment to compete with the Westphalian factory? Distance, it may be said, will protect us. Persons who have to draw their ideas of the formidable obstacle which distance, even in these days of locomotion, opposes to business, from the difficulty which attends the transference of two or three passengers, with a moderate quantity of luggage, from the Great Western Station, at Paddington, to the Brighton Station, at London Bridge, may be excused for feeling at ease as to the proceedings of rivals in the north of Germany. But what are the facts? The Prussian Government has strictly subordinated the rate of the railway charges, to the interest of the State in promoting manufactures. Instead of three or four companies struggling for a rival traffic, which they disgorge from their termini without an attempt to facilitate its future course, everything is ordered with the aim of delivering the product of German industry, at the least practicable cost, in the market of the world. So it follows that to send, let us say, steel plates for a frigate, by a ten or a twelve hours' railway journey to Rotterdam, to ship them on a steamer, to pay shipping charges, freight, dues, landing charges, and deliver them in London, costs less, the manufacturers tell us, than to send them thither from Manchester.

What have we then to rely on? Distance is no protection. Low price is no protection. Excellence, which is the best protection, is yet sought by some of our first English houses, but their names are few. It is sought as the chief object to be attained by the German manufacturers, and the result is that they are not ashamed to compete with our very best houses, either for quality or for price. The lesson of 1848 is being taught to the world once more—taught indeed, not by cannon and by bayonet, but by means no less fatal to our industry, unless we bestir ourselves—that a mob cannot contend with an organized and disciplined force. The English workman, as long experience bids us believe, is the best raw material in the world. But, untaught and unorganized—or organized only in a self-destructive method that the foreign manufactures would gladly see kept up for yet a little while longer, every day that passes leaves him more and more behind. It would be quite worth our while, said a foreign manufacturer not long ago, to subscribe £10,000 or £15,000 a-year to the support of your trades' unions. It is not the case that the last fifteen years have seen no progress at home. The various railways that so unsystematically pierce the metropolis, furnish evidence to the contrary in their enormous viaducts. The ironwork that now spans the Thames in so many forms—that which carries Fleet-ditch over the head of the Metropolitan passenger, or that which renders hideous the entrance from Southwark to London—shows that our manufactures have advanced in their craft since Stephenson flung his tube over the Menai Straits. But if we have slowly advanced, foreign manufacture has sprung up as the creation of a day. In the year 1852, French railway companies were buying rails in South Wales. Foreign purchase was discouraged by the French Government, and disliked, for reasons both good and bad, by French engineers and directors. But they were wise enough to take what they could get at the time, while looking for something better. So Locke and Brassey made the Paris and Rouen Railway, and English houses which we could name sold rails in France. At that time such was the quality of the French manufacture that the rails cracked and crumbled under the weight of the ponderous locomotives of French design. For two English fitters to cut a foot off a good iron rail may be the work of three parts of a day. A nick round with a chisel, and a blow over a stone, and the thing was done with the rails we mention. But if a Welsh ironmaster were to base his business calculations on finding such a state of things now in existence, he would reckon without his host.

Within fifteen years, it may be said, the very idea of foreign competition with English manufacture on indifferent ground has originated. Within five years it has become no longer an idea, but a fact. Foreign locomotives have been made for English railways. "At a loss," says the English manufacturer. Most people who found a great business commence by loss—a calculated and wisely sustained loss. It may be a form of advertising—the great moral engine of the day. A reference to running engines would be a better advertisement, in our notion, than the very largest and most ingenious posters. An English manufacturer met a friend the other day in London. "What are you doing here?" he said. The other told him in confidence that he was waiting to know the result of a competition for a large quantity of work. "I fully expect the order," he said, "for I have tendered at a price by which we shall lose, merely to keep the works open." The other asked if he had any objection to exchange figures with him, as the tenders were all in, and he had himself tendered for a Belgium firm. The Englishman named his price. "You may go home, then," said the other, "I am fifteen shillings a ton below you, and it will pay our firm very well at that price." It is easy to multiply instances. But there is an obvious impropriety in quoting names, to the benefit of one tradesman, and to the discomfiture of another. And to instances given without names may be opposed the round assertion that they are imaginary. It is, therefore, a fact not to be neglected, when a large and well-known building may be pointed out as a visible illustration of the present ewing of the balance between the English and the foreign manufacturer. We shall have need of more hospitals—of hospitals, in the older sense of the term, a sense rendered in modern English by alms house, a big poor house, if we lose our manufactures. A battle lost is not a campaign, but the result of a battle of this kind shows which way the campaign is at present going. The subject is one of the deepest importance for all who care for the future of the country.—"London Review."

THE ROYAL HORTICULTURAL SOCIETY

AT the meeting of the Royal Horticultural Society, held in the Council-room, South Kensington, the show of flowers, especially of roses, auriculas, and orchids, was very splendid, but the most prominent objects were twelve new varieties of Coleus raised at the society's garden's at Chiswick, which were much admired. Mr. Bateman made some remarks on Dahlia imperialis and the orchids which were exhibited, and especial attention was called to a specimen of Odontoglossum gloriosum with two lips, which is a striking proof how little founded is the notion that they afford no abnormal instances of structure. Mr. James Batemen, F.R.S., presided, and the following candidates were elected fellows:—R. Dudley Baxter, W. Macdonald Bird, Miss Clark, Sir Wm. Clay, Bart., Mrs. F. L. Cook, Wm. Dutton, F. Halsey, Alfred Head, John Knowles, P. M. Leonard, H. Marnham, Sir W. Smith Marriott, Bart., W. W. Platt, Mrs. Plowright, Mrs. Gerald Potter, W. Skilbeck, Lady Soame, J. E. Taylor; and the Harrogate Horticultural and Floral Society was admitted into union. Joseph Hobbins, M.D., and Mr. G. M. Woodrow were elected corresponding members of the Society.

Obituary.

WE have to record the death of Captain Claxton, R.N., who has rendered signal assistance to our engineers on many important occasions. Captain Claxton distinguished himself during the Peninsular war. Later on in life he held the post of secretary to the Great Western Steamship Company, and when their vessel, the "Great Britain," was stranded in Dumdrum Bay, Captain Claxton was selected to protect the ship during winter, which he did most effectually under Mr. Brunel. Subsequently, Captain Claxton was engaged in the critical operations of floating the tubes of the Conway and Britannia Bridges, which he successfully accomplished to the satisfaction of Mr. Robert Stephenson. He has also assisted Mr. Brunel in similar operations at Chepstow. Captain Claxton, who was in his seventy-ninth year, died regretted by a large circle of warm friends.

Correspondence.

THE PRESENT CONDITION AND FUTURE PROSPECTS OF MACHINE MANUFACTURE IN RUSSIA.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Permit me to call your attention to a very important subject for English machine manufacturers, and one which has engaged part of my thoughts for some years, while now, I believe, the time has come to bring this subject before the public, and more particularly before the mechanical part of it. In order to encroach as little as possible upon your valuable space, I must commence rather abruptly, reserving what should have been introductory remarks until you have expressed your opinion on the merits of my proposition; then will be the proper time to give those remarks in the form of statistics and proofs of the feasibility of my plan. Without further prelude, therefore, I will proceed to explain myself as well as I can.

You will see by the heading of this letter that I live at present in Russia; and it is of the condition of that country in respect to mechanics and engineering that I mean to speak. I have lived in the interior of this country and practised as a mechanical engineer for about eleven years, and have witnessed in that time changes which have all tended to the bettering of the country and the people, and, among other good things, have caused an increased and increasing demand for machinery. Owing to this increased demand, also from the extension of railroads, and other causes, the Imperial Government is very anxious to introduce

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and encourage machine-making factories, and with a view to do this has made several propositions to capitalists and machine manufacturers. Although some of these propositions are very favourable, still there has as yet been no particular response made to any of them, and least of all from the wide interior.

The Government scheme, which bears more directly upon the subject to which I would wish to direct attention, is the proposed import duty on all machinery coming from abroad, which duty is intended to protect and encourage home manufacturers, and the imposition of which, although not yet decided upon, has such a strong party in its favour that I think it is very likely to be carried out. This expected increase in the price of foreign machinery naturally causes the users of machinery to inquire if the present existing Russian engine and machine makers are or will be in a position to supply their wants; or must the demand for machinery decrease when foreign competition is checked? The general opinion of people pretty well informed about the antecedents of Russian machine making, and about the unenterprising spirit of the real native manufacturer, is, that without the aid of foreign capital and enterprise employed in the country, the demand for machinery must remain unsatisfied, and consequently decrease. In this opinion my experience leads me fully to concur; but the proofs of the truth of it I cannot stop to give now: I will rather hurry on to the speculations to which this conviction gives rise.

In order to show, however, as far as my own unsupported statement can do so, that I know enough of the subject to warrant me in bringing it under your notice, I may state that I was instrumental in starting a machine factory in this town for Russian would-be manufacturers, and was for nine years trying to lick it into shape. I gave up the attempt at last in disgust; but not before I had succeeded in being the first to make a steam engine in the south of Russia, and in the latter five years made upwards of forty of different sizes. I have just finished a series of letters, written at the request of parties interested in the subject, and printed in the local newspaper, upon the present state and future prospects of Russian machine manufacturing. I turn now to you, I might almost say, at the request of the users of machinery here, in the hope that you, as an organ of British mechanical enterprise, will approve of, and perhaps publish, my proposition; while your doing so may perhaps give effect to the opinion I have here publicly uttered, that foreign machine makers will establish themselves here, and that Russia must depend for many years to come upon such domiciled manufacturers; and that not until perhaps generations of such have made their fortunes here will Russians be in a condition to compete with them.

My proposition is this:—That in order to meet the Russian demand for machinery with a proper supply, the manufacture of such machinery must (and under the changed and improving condition of the country, can) be carried on here on the spot, mostly from Russian materials, and wholly with Russian workmen. But the principal thing to be borne in mind is, that the capital for such an undertaking, and, above all, the good management and the enterprising spirit, must be imported; and I should wish them to be English. The time has come which makes such a project in this district sure of success; and if Englishmen do not take this time by the forelock, our neighbours the Germans and French will. They have been at work in a similar way to what I propose for years, and, indeed, the only successful manufacturers here in many trades are foreigners, chiefly of the above-mentioned nationalities; but with present prospects the field is so vast, that there will be employment for many more.

My reasons for saying that the time is now come when the success of such a project may be said to be as sure as that of all human projects can be, are founded upon the following considerations:—Firstly, on the increase of commercial confidence, caused by the late reforms in the courts of law, and in the administration of justice, the beneficial effects of which change are becoming every day more manifest. Secondly, on the extension of railway communication, more especially the late concessions; for instance, the town from which I write, often called the third capital of Russia, will, in the course of a year and a-half, be in direct communication by rail with Moscow and St. Petersburg, and, in the course of three years, with the coalfields and iron mines of the Don, with the river depôts of Siberian iron and copper, and with the sea of Azoff. My third argument is self-evident and of general application in all civilized countries, —that is, that a supply of good machinery at fair prices will create an increased demand. The demand, however, exists already, which I am willing to prove, if you will allow me to do so; for the present I will only point to the fact, that the number of locomotives ordered from abroad by Russia in the last three years was 600, for already existing railways, and for this year there are already ordered 179, and that before the concession was given for the Koursh-Khaskoff and the Khaskoff-Taganrog railways. In connection with this line of railway there is an immediate opening for a waggon factory, as there is none nearer than Moscow, where an Englishman has established one within the last few years, and by the terms of the contract, all the waggons, and as much of the rolling stock as possible, must be made in Russia. My fourth and last reason is, I am sorry to say, founded upon the reports of the stagnation of trade in England, whilst, at the same time, there seems to be no want of capital, or of engineering enterprize.

It would be quite superfluous in me to make any remarks about the ills of expatriation to men who are covering the world with their works, and are, like other Alexanders, searching for more worlds, not perhaps to conquer, but to civilize, it is only necessary to remind them that Russia is one of England's nearest neighbours, and is every day approaching nearer. One other remark only I allow myself to make, and that is, that I have ever found a spirit and feeling abroad among all classes of Russians towards England, and for Englishmen, which I should very much wish to see reciprocated more warmly from our side. My proposition, therefore, to put it in plain words, is this:—To start with English capital, and under English management, here, in the centre of the south of Russia, a large engine factory or factories, for the construction of locomotive, portable, and stationary engines and boilers, the manufacture of machinery for beet-root sugar making and refining, the fitting out of gas and waterworks; in short, all the heavier classes of engines and machines. In this crude state I leave my project in your hands, holding myself in readiness to furnish you, or any parties who may be inclined to take it up, with full particulars and statistics of the more than probability of success to such an undertaking, if entered into with our usual national spirit.—I am, Sir, yours, &c., ALEXANDER CAMERON,

Member Russian Technical Society.

Khaskoff, Russia, March 19, 1868.

[We thank Mr. Cameron for his valuable and highly suggestive letter, and shall be glad to hear further from him upon the subject, which is one of vital importance to our manufacturing engineers. We invite the opinions of our readers upon Mr. Cameron's proposition, our own being that it merits the earnest attention of engineers, not only on private, but upon public grounds.—ED. M. M.]

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—J. H.—F. W. B.—H. M.—F. W.—G. J. G.—J. C.—R. S.—S. M —W. H. H.—G. W. H.—G. E. P.—R. S.—J. F.—W. D. M.—J. K.—T. M.—R. J. S.—T. F. C.—R. S.—E. J.—B. J. S.—W. W. M.—F. H.—J. B. K.—S. P.—R. J. S.—H. W.

Naval, Military, and Gunnery Items.

A RETURN issued on Saturday shows that the number of her Majesty's ships and vessels at the different stations over the world on March 31, 1867, was 276; the total complement of men 44,245.

THE "Messager" of Cronstadt gives some details of the improvements which are being introduced into the Russian artillery. The vessels are already armed with 8-inch breech-loaders, and 15-inch smooth-bore guns. A successful trial has been made with a 9-inch piece made by M. Krupp; 700 shots were fired without the cannon being at all damaged. For the maritime fortresses, a brass gun of 11-inch bore, and to weigh 845lb. (84lb. each) has been projected. Trials are being made of 8-inch iron guns with steel hoops.

A correspondent of "Notes and Queries" says:—I have heard or read an anecdote which Earl St. Vincent's reverence for the quarter-deck reminded me of. Lord Cornwallis went out to India as Governor General in the ship of his brother, Admiral Cornwallis. One sultry day the admiral, coming up from his cabin, caught sight of his brother lounging on a chair in his dressing-gown. After chafing some time under this, and not liking to come into collision with the Governor General, he turned gruffly to his first lieutenant and said, "Go and tell that land lubber to get up from his Majesty's quarter-deck."

Another western steamboat has blown up. The "Magnolia," which left Cincinnati for Maysville, Kentucky, on March 18, with over 100 passengers, and heavily laden with freight, exploded her boilers on the Ohio river, about twelve miles above Cincinnati. The boat afterwards caught fire, and of the persons on board, who, with the crew, numbered 160, but 57 are known to have been saved, the others being drowned or burnt to death. Among the lost are the captain of the boat and a large number of ladies. The boat is a total wreck, for after the explosion some gunpowder which was on board caught fire and blew up the hull, destroying everything.

The "Courrier de Bayonne" gives it as certain that the Minister of War has decided on forming a camp of instruction for 1868 at Lannemezan (Hautes-Pyrenees). The troops will be composed of four regiments of infantry, a battalion of chasseurs, a brigade of cavalry, consisting of three regiments, and the usual accessories of artillery, engineers, &c. This decision will give great animation to the district, and we are assured that the Emperor will visit the place to satisfy himself if there is any possibility of giving to it the proportions of Chalons. The 77th regiment of the line, at present in garrison at Bayonne, will go there for two months and be replaced by the 58th, now at Pau.

THE Russian merchants are yearly continuing to develope the internal resources of that empire by means of steam navigation. The Tyne has largely supplied Russia with steam vessels, and this spring a number of orders have been completed. Messrs. Lesslie and Co. have finished a fleet of steam lighters of considerable tonnage for river service on the Black Sea; and Messrs. Charles Mitchell and Co. have completed a steamer of 300 tons for the commissioners for improving the Don estuaries; they have also on hand a paddle steamer for the Volga, and a steamer named the "Alexander," intended for the service between St. Petersburg and the principal towns on Lake Onega. She is 500 tons, will have engines of 120-horse power, will have accommodation for three classes of passengers, and is specially designed for river service and for open water.

MR. PETERS, an economical Member of Congress from Maine, has distinguished himself by introducing a bill which practically abolishes the United States Navy. His bill relieves all naval officers at the age of sixty; abolishes all the grades except captain, commander, lieutenant, and master, and suspends the naval academy at the close of the academic year! The fault of the bill, says the American "Army and Navy Journal," is that it does not go far enough. Mr. Peters ought to add provisions for the immediate sale of all the vessels in the navy, for the closing of all the navy-yards, and for dispensing with the Navy Department. Then he should introduce an analogous bill for abolishing all grades in the army except colonel, major, captain, and lieutenant; suspending the obnoxious Military Academy; and dismantling all the forts; and closing all the arsenals in the country. By so doing what untold millions would be saved!

Miscellanea.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending April 4, was 3,134; total number since the opening of the museum, free daily (May 12, 1858), 1,270,767.

MR. WINWOOD READE will sail in a few weeks for the Gold Coast, and will probably commence by exploring the Assinie river. Mr. Reade will travel under the auspices of the Royal Geographical Society.

THE Post-office department having now to carry official correspondence without charging the postage to the several Government offices, have given an estimate of the quantity for the year. It is calculated at 14,121,000 ounces.

A RAILWAY bridge in course of construction over the Dnieper, near Smolensko, for the line between Vitebsk and Orel, has been destroyed by fire. The loss is estimated at £16,000. The cause of the disaster is not known.

The village of Valbella Superiore, in the Milanese, was a few days back entirely destroyed by fire. An old woman, a young girl, and twenty-nine head of

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cattle, perished in the flames. Six hundred and forty persons have been reduced to destitution by this catastrophe.

THE visitors to the South Kensington Museum during the week ending April 4, were, on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 9,751; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,988; total—11,739. Average of corresponding week in former years, 9,763; total from the opening of the Museum, 7,279,371.

MR. THOMAS PAYNE, of the Detroit and Milwaukee Railroad, has lately invented a contrivance to indicate to railway passengers the station which they are approaching, its distance from the one last passed, and from that point to each terminus of the road. It is placed in the centre of the car, and has two arms projecting about two feet from each side of the car, which coming in contact with posts placed for the purpose, turn the indicator immediately after leaving each station

THE total value of the iron and steel, and manufactures of these metals, imported by the United States of America in 1867, was 26,465,763 dollars; coal imported, 468,722 tons, value 1,334,261 dollars. The exports of oils, coal, and petroleum amounted to 66,330,084 gallons, value 19,210,242 dollars; refined petroleum, 59,208,965 gallons, value 17,926,782 dollars. The total imports for the year 1867 were of the value of 378,629,945 dollars, and the exports of the value of 463,398,863 dollars, yielding a good cash balance in favour of the States.

AT the last ordinary meeting of the Society of Engineers, held on Monday, the 6th inst., Mr. Baldwin Latham, President, in the chair, the following candidates were balloted for and duly elected as Members:—Messrs. James A. Hay, Royal Arsenal, Woolwich; Richard Dudgeon, London-wall and Columbia-street, New York; and Robert Joseph Hutton, Fairfield, Glasnevin, Dublin. As a Foreign Member, Lieutenant George Gordon Bigsby, Royal Engineers, Executive Engineer, Public Works Department, Bengal. As Associate, Mr. John Thompson, Nettlebed Potteries, Oxfordshire.

AT the general monthly meeting of the Royal Institution of Great Britain, held Monday, April 6, 1868, Colonel Philip J. Yorke, F.R.S., Vice-President, in the chair, Mr. R. M. Beachcroft; Mr. Matthew Boulton; Mrs. Cattley; Mr. Roger Eykyn, M.P.; Mr. William Millar; Mr. C. H. Mills; Mr. Donald Nicoll; Mr. Charles Pemberton; Mr. A. G. Potter; Sir George R. Prescott, Bart., and Sir Henry Thompson, F.R.C.S., were elected Members. Special thanks were returned for the following addition to the Donation Fund for the Promotion of Experimental Researches:—T. W. Helps, Esq., third donation, £10.

OUR French neighbours, recognizing the close relationship between horticulture and the fine arts, have taken steps to cement the alliance. We, "Gardeners' Chronicle," are able to announce that the Societe Imperiale et Centrale d'Horticulture intend to organize a special horticultural display in connection with the "Exposition des Beaux Arts," from the 1st to the 8th of May next, and to prolong it, with such decorative plants as can be retained, or renewed, till the 20th of June. The joint exhibition will be held in the garden of the Palais de l'Industrie. Horticulturists of all grades and nationalities are invited to take part in the display, and are encouraged so to do by the offer of prizes.

THE Indians seldom molest the telegraph wires, because at an early period they were led to believe that the "Great Spirit" was the presiding genius, a circumstance strengthened by the mysterious communication of thought. Some, however, doubted it, and one day a young Sioux Indian determined to show that he had no faith in the "Great Spirit's" connection with the wires, so he set to work with his hatchet to cut down one of the telegraph poles. A severe thunderstorm was going on at a distance; a charge of electricity being taken up by the wires was passed to the pole which the Indian was cutting, which resulted in the death of the Indian. For a long time thereafter the telegraph line was not molested.

IN Tuscany there are four mines of quicksilver, but at the present time three have been abandoned on account of the low price now obtained for this metal. The only mine now worked is that of Siele, near Castelazara. The quantity of ore extracted in 1864 was 3,000 quintals (300 tons), which yielded from 2 to 2¼ per cent. of quicksilver—about 6,000 kils. Quicksilver is also found in the neighbourhood of Agordo, in the Venetian provinces. The veins of sulphide of mercury are said to be most extensive but are worked on a very small scale. The following is the annual produce of quicksilver in Italy:—

Mines.	Quintals.	Value.
Castelazara . . .	3,000 . . .	3,600 francs.
Agordo	44,608 . . .	63,000 „
Smelting Works.		
Castelazara	66 . . .	34,200 „
Agordo	230 . . .	91,840 „

From 1863 to 1865 the imports of quicksilver were 10,900 kils., of the value of 71,100f.; and the exports 1,000 kils., of the value of 2,700f.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—2611, 2638, 2670
BUILDINGS AND BUILDING MATERIALS—2612
CHEMISTRY AND PHOTOGRAPHY—2606, 2608, 2618, 2656, 2666
CULTIVATION OF THE SOIL, including agricultural implements and machines—2582, 2583, 2627, 2639, 2640, 2659
ELECTRICAL APPARATUS—2599, 2622
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2581, 2590, 2597, 2613, 2623, 2624, 2628, 2642, 2658, 2660, 2664
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—2652, 2661
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—2594, 2619, 2649, 2655
GENERAL MACHINERY—2580, 2586, 2588, 2607, 2609, 2610, 2621, 2633, 2635, 2636, 2645, 2651, 2663, 2665
LIGHTING, HEATING, AND VENTILATING—2584, 2629, 2641, 2643, 2648, 2668
METALS, including apparatus for their manufacture—2596, 2637, 5657
MISCELLANEOUS—2585, 2589, 2593, 2595, 2601, 2602, 2603, 2604 2614, 2615, 2616, 2620, 2626, 2631, 2632, 2634, 2644, 2646, 2647, 2650, 2662, 2667, 2869, 2673
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2591, 2598, 2617, 2653, 2671
SHIPS AND BOATS, including their fittings—2592, 2605
STEAM ENGINES—2600, 2625
WARFARE—2587, 2630, 2654, 2672

2580 W. F. COOKE. *Improvements in tunnelling and quarrying slate and other minerals, and in machinery used for these purposes.* Dated September 11, 1867.

The patentee claims, first, tunnelling or quarrying slate and other minerals with a tunnelling machine working in combination with a traversing machine to cut parallel tunnels into the slate or mineral, as described. Second, tunnelling or quarrying slate and other minerals with a tunnelling machine cutting into the slate or mineral parallel tunnels intersecting one another, as described. Third, the quarrying by cutting into the slate two parallel rows of tunnels, one above the other, or at a distance from one another, and afterwards sawing or cutting away the block of mineral between the two rows of tunnels, as described. Last, constructing tools in the manner described for cutting away at the back of a circular block of slate or mineral which has had a groove cut around it by a tunnelling machine.—Patent completed.

2582 H. STEWART. *Improvements in driving the saw-blade cutters of reaping machines.* Dated September 12, 1867.

This invention consists in the application of a drum or pulley to the wheels or axle of a reaping machine. The drum or pulley has a zig-zag groove recessed into its periphery; a sliding block, stud, or roller attached to a lever works in the zig-zag groove, and causes the lever to vibrate upon a fixed centre. The outer end of the lever is attached by a connecting rod to the saw blade cutter, to which it imparts a reciprocating motion.—Patent abandoned.

2583 J. WILDERSPIN. *Improvements in the construction o horse rakes.* Dated September 12, 1867.

This invention consists in the combination and arrangement of certain mechanism whereby the lines or teeth of horse rakes can be raised, and the load accumulated thereon discharged, in a simple and effectual manner.—Patent completed.

2584 J. PERRIN. *An improved fuel economizer.* Dated September 12, 1867.

As it is probable that an extension of time for completing this patent will be petitioned for, the documents relating to the invention cannot at present be seen.

2585 J. W. HALFPENNY. *Improvements in tobacco pipes.* Dated September 12, 1867.

In this pipe the smoke passes through an orifice in the clay lining, where it becomes separated from the oil, the latter being retained in a conical chamber, whence it passes through the orifice first mentioned into a receptacle provided for the purpose at the bottom of the pipe, the smoke thus passing through into the stem entirely freed from the essential oil.—Patent abandoned.

2586 C. OATES. *Improvements in fire-escapes and ladders.* Dated September 12, 1867.

This invention comprises, among other features, the following:—Upon the axle of a pair of wheels, which serve as the means of transport of the fire-escape, two parallel levers are mounted, the axle serving as the fulcrum on which the levers turn. The longer arms of the levers serve as handles with which to push the fire-escape about on its wheels, as well as to raise and depress the short arms of the levers. The handles are connected near their ends by a cross-piece. The levers, axle, and wheels and cross-piece constitute a carriage on which the ladder of the fire-escape is supported and carried. The ladder is compound, consisting of two or more ladders sliding within one another, telescope fashion, the inner ladder being raised within the outer one by an endless chain, which passes over pulleys at the top and bottom of the outer ladder, to which chain the inner ladder is fastened near its lower end.—Patent abandoned.

2587 J. R. COOPER. *Improvements in breech-loading fire-arms.* Dated September 12, 1867.

Here the opening of the breech, the withdrawal of the case of the exploded cartridge, and the cocking of the hammer, are effected at one operation. The invention is especially applicable to central-fire guns, but may also be applied to guns in which the firing is not central. The patentee closes the breech of the gun by a closing block hinged to the side of the shoe or open breech chamber, and capable, by turning upon its hinge, of being shut down into or raised from the breech chamber. A spring acting on the joint of the closing block lifts it from the breech chamber and supports it in its raised position when the said block is at liberty to move. The hammer is jointed on the under side of the barrel, and on its liberation by pressure upon the trigger is forced upwards and made to strike the striker and discharge the cartridge. On the centre on which the hammer turns is an arm or lever which works in a slot at the back of the breech chamber. The top of this lever is provided with a comb or thumb-plate by which it is moved. A spring presses the lever into its raised or original position, and a projection on the front of this lever projects over the breech-block when the latter is shut down, and fixes it in its place during the discharge. On shutting down the breech-block, it presses upon the inclined upper side of the projection, and, forcing it back, causes it to snap over the block and bolt it down. When the arm or lever is depressed, it bears against the front of the hammer, and carries the hammer down until it reaches its cocked position. The cartridge-case extractor consists of a bar sliding in a slot in the breech chamber. The bar carries at its front a hook against which the rim of the cartridge bears, and at its rear end engages with the lever described. When the lever is drawn back, it draws back the extractor, and when the lever advances, the extractor moves forward.—Patent completed.

2588 W. BROWN. *Improvements in machinery for rolling hoops, strips, angle bars, and other bars of iron and steel.* Dated September 12, 1867.

The patentee claims, first, the arrangement or combination of two sets of rolls, one set on each side of the billeting or reducing rolls, substantially as described. Second, the combination with the said rolling machinery of two or more pairs of hard or planishing rolls, substantially as described and illustrated. Third, making in the billeting or reducing rolls of the said rolling machinery flattening and edging grooves, or edging, flattening, and edging grooves, substantially as described and illustrated. Also, when bars of small size are to be rolled, making the billeting or reducing rolls of the said machinery with elliptical and square grooves alternating with one another, substantially as described and illustrated. Lastly, making the grooves of ordinary three high billeting or reducing rolls with flattening and edging grooves, substantially as described and illustrated.—Patent completed.

2589 H. SYMONS. *Improvements in fireguards and fire screens.* Dated September 13, 1867.

This invention consists in making fireguards and fire-screens of a number of leaves made in various designs, either of plate metal or variegated wirework, each of which leaves has an entirely independent action, and revolves upon an axis which is attached to hooks adapted to fit on the bars of any stove or grate ordinarily used in domestic dwellings.—Patent abandoned.

2590 P. R. COUCHOUD. *Improvements in machinery for manufacturing chenille.* Dated September 13, 1867.

This invention consists, first, in the employment of an endless wire composed of one or more threads, contiguous with which are the chenille threads, pressed and maintained against the wire by rollers moved by a constant and regular force actuated by springs concealed in slots or otherwise. Second, the formation of the filamentous gut or cord forming the chenille by a circular creel bearing an unlimited number of threads, either single or complex, carried on bobbins or reels which, participating in the circular motion of the creel, wind the threads round the endless wire, and so form the filamentous cord. Third, the adaptation of two chenille threads, which, being wound on two different bobbins or reels, serve to close the pieces of gut and may be grouped in pairs of two, four, or more round the endless wires, so as to make a like number of chenille simultaneously, which has not previously been attempted. Fourth, the adjunction of a circular knife having either an eccentric rectilineal motion, or fixed with an oblique edge, by which a continuous manufacture is carried on. Fifth, the winding of the chenille on a receiver or receivers having a rotary motion producing the requisite twist, no matter what may be the form or position of the receiver, the principal characteristics of which are—first, that the twist may be varied according to desire or necessity; and, second, that the chenille is in no way injured by pressure.—Patent completed.

2591 J. REID. *Improvements in apparatus for finishing parts of locomotive wheels.* Dated September 13, 1867.

This invention relates, principally, to the crank pin holes in locomotive wheels, and the improved apparatus comprises arrangements for accurately adjusting a pair of wheels by the journals of their axle, for insuring the crank pin holes being accurately in planes at right angles to each other, and parallel to the journal axis, and for forming these holes with a uniform and correct taper. The improved details for forming the taper are also applicable to the axle holes.—Patent completed.

2592 F. A. PAGET. *Improvements in preventing the deviation of the compasses of iron or steel ships.* Dated September 13, 1867.

In his provisional specification the inventor states that he claims the following:—First, demagnetizing or altering the state of the magnetism of iron vessels, or any parts of or on such vessels, by encircling the vessels or the parts of or on such vessels with an electric spiral or spirals, as described. Second, the employment of any kinds of galvanic battery for the purpose of supplying the electricity to such an electric spiral or spirals. Third, the employment of any kind of magneto-electric machine for the purpose of supplying the electricity to such an electric spiral or spirals. Fourth, the employment of any kind of induction apparatus in combination with a battery. Fifth, the employment of any commutator, or any rheostatic apparatus, for regulating the currents from the battery, or from the magneto-electric machine. Sixth, the employment of men with diving dresses for winding or unwinding the insulated metallic wires round the hull. Seventh, the employment of the insulated wire in the form of open rings, which are afterwards united together by any known means. Eighth, the combination of this process with that by which the plates are rubbed with a permanent or electro-magnet, which latter process, however, he does not claim by itself —Patent abandoned.

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2593 W. F. BATHO. *Improvements in apparatus for heating, evaporating, and cooling liquids.* Dated September 13, 1867.

The patentee claims, first, making that part of the apparatus in which the heating and evaporating is effected, or which when used as a refrigerator contains the refrigerating liquid, of a coil or coils of pipes, combined with a series of pendant tubes, substantially as described and illustrated in the drawings. Second, the construction described and illustrated in the drawings of a deflector or guide for the pendant tubes of apparatus used for heating, evaporating, and cooling liquids, by means of a screwed bush of brass, or other non-corrosive metal or alloy at the top of the said outer tube, as described.—Patent completed.

2594 R. LOWE and J. TAYLOR. *Improvements in the manufacture of articles of jewellery.* Dated September 13, 1867.

Here the patentees form the body or foundation of the article of wire gauze, made of gold wire, or wire of other metal or alloy. The wire gauze is readily fashioned into the required shape, and the figure of the article is secured by an edging made of a piece of open-jointed tubing of small diameter.—Patent completed.

2595 J. M. NAPIER. *Improvements in wine glasses, and in stands or holders for the same.* Dated September 13, 1867.

This invention has for its object improvements in wine glasses which are not provided with a foot or base, and in the stands or holders for supporting them (such as are described in the specification of a patent, dated March 11, 1865 (No. 693), and consists in furnishing such wine glasses with movable stems, of any suitable material, attached to the bowl of the wine glass by screw, spring, or other convenient fastening, so that they may be removed and replaced with ease.—Patent completed.

2596 S. DALTON. *Improvements in the manufacture of iron and steel.* Dated September 13, 1867.

The patentee claims treating iron in a manner similar to the puddling or boiling process until it is in a state fit to be balled or made into blooms for shingling or rolling, and then, in place of so doing, melting the metal and casting it into moulds. He also claims adding spiegeleisin, or other cast iron, to the puddled or boiled metal when it is in a state fit for balling or forming into blooms for shingling or rolling, and, when the mixture is thoroughly melted, casting it into moulds. He also claims constructing furnaces having flues under the working bed, in the manner set forth.—Patent completed.

2597 W. WHITEHEAD. *Improvements in printing fabrics, or in producing patterns thereon.* Dated September 13, 1867.

Here the patentee prepares the fabric (which he prefers should be of silk or wool) by dyeing it with an aniline colour; it may be magenta or purple, or other dye, such as is prepared from aniline, and he then prints upon the fabric so dyed the pattern desired, using for this purpose an alkali (he prefers potash) thickened with gum and sulphate of lead; or it may be other powder which will prevent the pattern spreading. He then places the piece in a steambox together with red prussiate of potash and oxalic or other acid, and the steam being turned on, a gas is generated which, acting with the material which has been printed on to the fabric, discharges the aniline dye in the parts on to which the alkali has been printed, and so a white figure is obtained.—Patent completed.

2598 H. A. BONNEVILLE. *A new and improved railway brake.* (A communication.) Dated September 14, 1867.

This invention consists in interposing the bent back lower ends of the iron blocks between the wheels and the rails. The blocks of each carriage are secured by connecting rods, and the whole is suspended on rollers at the upper ends of the blocks and rolling on an iron bar placed in an inclined plane, and forming part of a frame fixed under the carriage. Each apparatus is connected with the following and the preceding one by iron bars, and the keys which may be taken off at will to set the carriages free from each other when desired. The apparatus of the first carriage is connected with a piston rod working in a special cylinder of the steam engine. By actuating this piston all the blocks are repelled backward, and at the same time lowered to a level with the rails, the rollers run along the inclined planes from the front towards the rear; each wheel then mounts on its corresponding block and slides with friction on the rail, thus operating the stoppage of the train.—Patent completed.

2599 W. G. BROWNSON. *Improvements in telegraphic apparatus relating especially to telegraphic relays, repeaters, and commutators.* Dated September 14, 1867.

The documents relating to this invention cannot at present be seen, an extension of time for completing the patent having been petitioned for.

2600 W. E. NEWTON. *A mode of increasing the efficiency of steam for motive power purposes.* (A communication.) Dated September 14, 1867.

The object here is to increase the efficiency of steam as a mechanical agent for driving machinery, &c., by employing in conjunction with it highly heated air under pressure from an air forcing engine, and mixing this air and steam together in the steam chest on their way to the cylinder of the engine. By these means a retreating or superheating of the steam, after it leaves the boiler, and while it is confined within the steam chest and cylinder, will be effected. Reference to the drawing is necessary for a full description of the invention.—Patent completed.

2601 J. ANTILL, G. GRIMES, and H. C. TUNKS. *Improvements in the construction of cores used in casting metallic pipes or tubes of a curved or syphon form.* Dated September 14, 1867.

This invention consists in forming the cores of such a material that they may be easily broken to pieces and removed from the interior after the casting is completed. The substance the inventors make use of is the ordinary plaster of Paris, which they mix up with hair, cotton, or any other animal or vegetable fibrous material, in order to bind and strengthen it.—Patent abandoned.

2602 H. A. BORDIN. *An improved means and apparatus for preventing sea-sickness.* Dated September 14, 1867.

The patentee makes use of a flexible bandage or apparatus to go round the upper part of the human face, and so adapted that, when suitably pressed by the fingers, or kept air-tight by any other suitable means, the light shall be excluded from the eyes, whilst, in order to prevent the apparatus from pressing on these latter, or injuring them, two protuberances are formed in the apparatus opposite and over the eyes so as to allow to these latter their free movement. The apparatus can be fixed to the head of an elastic band, or any other convenient fastening.—Patent completed.

2603 R. CANHAM. *Improvements in means or apparatus for sharpening knives and other edged articles, which improvements are also applicable to grinding and polishing various surfaces.* Dated September 14, 1867.

This invention consists, first, in the employment of cylinders or rods of steel, stone, or other suitable material, fixed on end at any desired angle to each other, and mounted in suitable holders, with or without capability of adjustment to different angles, according to the particular angle desired to be given to the edge of the instrument to be sharpened. The invention also consists in the employment of suitable guides to maintain the knife or other article in the desired position whilst sharpening the edge.—Patent completed.

2604 J. JEYES. *A new or improved material to be used as a substitute for oiled silk, bladders, gut skins, india-rubber, and other waterproof materials and leather.* Dated September 14, 1867.

The patentee takes blotting paper, tissue paper, or thick paper, and covers or saturates the same on one or both sides with a solution or compound of the following ingredients:—Gutta-percha about one part, gum shellac about one part, coal tar about two parts, and methylated spirit about four parts. The gutta-percha, shellac, and tar are to be mixed separately from the spirit at a temperature of about 212deg. Fah., and then the spirit is to be added so as to form a complete solution of the ingredients.—Patent completed.

2605 P. CRAUSE. *Improvements in propelling boats, ships, and other vessels.* Dated September 16, 1867.

This invention consists in the employment of a cylinder or cylinders closed at the inner and open at the outer end, and inserted in the side or sides of the vessel, in which cylinder or cylinders is or are contained a similar cylinder capable of working therein by the action of the piston rod of a steam engine. The inner cylinder is driven and caused to act as a piston or plunger on the water by a rod passed through the closed end of the outer cylinder, and connected to the piston rod of the engine or other motive power. There are other features comprised in the invention.—Patent abandoned.

2606 G. PICKIN. *Improvements in the treatment and preparation of mineral oils and spirits for illuminating and other purposes.* (Partly a communication.) Dated September 16, 1867.

This invention has more particularly for its object improvements in the preparation and treatment of volatile oils or spirits obtained by the distillation or refining of petroleum, shale, or coal oil, or gas tar, or other analogous mineral oils, whereby the illuminating power of such spirits or light oils is improved, and by which means they are rendered safe and free from danger by explosion or ignition by contact of flame with the vapours. And for the purpose of carrying out the improvements as above described the patentee takes a quantity of light oil or spirit, and to every hundred gallons by measure he adds the following ingredients, viz.:—Of pulverized hemlock bark, 1½lb.; of flax seed, 1½lb.; of white oak bark, 4lb. to 5lb.; of muriate of soda or common salt, 3lb. to 5lb.; these are to be carefully mixed with a portion of the bulk of the spirit or other light oils, and after being steeped for a sufficient time are to be strained off through suitable strainers or bags, and then returned to the main bulk of the spirit or oil.—Patent completed.

2607 J. A. M'KEAN. *Improvements in machinery for cutting rocks.* (A communication.) Dated September 16, 1867.

This invention will probably be described and illustrated in a future number of this journal.—Patent completed.

2608 P. DUMONT. *An improved manufacture of soap.* (A communication.) Dated September 16, 1867.

The soap forming the subject of this invention, and which the inventor calls mineral soap, is composed of potash of commerce, animal fat, cocoanut oil, river water, carbonate of potash, and fine sand. The proportions are as follows:—Potash of commerce, 6 kilogrammes; animal fat, 22 kilogrammes; cocoanut oil, 2 kilogrammes; river water, 9 kilogrammes 950 grammes; carbonate of potash, 50 kilogrammes; fine sand, 50 kilogrammes.—Patent abandoned.

2609 G. F. BRADBURY and T. CHADWICK. *Improvements in, or applicable to, sewing machines.* Dated September 16, 1867.

We cannot here give space to the details of this invention.—Patent completed.

2610 W. J. CUNNINGHAM. *Improvements in means or apparatus to be employed to sewing machines, and to other machines wherein cams or cam surfaces are employed working in connection with trucks or rollers, by means of which they are in working rendered comparatively noiseless.* Dated September 16, 1867.

This invention is not described apart from the drawings.—Patent completed.

2611 C. HOLSTE. *Improvements in blast furnaces.* (A communication.) Dated September 17, 1867.

This invention relates to improvements in the hearth of blast furnaces in which the scoria or slag is continually discharged, but in such manner as to remain at the same level within the hearth with as little fluctuation as possible. The hearth is completely closed by carrying the walls to the bottom on all sides the tymp; the fore part of the hearth, and the dam used heretofore in blast furnaces, are done away with by this construction.—Patent completed.

2612 W. LE DUC. *Improvements in the mode of covering roofs with slate or other materials, which improvements are applicable also to the covering or forming of walls.* Dated September 17, 1867.

Here the pieces of slate, &c., are made in the form of squares, having two of their corners situated diagonally opposite to each other cut off or removed, so that the piece of slate when prepared for use presents the form of a six-sided figure. In laying the pieces of slate they are arranged in horizontal rows, with their shorter sides in juxtaposition, the lower rows being first laid, and each succeeding row above so placed that its lower corners overlap and cover the joints or intervals between the shorter sides of the pieces of the lower row.—Patent completed.

2613 W. BRAILSFORD and J. GADSBY. *Improvements in the manufacture of lace made on bobbin net or twist lace machines.* Dated September 17, 1867.

The patentees claim the arrangement of the warp threads and bobbin threads in such manner as to produce an open ground or mesh in conjunction with fine weavings, and the ornamentation thereof by the use of embroidering threads, so as to present a resemblance to the pillow or hand-made lace known as "Chantilly" lace, as described.—Patent completed.

2614 J. C. BAYLEY and D. CAMPBELL. *Improvements in firelighters and fire revivers.* Dated September 17, 1867.

This fire-lighter consists of a mixture of wood sawdust, turnings, or shavings, and resin. The resin must be first melted and the sawdust or other materials above mentioned added to it; when thoroughly incorporated the composition is moulded into the required forms, and when dry is ready for use.—Patent abandoned.

2615 T. TURNER. *Improvements in mounts or holders for maps, tablets, prints, blinds, and similar articles.* Dated September 17, 1867.

This invention consists in constructing mounts or holders of two half rollers or cylinders—that is so say, a roller or cylinder divided longitudinally, and in providing means for fastening the half rollers or cylinders together at each end. This provision for fastening consists either of a circular groove formed near each end of the roller to receive an elastic band, or of two plain or internally threaded conical or other suitably formed caps made to receive the two ends of the roller which are of corresponding form. The top of the map, tablet, or other article or articles to be held is placed between the two rollers, and the elastic bands or caps are then fitted over their ends, so as to keep them together, whereby the map or other article is securely held between them.—Patent completed.

2616 S. JAY. *A new or improved apparatus for adjusting or securing scarfs, neckties, and other articles of apparel.* Dated September 17, 1867.

The object here is to prevent scarf and neck-ties from rising up the collar, and the invention consists of two main parts, viz., one or more turned-down pins or points which are inserted into the article to be adjusted or secured, and one or more turned-up hooks, preferably flat, to take under another article of apparel, which, in the case of scarfs and neck-ties, would be the collar. These two parts are connected together by a piece of tape and their distances may be adjusted as required.—Patent abandoned.

2617 S. C. AMESBURY. *Improvements in apparatus for communicating between passengers and guards of railway trains, and between guards and engine drivers of railway trains.* Dated September 17, 1867.

This motive power communication and connection is by means of the axle of the carriage or van, and communicating with an alarm apparatus in such a way that, on a handle inside the compartment being displaced while the train is in motion, an alarm is at once mechanically set going. The alarm may be of various construction, and is to be actuated by a belt or chain encircling the axle of the carriage or van.—Patent abandoned.

2618 T. BELL. *Improvements in treating the oxide of iron residues of gas purifying, in order principally to extract sulphur therefrom.* Dated September 17, 1867.

Here the inventor treats the oxide of iron residues with bisulphide of carbon, by which the sulphur is taken up from the oxide; afterwards he draws off from the oxide of iron residue as much bisulphide of carbon as practicable, and treats it again and again in a similar manner with fresh bisulphide until there is no sulphur remaining in the oxide. He afterwards distills off, and so recovers the remaining bisulphide, leaving only cyanides and a few other impurities in the oxide of iron, which may be afterwards burnt off or otherwise removed. To obtain the sulphur from the bisulphide of carbon he subjects it to distillation, by which the bisulphide is driven off and recovered to be again used, and the remaining sulphur may be afterwards melted and formed into cakes or bars for use.—Patent abandoned.

2619 D. GARDNER. *Improvements in spring mattresses, sofas, couches, and chairs.* Dated September 17, 1867.

This invention consists, essentially, of a mode of binding or fastening and retaining the helical volute or spiral conoidal wire springs forming the main resting or seating part of spring mattresses, sofas, couches, and chairs, in their proper position, ranged in horizontal, parallel, straight rows at any desired distance apart, both longitudinally and transversely, so as to cross each other at right angles or diagonally at any other desired or suitable angle, by long flat straps or bands of thin rolled iron or steel (or in place of each flat band one or more wires might be employed) lying in the same direction as the rows of springs, and across the axial line of their ends where the bands are made to cross each other and be laced under and over the end coil of the springs, so as to bind the springs to the frame or set of straps crossing each other, by preference in a lacing manner alternately over and under each other, as well as being so laced to the last wire at each side of the springs.—Patent abandoned.

2620 T. STEVENSON. *Improvements in the manufacture of faggots or firelighters.* Dated September 17, 1867.

This invention consists in arranging the radial pieces of wood, which are of uniform length, round a central core or nave on which the inner ends of the radial arms or pieces press uniformly. The outer ends of these radial pieces fit or rest in grooves or indentations made or cut in the curved pieces which form the outer rim or felloe of the wheel. When the whole are bound together with an enveloping string, and the wheel is dipped in melted resin, the article will be ready for use.—Patent abandoned.

2621 A. M. CLARK. *Improvements in valve closet apparatus, part of which is applicable for regulating the flow of water in other cases.* (A communication.) Dated September 17, 1867.

This invention consists, first, in the application to such apparatus of an elastic valve of peculiar construction as a substitute for the arrangement now in use. Second, in means of regulating the pressure of the water in the pipes, which is also applicable for regulating the flow of water in other cases. Third, in the application to water-closets generally of means of separating the solid and liquid matters in the basin itself. Fourth, in the application of a cock for regulating the pressure of the water from the mains which also regulates the supply to the basin.—Patent completed.

2622 F. H. VARLEY. *Improvements in apparatus for testing telegraph conductors, part of the invention being applicable to other purposes.* Dated September 18, 1867.

This invention is not described apart from the drawings.—Patent completed.

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2623 W. W. BURDON. *A new or improved process of bleaching fibre.* Dated September 18, 1867.

Here the patentee first takes the fibre or material to be operated on, and dries it well by artificial heat; he boils the soft material and reduces the hard to shavings; he then puts it into a caustic alkaline solution, and boils; he next washes it well from all impurities, and exposes it to the light; he then puts it into a solution of chloride of lime, or a solution of lime and water, and allows it to remain some time. Next he adds sulphuric acid, or hydrochloric acid, and lets it steep, then washes and exposes it to the air on a floor, or on the grass; he then boils again as before and exposes to light; and he washes again and repeats lying in the solution and boiling, and exposes for some time to the air and light; and he uses the sulphate of magnesia, steeping the material in it, and adding sulphuric acid, also nitric acid, and hydrochloric acid, as he finds necessary or convenient.—Patent completed.

2624 C. LITSTER and G. STOREY. *Improvements in looms for weaving.* Dated September 18, 1867.

The documents relating to this invention are with the law officers under objection, and cannot at present be seen.

2625 T. ADAMS and G. J. PARSON. *Improvements in, and applicable to, slide valves.* Dated September 18, 1867.

This invention has for its object the formation of steam-tight joints applied to the working surfaces of slide valves, and consists in the adaptation and application of metallic packing rings to the steam displacement rings, or to the seating of the valve, or to the valve itself.—Patent completed.

2626 J. SOAMES. *An improved candle fixer.* Dated September 18, 1867.

This candle-fixer consists of a metal button or disc of a suitable diameter, with a shank or pin on its under side, and having on its upper side or face claws or angular and tapered prongs, of which there may be three or more, of any convenient height, projecting upwards, for receiving and holding the lower end of the candle. To the shank or pin projecting from the under side of the button or disc a spring is fixed. This spring is made of suitable dimensions to be received into the socket of a candlestick, according to its diameter, and the size of the candle to be used, and by the expansion of the spring firmly secures the candle and candle-fixer.—Patent abandoned.

2627 T. B. WILKINSON. *Improvements in apparatus for crushing beans, oats, and other grain or seed.* Dated September 18, 1867.

Here, at the lower end of a hopper (into which the grain or seed to be crushed is placed) is an outlet case or trough, in which are enclosed two serrated surfaces, between which the grain or seed must pass as it leaves the hopper. One of these serrated surfaces is formed on a flat plate, which, by a weighed hand lever on the outside, can have a vertical to-and-fro motion imparted to it. The other serrated surface, which may be somewhat curved, is carried by and can be turned on a centre or pin at its upper end, and the lower end of this serrated plate is acted on at the back by a screw in such manner that it can be set to or from the lower end of the moving plate.—Patent abandoned.

2628 H. M. MELLOR. *Improvements in circular knitting frames.* Dated September 18, 1867.

This invention relates to arranging that class of circular knitting frames in which a circle of fixed needles is employed, in such manner as to produce work with a tuck, rib, or seam down it from end to end, so that the work may more nearly resemble that produced on a flat frame, and also arranging such knitting frames so that they may produce ribbed work. The details of this invention are too voluminous to be quoted here.—Patent completed.

2629 R. WATSON. *Improvements in apparatus for distributing gas for heating and lighting.* Dated September 19, 1867.

Here the inventor erects at or in communication with gasworks a strong metallic vessel, called by him the container. By a pump (or a series of pumps), the one delivering into the other, or by water pressure or other means, he forces or compresses gas in the container, and maintains a high pressure therein. A number of taps or valves are fitted into the container through which the high pressure gas is delivered into portable vessels, called by the inventor the distilling vessels. The distributing vessels are those which are filled from the container and are carried to the places where the gas is required; they are made of metal of a cylindrical or other suitable shape, and are provided with taps of valves and connections corresponding to those on the container, so that they can be easily and quickly coupled on to and disconnected therefrom. Lamps to which the said distributing vessels are connected at the place where the gas is to be burnt, or the said vessels themselves, are fitted with means for controlling or cutting down the pressure to a proper burning point, and such means consist in fitting into a small vessel in the delivery pipe, or in an enlarged part of the delivery pipe, sponge or other porous and compressive material. The gas in its passage to the burner, by first coming into contact with one side of the said sponge or other material, compresses it and reduces the area of the openings therein, more or less in proportion to the pressure, and so allows at all times only the required quantity to pass to make proper combustion.—Patent abandoned.

2630 T. C. CLARKSON. *Improvements in the manufacture of ammunition boxes, pontoons, baggage waggons, and various equipments for civil, military, and naval purposes.* Dated September 19, 1867.

The extreme length of this specification prevents our quoting it here at sufficient length for an intelligible abstract.—Patent abandoned.

2631 P. PORTER. *An improved map, blind, scene, and picture roller.* Dated September 19, 1867.

This picture roller, &c., consists of an upper frame or moulding of twice the usual breadth to admit of rolling or folding lengthways, and parallel to this frame is attached a roller turning on its axis, supported at the ends, and leaving room for the map, scene, or picture to move easily up and down between the roller and the upper frame or moulding. The maps, pictures, scenes, or blinds are provided with a roller at each end, and being reversed they may each be respectively exhibited while the upper frame remains in position by means of a cord attached to each roller in the centre, by which they may be elevated or depressed at pleasure.—Patent abandoned.

2632 J. RUST. *A new or improved material for decorative purposes.* Dated September 19, 1867.

The patentee claims the manufacture of a new or improved material applicable for decorative purposes by melting glass and sand, or other earthy matter, together in a crucible or furnace, with the addition of metallic oxides or other colouring matters, and moulding or casting the same into the requisite forms.—Patent completed.

2633 W. J. MURPHY. *Improvements in the method of, and apparatus for, obtaining and applying motive power.* Dated September 19, 1867.

This invention relates to the application of hydrostatic pressure, and also atmospheric pressure, as a motive power. The inventor proposes as a mode of propelling ships or vessels (by means of the hydrostatic pressure produced by their own displacement) that, in the hold or bottom part of every such ship or vessel, there shall be fitted a large tube or cylindrical vessel curved into a semicircle, so that the two ends both project forwards, the curved tube or vessel being filled with water, and the ends being elongated and forming straight cylinders in which two solid pistons are inserted, the outer ends of the rods of such pistons being furnished with heads which bear against strong transverse beams suitably fixed in the hold or bottom of the vessel. In the centre of the semicircular part of the cylindrical vessel or tube a small injection pipe is to be fitted, having a plunger working therein. The other or larger end of the plunger is to be fitted into a shorter cylinder open at both ends and surrounded by the water at the stern. By this means the pressure produced by the displacement of the water by the vessel acts upon the piston end of the plunger, throwing the force of the pressure upon the smaller end of the plunger working in the injector, and consequently the hydrostatic pressure thus created forces the two piston heads against the transverse beams, thus causing the ship or vessel in effect to act as a piston in a cylinder of water, and propelling it by an external pressure in the same manner as the wind acts upon sails.—Patent abandoned

2634 J. HUGGINS. *A polarizing kaleidoscope.* Dated September 19, 1867.

This invention consists in a combination of apparatus whereby the varied changes of pattern produced by the well-known instrument termed the "kaleidoscope" are viewed by means of polarized light.—Patent abandoned.

2635 W. MOLINEAUX. *Improvements in machinery for rolling bars, rods, and plates of iron, steel, and other metals.* Dated September 19, 1867.

This invention consists of an arrangement of parts for acting upon the upper roll of a pair of rolls so as to lower the said upper roll to the required extent, and at the required time, to produce the desired taper or varying thickness, or irregular figure, in the bar, rod, or plate passing through the rolls.—Patent abandoned.

2636 T. BLETCHER. *Improvements in sewing machines.* Dated September 19, 1867.

This invention relates to sewing machines which work with two threads and produce a stitch known as the "lock stitch." The improvement consists, chiefly, in the novel construction, arrangement, and combination of devices for forming the stitches, and in the mechanism for operating the same. The upper thread is carried by a vertically reciprocating needle, and is thereby passed through the cloth or other material in the usual manner. The under thread is carried by a bobbin, which is supported to turn freely upon a pin or rod enclosed in a case or holder. The latter is somewhat similar in form to the flying shuttle employed in other sewing machines, but instead of being caused to move through the loops of needle thread, the holder remains stationary while the successive loops of thread are passed over it by means of a vibrating hook of particular formation, and a lever with elastic arms. The hook places the loop upon the point of the bobbin case, and the elastic lever draws the loop upward between the case and its support, and tightens the thread as each stitch is formed.—Patent completed.

2637 J. G. WILLANS. *Improvements in the manufacture of iron.* Dated September 19, 1867.

The patentee claims forming a mixture of manganiferous iron ore and such coal or other carbon as will cause it to cohere at a red heat, the carbon being in excess of the quantity required for combining with the oxygen in the ore, but insufficient to afford by blast the requisite heat for melting it after its reduction, and the smelting such mixture by other fuel in blast furnaces so as to obtain spiegeleisen or similar compound of manganese, carbon, and iron therefrom, as described.—Patent completed,

2638 H. FISHER. *Improvements applicable to steam boiler and other furnaces.* Dated September 19, 1867.

This invention relates to a former patent, granted to Mr. J. Fisher, dated December 26, 1865 (No. 3338), and one of the main objects of the invention is to prevent, as far as possible, the destruction of the materials forming the furnace. When applied to the furnaces described in the specification of Mr. J. Fisher's patent, the invention consists in the form of hollow brick fuel rests or tubes for the upper tier thereof, whereby the midfeather support may be in some cases dispensed with; and also in the form of the fuel rests when used as water passages. The details of the invention are voluminous.—Patent abandoned.

2639 J. H. SAMS. *Improvements in drill sowing machines, in horse rakes, and in horse hoes.* Dated September 19, 1867.

We cannot here give space to the details of this invention.—Patent completed.

2640 W. W. GIBSON. *Improvements in decorticating and cleaning cereals, and in the machinery or apparatus employed therefor.* Dated September 20, 1867.

This apparatus consists of a revolving drum which may be made either of wood or metal. On the surface of this drum blades or strips of glass, porcelain, common clay, &c., are fixed. The drum is situated within a chamber in which the grain to be decorticated is placed, the sides of the chamber being composed of wire gauze. The grain to be cleaned and decorticated is fed into the apparatus from a hopper at the top, and as it passes between the surface of the revolving drum and wire gauze casing the triturating or rubbing action to which it is thus submitted causes it to be decorticated and cleaned, and the husks and cleanings are blown out through the meshes of the wire gauze covering. In place of forming the casing entirely of wire gauze, it may be partly formed of chambers containing glass, porcelain, clay, or pottery ware strips, the strips being fixed in a manner similar to that by which they are held in the drum. The decorticated and cleaned grain passes out through a spout at the bottom of the case.—Patent completed.

2641 W. POTTS. *Improvements in apparatus for ventilating rooms and buildings.* Dated September 20, 1867.

The patentee claims constructing and arranging in the cornices of rooms and buildings, or at the highest convenient part of the room or building, two independent or separate channels, situated at different levels, the upper one serving to collect and remove the hot and vitiated air from the room or building, and the lower one serving to introduce cool and pure air into the room or building, the hot and vitiated air entering its channel, and the cool and pure air passing from its channel through ornamental or other perforations or wire gauze, as described.—Patent completed.

2642 J. J. and E. HARRISON. *Improvements in carding engines.* Dated September 20, 1867.

This invention relates to that part of the carding engine called the doffer, and consists in improved modes of removing the fleece from the doffing cylinder. Instead of the ordinary doffing comb worked by mechanical movements, the inventors employ a draught of air directed obliquely or tangentially against the card of the doffing cylinder, either inside, or so as to part the fleece from the card, and allow it to be delivered in the usual manner.—Patent abandoned.

2643 L. LENZBERG. *Improvements in gas lamps and burners for the same.* Dated September 20, 1867.

This invention has for its object increasing the illuminating power of gas in outside and inside gas lamps, and consists, first, in adapting to gas lamps a reflector similar to that used in "sunlights" of metal or earthenware, enamelled, silvered, painted or glazed, or prepared with any other suitably reflecting surface, and of a conical, hemispherical, or other suitable shape, in combination with the ordinary sunlight burner, or with the improved burner described in the specification. Second, the invention consists in an improved burner. The reflector and burner are placed inside the lamp frame, one or more openings being left in the reflector for the escape of heated air. Spaces or openings are left or made around the lamp frame to form a current for carrying off the heated air, and for cooling the reflector. The lamp frame is so constructed that its top or bottom is removable, or movable on hinges, to permit of cleaning or repairs.—Patent completed.

2644 A. M. CLARK. *Improvements in the means of tinting or colouring artificial flowers and foliage.* (A communication.) Dated September 20, 1867.

Here the inventor applies the colours by the aid of chromo-lithography, by which means he obtains the desired result in a speedy and economical and more perfect manner than hitherto, mineral colours being employed instead of vegetable, which are infinitely more expensive.—Patent abandoned.

2645 F. T. M. A. GUYON. *A typographic fixiform.* Dated September 20, 1867.

This invention is not described without reference to the drawings.—Patent completed.

2646 C. M'DERMOTT. *An improved slate sponge.* Dated September 20, 1867.

This invention consists of an india-rubber hollow ball, and a piece of sponge, the sponge being attached to the ball by an aperture in the rubber into which a corner of the sponge is fixed. If the air be pressed from the ball, and the ball then dipped into water, it will fill immediately, and the sponge can be moistened from time to time, as may be required, by a slight pressure of the ball.—Patent abandoned.

2647 C. M'DERMOTT. *An improved metallic seal for envelopes.* (A communication.) Dated September 20, 1867.

Here the inventor employs, first, an eyelet of the ordinary shape and size, but having a brim or head of about the size of a threepenny piece. At the edge of this brim are two small prongs at an equal distance from each other, and bent parallel with the eyelet. Second, a round piece of metal of about the size of a threepenny piece, having a hole in the centre of the diameter of the eyelet above alluded to. At the edge of this metal are two prongs, at an equal distance from each other, and bent at right angles to the body of the metal. In applying this contrivance to an envelope, the brim of the eyelet is fastened to the inner flap of the envelope by the two prongs, which are pressed through the paper, and clenched on the reverse side. The round piece of metal is fastened to the outer or gummed flap by the prongs in a similar way, the hole in the centre of the metal being carried through the paper. When the envelope is closed, the eyelet comes through the outer flap, and the metal attached to it, and is then clenched or bent down.—Patent abandoned.

2648 J. G. TONGUE. *Improvements in the preparation of oil for illuminating or other purposes, and in the construction of the lamps employed for burning the same.* (A communication.) Dated September 20, 1867.

This oil is composed of two parts, or thereabouts, of highly refined rape oil, and one part, or thereabouts, of a product resulting from the distillation of petroleum or mineral oil. Lamps constructed in accordance with the second part of these improvements may be constructed so as to have the appearance of ordinary moderator lamps, although the form of such lamps may be greatly varied. The outer wick tube of the burner of a lamp constructed for burning oil of the above description, a short distance below the point at which the wick burns, is perforated with a series of small holes, so that when the oil rises to this point, it flows through the holes into an annular space formed by another tube which surrounds the wick tube, by which means any excess of oil is re-conducted to the oil reservoir.—Patent abandoned.

2649 R. RAFFAULT. *An improved petticoat.* Dated September 20, 1867.

This invention consists in providing plaits, folds, creases, or gatherings in suitable parts of petticoats, with the object that the said plaits, folds, creases, or gatherings in expanding should offer room for the knees or other protuberant parts of the body of the wearer when sitting or stooping down, or reclining, and which plaits, folds, creases, or gatherings may afterwards resume their original shape, so as not to alter the general appearance of the petticoat.—Patent completed.

2650 S. DREYFOUS. *Improvements in bread ovens, and in their combination with various apparatus for the manufacture of bread.* (A communication.) Dated September 20, 1867.

This invention consists in combining the fireplace for the boiler of a steam engine with a bread oven or ovens, in order that the oven or ovens, and the boiler, may be heated simultaneously by the heat arising from the fuel of the fireplace, whilst the engine serves for working a kneading machine, or other suitable apparatus, subservient in bread making.—Patent completed.

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2651 E. H. NEWBY. *An improved alarm apparatus.* Dated September 20, 1867.

This invention relates to an apparatus which is chiefly designed for temporary attachment during the night to the door or window of a bedroom, to indicate any attempt made to open the said door or window. The apparatus gives warning by means of a bell, which, by the action of a simple arrangement of clockwork, is caused to ring violently when a vibrating hammer or striker is released from a catch or stop.—Patent abandoned.

2652 W. HALL. *Improvements in separating yeast from liquid matters.* Dated September 20, 1867.

The documents relating to this invention cannot at present be seen.

2653 W. E. NEWTON. *Improvements in whips and whip holders.* (A communication.) Dated September 20, 1867.

This invention consists in making the whip tubular at its butt end, so that it may be held in an upright position upon a suitable stem or holder. The invention further consists in a stem or holder formed of metal, which is attached to any convenient part of the vehicle, and serves to sustain the whip when it is provided with a tubular butt, as hereinbefore mentioned. The invention further consists in the combination of a stem or holder with a whip formed with a tubular butt, whereby the efficient operation of the principal features hereinbefore indicated is secured. The invention further consists in constructing the loading at the butt of the whip in the form of a socket, so that no additional expense is involved in making the butt of the required tubular form, at the same time that the surface around the socket, being hard and smooth, no wearing away of the same is liable to occur. The invention further consists in certain means whereby the more secure retention of the whip upon the holder is obtained. —Patent completed.

2654 C. E. and J. GREEN. *A new or improved cartridge for breech-loading firearms.* Dated September 21, 1867.

Here the cartridge is shot out direct from the barrel of the gun, no metallic case being required. The inventors construct the case in the usual way, but prefer using waterproof paper; they then place a small portion of detonating powder between two or more pieces of pasteboard, which pieces of pasteboard are perforated and pressed down upon the powder; upon this pasteboard a layer or layers of vulcanized india-rubber is or are placed, through which the pin or striker of the breech apparatus penetrates the cartridge at its base, thus causing the explosion. With this cartridge no extractor is required.—Patent abandoned.

2655 P. CRAUSE. *Improvements in ventilators for hats and other coverings for the head.* Dated September 21, 1867.

This invention consists in the adaptation and application to a hat of a concave ring of thin sheet metal of about 1¼in. to 2in. internal diameter, so placed as to cover apertures formed in the hat, the inner end of such ring being fixed to the hat, and a space being left between the outer edge of the ring and the hat. By this means the air entering through the apertures, instead of passing directly on to the head, as usual, would be deflected and diffused by escaping at the space between the outer edge of the ring and the hat.—Patent abandoned.

2656 G. E. MARCHISIO. *Improvements in the treatment of the residuum which results from the purification of cotton seed oil, and of the residuum which results from the distillation of the said material, for the manufacture of isolating, preservative, and anti-corrosive compositions.* Dated September 21, 1867.

The patentee claims, first, the methods of treating the "foots" or residuum which results from the clarification and purification of cotton seed oil, and also of treating the residuum which results from the distillation, evaporation, or other analagous treating of foots, and the production therefrom of a composition in a liquid, semi-liquid, or solid state, applicable for the various purposes mentioned, substantially as set forth and described. Second, the manufacture and preparation of isolating preservative and anti-corrosive compositions, substantially as described and set forth, or any mere modifications thereof.—Patent completed.

2657 J. HARGREAVES. *Improvements in the manufacture of iron.* Dated September 21, 1867.

This invention has reference to a previous patent, dated August 22, 1867 (No. 2407), and relates to the use of a solution of chloride of manganese for separating shale and pyrites from coal. The patentee claims the use or employment of chloride of manganese, substantially in the manner and for the purpose set forth.—Patent completed.

2658 D. HOWARD. *Certain improvements in the manufacture of fabrics termed union flannels, and in other similar union fabrics.* Dated September 21, 1867.

This invention consists, first, in the employment and use of a warp composed of wool and silk, wool and cotton, or wool, cotton, silk, and China grass, or wool and any other fibrous substance which will mix with wool. Second, in the use of a weft composed of cotton alone, or cotton and flax, or cotton and silk, or cotton, flax, silk, and China grass, or the whole combined, or cotton and any other vegetable fibrous substances.—Patent abandoned.

2659 J. S. WILLIAMSON. *Drying, cleaning, and separating grain.* Dated September 21, 1867.

This invention is not described apart from the drawings —Patent abandoned.

2660 A. L. DICKINS and H. HEYWOOD. *Improvements in printing yarns or threads.* Dated September 21, 1867.

This invention consists in printing yarns or threads by passing hanks thereof between rollers, such hanks being held parallel to the axes of the said rollers. These rollers are provided with projecting rings, or other suitable parts, disposed along the rollers at intervals, according to the design intended to be produced, and when more than one colour is desired, they use two or more colour boxes provided with rollers for conveying the colours, and with projecting rings or parts corresponding to those upon the printing roller to which a particular colour is appropriated. —Patent abandoned.

2661 D. T. LEE. *Improvements in the application or combination of animal with vegetable food.* Dated September 21, 1867.

This invention consists in combining extract of meat of any description, in any proportion, and prepared in any suitable manner, but, by preference, upon Liebig's formula, with flour, meal, bran, cocoa, sugar, or other edible vegetable product, and then preparing, cooking, or otherwise treating the compound in the form of biscuits, cakes, sweetmeats, or any other form in which it may be adapted for consumption.—Patent abandoned.

2662 B. and A. B. BLACKBURN. *Improvements in lucifer matches or tapers, and in the apparatus for holding and igniting the same.* Dated September 21, 1867.

This invention has for its object to produce a lighted taper or match which will burn sufficiently long (say) five or ten minutes, to admit of sealing two, three, or more letters or parcels. To this end the invention consists, first, in employing short lengths of wax taper or wax matches, provided at one end with an igniting composition, which will ignite upon the application of friction. The opposite ends of these short lengths are inserted in a solid combustible composition, such as wax, tallow, or stearine, which is contained in a small or shallow cup. When this composition is cold, it becomes solid and hard, and it will firmly hold the match in place. Any convenient number of these small cups are to be fixed on a piece of cardboard, wood, clay, &c., so arranged that the matches or tapers may be brought in succession against a projecting hard substance, by rubbing against which their prepared ends will be ignited by the friction.—Patent completed.

2663 J. MEIKLEJON. *Improvements in machinery or apparatus for lifting, lowering, and transporting heavy bodies.* Dated September 21, 1867.

This invention is carried out as follows:—At the entrance, one end, or other convenient part of the building, a wheel is placed, centrally, or thereabouts, between the adjacent sides. An endless chain or band passes over the wheel, by pulling which the wheel is actuated. On the same axis as that to which the wheel is placed there is attached a drum, the periphery of which is formed to receive the links of a chain, the two ends of the chain being passed thence over pulleys, and downwards through guide eyes at each side of the building. To each end of the chain a hook is attached for holding the body or bodies to be lifted. On either side of the building in which the hoisting apparatus is erected angle, T, or channel iron guides are placed, upon each of which a travelling carriage is placed, and which is provided with hooks, so that when it is desired to transport a body it is raised, by the lifting gear, and attached to one or more hooks, on one of the travelling carriages, and when so placed the transportation is easily effected by an attendant pushing the carriage along the guides to the place desired, after which the body or bodies may be detached and lowered by means similar to that used for raising it, or by other lowering arrangement at present in use.—Patent abandoned.

2664 J. BAIRD. *Improvements in the treatment of jute, and in oils or preparations for softening the fibres thereof.* Dated September 21, 1867.

This invention has for its object the dispensing either wholly or partially with the use of fish oils, such as whale, seal, or cod oil, which have hitherto almost exclusively been employed in the treatment or preparation of jute for the purpose of softening the fibres thereof prior to its manufacture. These fish oils are not only in some cases expensive, but frequently their use is objectionable by reason of the excess of fibrinous or mucous matter which they contain, and which, though necessary to a certain extent, will, when in excess, tend to clog the fibres, and the machinery operating thereon Now, according to one part of this invention, the patentee proposes to dispense entirely with the use of fish oils, and to employ in lieu thereof any of those fatty oils (such, for example, as olein, lard oil, rape oil, olive oil, cotton oil) which are free, or comparatively free, from dissolved fibrine, such fatty oils being either employed separately or in mixtures of any two or more of them.—Patent completed.

2665 A. MACKENSIE and S. ROBINSON. *Improvements in apparatus to be applied to cisterns for preventing waste of water.* Dated September 21, 1867.

In applying this invention to water-closet cisterns, for example, the patentees construct inside the cistern, at the lowest part thereof, a gauge chamber of sufficient capacity to contain the requisite amount of water for one flushing of the closet. A small aperture is made in the side of this chamber at the bottom for filling the same from the surrounding water in the cistern, such aperture being opened by the act of closing the principal valve of the cistern, and closed when such valve is opened, a small inlet valve being employed for that purpose adapted to the aperture referred to. At the bottom of the gauge chamber there is fitted the valve-seat and valve, opening either into the old service box, or into a supply pipe leading direct to the basin. This valve is provided with a tubular spindle, having a piston, being connected to a float inside the closed chamber before referred to, and on the lower part of the piston is formed a valve cap, and on the upper part of the tubular spindle through which the piston works there is formed a valve seat, so that, when the piston is raised by the float to a given height, the second passage for water (namely, the passage through the tubular spindle) is closed, and remains closed until, by the opening of the principal valve, the chamber is emptied. This piston is further coupled by a wire to the usual overhead weighted lever which is connected to the "pull" or handle of the closet. The object of the entire arrangement is, first, to admit the full complement of water in the closed chamber to pass down through the principal valve when opened; and, second, to permit of a certain gauged or regulated quantity of water sufficient to fill the pan of the closet to descend through the tubular spindle of the main valve after it has been closed. This latter is the result of the quantity of water admitted to flow through the small open aperture being in a certain proportion in excess of the quantity which can pass down through the tubular spindle or piston valve, and, consequently, the chamber will in a short time become nearly full, and the float raised so as to close the inner valve. This float, however, is not sufficiently buoyant to open the principal valve.—Patent completed.

2666 D. SCULL. *Improvements in the treatment of xyloidine.* Dated September 21, 1867.

This invention consists in the substitution for such dehydrated spirit or naphtha of alcohol which has not been subjected to the process of dehydration, in conjunction with, and in combination with, certain substances and compounds mentioned in the specification, which substances and compounds are soluble therein, and which are insoluble, or nearly so, in water, such, for example, as fixed oils, vegetable oils, essential oils, resins, gum-resins, spirits of turpentine, fats, light oils, and naphtha from coal, and mineral naphthas, and the patentee employs such substances, or mixtures of the same, in such proportion, as that, although the substances individually possess but little, if any, solvent action on the hydrated xyloidine, they shall, by suitable admixture with alcohol, be rendered solvents of the same.—Patent abandoned.

2667 T. MUIR. *Improvements in washing rollers and blankets used by printers, and in the machinery or apparatus employed therefor.* Dated September 21, 1867.

Here the rollers to be washed are placed with their journals resting in brackets projecting upwards from a trough. In the trough a large revolving can or drum is placed, the can or drum being covered with blanket. The rollers to be washed are so disposed that, when placed on the blankets, their surfaces rest or bear upon the flannel-covered surface of the large revolving can or drum, and when the latter is revolved, its frictional contact with the printing rollers causes them also to revolve. Across the top of the washing machine a perforated pipe extends, and it is connected at the centre, or thereabouts, with a vessel or reservoir containing the washing fluid, which, as the machine is in action, drops through the perforations on to the rollers, and these being rubbed by the action of the blanket on their surfaces during the time that the washing liquid is falling, causes the ink and other matter adhering to them to be removed. The washing is finished by running clean water over the rollers after the washing liquid has been used.—Patent completed.

2668 A. AITCHISON and H. J. GRANTHAM. *Improvement in the production of carburetted gas, and in the apparatus and burner applicable thereto.* Dated September 21, 1867.

The patentees claim the method of carburetting gas by causing the same to pass into a globe or vessel containing any suitable hydrocarbon saturated in conjunction with sponge, or other absorbent materials, whereby the traverse or passage of the gas through the globe to the burner causes it to take up a sufficient quantity of hydrocarbon vapour to carburet the gas and increase its illuminating power; and also the apparatus employed therein, substantially as specified.—Patent completed.

2669 J. RIVES. *Improvements in the manufacture of metallic pens.* Dated September 21, 1867.

The first part of this invention has for its object the hardening of the points of metallic pens to render them more durable. For this purpose, after the pens have been tempered and split in the ordinary manner, the patentee places around the points of each pen a small bead or collar of copper (or other metal that is a good conductor of heat); he then heats the point in a flame, or by a blow-pipe, and plunges it either into water or oil, or otherwise cools it rapidly; by this means the points of the pens may be so hardened that they will even cut glass.—Patent completed.

2670 S. C. LISTER. *Improvements in furnaces.* Dated September 21, 1867.

This invention relates to a previous patent, dated July 17, 1867 (No. 2099), and has for one of its objects the supplying air to the gases and vapours as they arise from the surface of fuel on the firebars of a furnace. This he effects by forcing air by mechanical means into the furnace through perforations in chambers or pipes placed along the sides, or it might be along the centre, or at other points of a furnace; the perforations being above the surface of the fuel, a very intimate mixture of air and gases is thus obtained, by which combustion is facilitated, and so a saving of fuel is effected.—Patent abandoned.

2671 T. KENDRICK. *Improvements in self-acting folding carriage steps.* Dated September 21, 1867.

The connecting rod or lever which is acted upon by the carriage door, and by which the steps are unfolded and folded up, is, in the ordinary arrangement, connected to the side bars of the step, and passes through a slot or opening in the top step and back vertical plate. By this lateral connection the carriage door is subjected to much strain, and the object of this invention is to reduce the said strain to a minimum by so arranging the folding and unfolding mechanism as to cause it to act upon the steps centrally instead of at the side, as is usual.—Patent abandoned.

2672 J. R. COOPER. *Improvements in firearms.* Dated September 21, 1867.

This invention has for its object the prevention of the accidental discharge of firearms, and consists of the adaptation or use of a bolt or pin made to pass transversely through or bear against such part or parts of the firearm as will cause the said bolt or pin to fix the hammer, or to fix such other part of the firearm as will prevent the discharge of the firearm.—Patent completed.

2673 G. W. MCGEORGE. *Improvements in pipes for smoking* Dated September 23, 1867.

This invention consists in the adoption of an outer bowl, as usual, and a partition or partition bowl or receptacle for the oils disengaged in smoking (the same being provided with an aperture or apertures for the smoke), and an inner bowl for containing the substance to be used for smoking, also provided with an aperture or apertures for the smoke, as set forth, whereby the disengaged oils are deposited in the partition bowl or receptacle, and kept separated from any saliva from the mouth which may find its way into the stem or outer bowl. —Patent completed.

2674 C. RITCHIE. *Improvements in apparatus for regulating automatically the supply of gas, air, and water, or any one or more of them, to steam boilers heated by gas or otherwise, and for utilizing the heat of the gases produced or heated by combustion.* Dated September 23, 1867.

Here the patentee constructs in, or attaches to, the boiler, at any convenient part thereof, a small cylinder or receptacle, one end of which is in communication with the boiler. Within this cylinder or receptacle is a piston or valve provided with a spiral or other spring of suitable tension or pressure, to which piston or valve, or to its rod, is or are connected in any suitable way a weight or weights which tend to force it downward in the cylinder or receptacle, in opposition to the steam which passes from the boiler into the said cylinder or receptacle. The rod of this piston or valve is connected by a lever and toothed wheels, or in any other convenient way, with (in the case of a boiler heated by gas) the tap or other contrivance which regulates the supply of gas, and also with the tap or other contrivance which regulates the supply of atmospheric air, so that, when there is too great pressure of steam within the boiler, the supply of gas is lessened or cut off, and the supply of air is at the time regulated, as may be required, for the support of combustion, or for cooling down the contents of the boiler, in order that the water may not be prevented by excess of pressure of the steam from entering the boiler from the cistern or any other source of supply that may be used; and also that the pressure of the steam when it becomes too great may be lessened; and that when a damper is used to regulate the

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air pressing into or from the furnace, this damper may be opened or closed by the piston or valve arrangements above mentioned.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated March 3, 1867.

716 H. P. Reynoldson, Twister's-alley, Bunhill-row, Middlesex, bookbinder. Improvements in portfolios.

Dated March 4, 1868.

736 F. Cadby, Birmingham, cut and engraved glass manufacturer. Improvements in the construction of cruet and egg frames or stands.

Dated March 6, 1867.

772 D. Price, Dudbridge, and C. Rowe, Briscombe, both in Gloucestershire, engineers. Improvements in apparatus for combing or cleaning animals.

Dated March 7, 1868.

789 S. Brown, Blackfriars-road, Surrey, perfumer. An improvement in the method of ornamenting bottles, vases, and jars used for perfume or toilet purposes.

800 W. W. Greener, Loveday-street, Birmingham, gun manufacturer. Improvements in central-fire breech-loading guns and pistols.

Dated March 9, 1868.

807 H. B. Barlow, Manchester. Improvements in machinery for carding, combing, and straightening the fibres of cotton and other fibrous substances. (A communication.)

Dated March 10, 1868.

826 J. Vero, Dewsbury, Yorkshire, hatter. Improvements in machinery or apparatus for the manufacture of hats.

Dated March 12, 1868.

844 J. Bourne, Northumberland-terrace, Regent's Park-road, civil engineer. Improvements in auxiliary propulsion.

Dated March 13, 1868.

857 J. H. Maw, Broseley, Shropshire. Improvements in moderator lamps.

859 A. Taylor, Oak-street, Wolverhampton. Improvements in brakes or apparatus to control the rotation of an axis.

Dated March 16, 1868.

893 J. Murray, Westgate-street, Newcastle-upon-Tyne, merchant, and R. Warden, Ellison-street, Gateshead, brass finisher. Improvements in lamps for burning paraffin and other oils and spirit.

Dated March 17, 1868.

898 R. Smith, Compton-road, Islington. Improvements in the means and apparatus for extracting foul air or gases from mines, sewers, brewers' vats, and other places.

900 C. Womersley, Saltaire, Yorkshire. An improved lubricator.

902 Sir J. Macneill, Cockspur-street, Charing Cross. Improvements in the construction of indicating apparatus for showing the number of passengers carried in public conveyances during each journey, and the amount of fares paid.

903 P. M. Villamil, Coleshill-street, Eaton-square, Middlesex, artist. Improved apparatus to facilitate the ascending of gradients by locomotive engines.

905 W. R. Lake, Southampton-buildings, Chancery-lane. An improved substitute for hair stuffing, and mode of manufacturing the same from vegetables fibres. (A communication.)

906 J. M. Poisnel, Rue Hauteville, Paris, manufacturer. Improvements in the manufacture of straps, belts, bands, pipes, and other articles of india-rubber or similar fabric.

907 J. Thompson, Manor House, Camberwell-road, and J. Thompson, Camberwell Green, Surrey. Improvements in machinery for shaping wood, applicable especially for producing spokes for wheels.

908 J. M. Poisnel, Rue Hauteville, Paris, manufacturer. Improvements in the manufacture of coverings for the feet.

909 W. E. Newton, Chancery-lane. Improvements in producing steel and cast steel, and in furnaces used therein. (A communication.)

911 W. E. Newton, Chancery-lane. An improved apparatus for measuring and administering medicine. (A communication.)

912 J. F. Spencer, Sunderland. Improvements in working the valves of steam and other engines.

Dated March 18, 1868.

913 J. M. Ure, Glasgow, engineer. Improved apparatus for lifting the driving wheels of a locomotive off the rails when the locomotive is either running or stationary.

914 W. Sinale, Macclesfield, Chester. Improved machinery or apparatus for figure weaving, in combination with a jacquard loom.

915 C. F. C. Cretin Borne, Glasgow. Improved means or apparatus for ventilating or supplying air to mines and other places.

917 E. Butterworth, Calder Cottage, near Rochdale, Lancashire, machinist. Improvements in furnaces or fireplaces.

918 W. R. Lake, Southampton-buildings, Chancery-lane. An improved mode of, and apparatus for, effecting the continuous return into a steam boiler of the water evaporated and taken from the same. (A communication.)

919 G. Martin, Toads-moor Mills, near Stroud, Gloucestershire. Improvements in the treatment of mixed fabrics, and in the extraction of wool therefrom, and in the construction of apparatus to be used for such treatment, which apparatus is also applicable to other purposes.

920 A. V. Newton, Chancery-lane. An improved manufacture of covering for floors. (A communication.)

923 B. E. R. Newlands, F.C.S., Malvern-terrace, Charlton, Kent. Improvements in treating and obtaining products from spent oxide of iron which has been used in gas works or otherwise, to separate sulphur from sulphuretted hydrogen, and in the purification of sulphur obtained from such oxide of iron.

924 R. A. Wright, Homerton, Middlesex, engineer. Improvements in the mode of, and apparatus for, cutting and dressing millstones and other stones.

925 J. B. Linnett, Birmingham, printer. Improvements in the means of producing optical illusions.

926 G. Wailes, Stroud, Gloucestershire, engineer. Improvements in the manufacture of safes or strong boxes.

Dated March 19, 1868.

928 P. Hill, Leinster-square, Middlesex. Improvements in brakes for perambulators and other vehicles propelled by hand.

929 B. Parks, Lewisham, Kent. Improvements in machinery or apparatus for separating and crushing breeze or cinders in one combined action.

931 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in ventilating windows and window blinds. (A communication.)

932 J. Edwards, Wednesbury, Staffordshire, manufacturer. Improvements in props or supports for supporting the roofs of coal or other mines.

933 W. Redman, Bankfoot, Hebden Bridge, Yorkshire, self-acting minder. Improvements in means or apparatus for the formation or building of cop bottoms in machinery for spinning and twisting cotton or other fibrous substances.

934 E. Rowland, engineer, and J. Dalton, Manchester. Certain improvements in the method and arrangement of apparatus for closing dampers, which apparatus may also be employed for measuring liquids.

935 G. Davis, Serle-street, Lincoln's Inn. Improvements in machinery for combing cotton and other fibres. (A communication.)

937 W. Richardson, Oldham, Lancashire. Improvements in machinery for the manufacture of bricks and tiles.

938 F. Warner, Jewin-crescent, City, engineer, and H. Chopping, Roxwell, Essex. Improvements in windmills.

939 W. Hooper, Mitcham, Surrey. Improvements in treating india-rubber, and in the manufacture therefrom of fabrics and of insulated telegraphic conductors.

940 J. L. Geiger, Great Winchester-street-buildings, City. Improvements in doubling, twisting, and throwing silk, and in apparatus therefor. (A communication.)

942 L. Encausse, Madrid, Spain, chemist. Improvements in the application of remedial agents to the human frame, and in the apparatus employed therein.

943 H. Chamberlain and J. Craven, Wakefield, Yorkshire, engineers, and H. Wedekind, Dunster-court, Mincing-lane, City, engineer. Improvements in the burning and drying of bricks, lime, cement, and other like substances, and in the kilns employed therein. (Partly a communication.)

Dated March 20, 1868.

945 R. Side, Southwark Bridge-road, Southwark. A compound lever, introducing gravitation as a motive power to supersede a considerable amount of steam power.

947 C. Mather, Salford, Lancashire, engineer. Improvements in machinery and apparatus for opening and cleaning wool and other fibrous substances. (A communication.)

949 R. Meldrum, Pittormie, Cupar, Fifeshire. Improvements in steam engines.

950 A. Brownlie, Wishaw, Lanarkshire. Improvements in apparatus for heating air for grain kilns.

952 J. Abraham and T. R. Bayliss, Birmingham, machinists. Improvements in central-fire cartridges for breech-loading firearms.

953 J. H. Cooper, Regent-street, bootmakers. Improvements in the manufacture of boots for hunting, shooting, fishing, and other uses.

954 C. Gunner, Lucas-road, Kennington. Improvements in lifeboats.

955 J. H. C. Bade, Dalston, Middlesex, engineer. Improvements in close fire ranges.

956 G. Twigg, Birmingham, manufacturer, and H. Bateman, Barnes, Surrey, architect. Improvements in the manufacture of corkscrews.

957 S. Duer, Harewood-square, Middlesex, engineer. Improvements in the manufacture of packing for stuffing boxes, pistons, and bearings. (Partly a communication.)

Dated March 21, 1868.

958 G. Davies, Serle-street, Lincoln's Inn. Improvements in apparatus to be used in the manufacture of millstones, and in the working of hard stones in general. (A communication.)

959 E. D. Johnson, Wilmington-square, Middlesex. Improvements in the construction of pocket watches.

962 W. S. Boulton, Norwich, manufacturing engineer. Improvements in lawn mowers.

964 W. G. C. Hudson, Barbara-street, Islington. A new or improved sandal or overshoe for preventing slipping in frosty weather and other uses.

966 J. G. Jennings, Palace Wharf, Lambeth, sanitary engineer. Improvements in water-closets, and in apparatus for supplying water, and in sewers or drains for receiving the same.

Dated March 23, 1868.

972 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in metal ties or bands for securing bales of cotton or other substances. (A communication.)

974 C. E. Brooman, Fleet-street, City, patent agent. Improvements in machinery for the manufacture of lace. (A communication.)

976 J. Bronner, Frankfort-on-the-Maine, Prussia, manufacturer. Improvements in the construction of gas burners.

978 G. F. Guy, Bury St. Edmund's, Suffolk. Improvements in the manufacture of sugar and other alimentary substances from beet-root.

980 A. W. Ramsear, Gray's Inn-road, gunsmith, and F. W. Wilson, Edgware-road, Middlesex. Improvements in breech-loading firearms and cartridges.

982 C. de Bergue, Strand, Westminster, engineer. Improvements in locomotive engines, and in the modes of transmitting the power of a locomotive engine to the tender and other carriages of a train, for converting their wheels into driving wheels.

984 A. Barclay, Kilmarnock, Ayrshire. Improvements in barometers and thermometers, and in their combination with watches, clocks, and other instruments.

986 H. Treverton, Duke-street West, Smithfield, City, manufacturer, and E. H. Fowler, Brixton, Surrey, clerk. Improvements in frames or holders for lamp shades or glasses.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated March 30, 1868.

1083 C. S. Tyson, Prince George, Maryland, U.S., engineer. Improved mechanism for taking up the recoil of heavy ordnance.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," April 7, 1868.

3339 J. P. Smith. Manufacture of cutting tools.
3340 J. P. Smith. Coating metals with metals.
3343 J. A. and J. Hopkinson. Steam boilers.
3347 J. Hudson. Machinery for the manufacture of paper.
3360 H. F. Gardner. Means of treating metals in order to produce their oxides. (A communication.)
3365 M. A. Hamilton. Cutting implement.
3370 E. T. Hughes. Tea and coffee pots. (A communication.)
3371 T. and B. Carter and J. Lisle. Machinery employed in the preparation of wool.
3372 W. Cotton. Machinery for cutting woollen corduroy.
3374 E. T. Hughes. Sprinkler for powdered substances. (A communication.)
3378 J. M. Napier. Vessels for preserving unguents.
3382 J. Scholefield. Covers for umbrellas.
3388 T. Rose and R. E. Gibson. Treating cotton seed.
3391 H. S. Cowan. Apparatus for signalling at sea.
3397 J. J. Parkes. Means of ventilating rooms.
3399 W. E. Gedge. Brake washer. (A communication.)
3409 R. Clay. Breech-loading firearms.
3416 C. and S. Hargrove. Bells.
3428 R. Porter. Constructing metallic buildings.
3432 J. Collingham and T. E. Smith. Steps of spindles for spinning.
3439 W. Brown and C. N. May. Portable steam engines and boilers.
3450 R. R. Gray. Metallic casks.
3462 J. Mabson. Bags for coffee.
3472 J. W. Kenyon and R. A. Armistead. Safety apparatus for steam boilers.
3491 C. M. Barker. Socket and flange spigot pipes.
3515 A. Camme and F. Delpech. Manufacturing iron and steel chains.
3533 J. Collingham and T. E. Smith. Spinning frames.
3552 W. E. Newton. Bench planes.
3553 L. Christophe and J. Montigny. Tubular cannon.
84 W. R. Lake. Cutters for forming wood mouldings. (A communication.)
111 J. H. Johnson. Pipes for smoking. (A communication.)
258 K. J. Winslow. Conveying rotary motion to axles.
493 W. R. Lake. Mode of extracting the volatile portions of ores. (A communication.)
755 F. T. Baker. Manufacture of cartridge cases.
756 J. J. F. Stevens. Railway signal apparatus.
785 J. Houston. Manufacture of composite candles.
846 W. Thompson. Manufacture of iron castings.
871 W. Bellhouse and R. Ashworth. Carding engines.
923 B. E. R. Newlands. Treating products from spent oxide of iron.
1083 C. S. Tyson. Mechanism for taking up the recoil of heavy ordnance.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed April 4, 1868.

2630 T. C. Clarkson	2841 J. Speight
2805 W. Low and J. Treadwell	2852 A. M. Clark
2808 W. R. Lake	2933 S. S. Maurice
2813 J. Smith	3071 J. Watkins
2822 J. H. Brown	3246 R. Heathfield
2826 J. B. Hulme	3271 K. J. Winslow
2835 A. Danilecki	3352 E. H. Bentall
2840 W. Potts	3651 M. J. Rice

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

924 G. Burt	973 R. Maynard
955 W. E. Newton	986 P. Hugon
958 G. T. Bousfield	1007 G. Davies
962 J. G. N. Alleyne	1058 C. F. Cotterill
971 F. R. Ensor	1700 M. Ashby

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

819 W. and F. W. Crichton	832 A. V. Newton
825 J. G. N. Alleyne	877 F. Ransome

LIST OF SPECIFICATIONS PUBLISHED

For the week ending April 4, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No	Pr
	s. d		s. d.		s. d.		s. d.		s. d.		s. d.
2367	0 10	2409	0 10	2426	0 4	2442	0 4	2456	0 4	2473	0 10
2369	0 8	2410	1 2	2428	0 4	2443	0 4	2457	0 4	2477	0 10
2370	0 10	2412	0 8	2429	0 6	2444	0 4	2458	0 4	2478	0 4
2374	0 8	2413	0 10	2430	0 6	2445	0 4	2462	0 4	2479	0 4
2378	1 4	2414	1 4	2433	0 8	2446	0 4	2463	0 8	2480	0 4
2389	0 10	2417	0 8	2433	1 4	2447	0 8	2466	0 4	2485	0 4
2391	1 4	2420	0 6	2435	0 8	2448	0 4	2467	0 4	2511	0 8
2393	0 10	2421	0 6	2435	0 8	2449	0 4	2469	0 4	2529	0 8
2394	0 4	2422	0 10	2436	0 4	2451	0 4	2470	0 8	2694	0 8
2395	1 6	2423	0 10	2437	0 4	2452	0 4	2471	1 4	2748	0 10
2403	0 8	2425	0 8	2441	0 4	2455	0 6	2472	0 4	3095	0 4

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, APRIL 17, 1868.

SCIENCE IN ABYSSINIA.

WHAT a contrast the proceedings of an expeditionary army in the present day offer to those of armies of former times! How science ministers to the health and comfort, and aids the progress, of our troops now to what it did in the Peninsular wars, or even in the later Russian campaign! Contrast the old snail's pace, lumbering, toilsome military tactics with those of our Abyssinian field force, and we need no more to demonstrate the progress of the applied sciences. In the first place, here is an official despatch from the commander of the forces in Abyssinia, dated March 14, detailing the operations of the troops, printed and circulated in London within four weeks of its date. What would our fathers have given for such detailed news in that time from places far nearer London than Abyssinia. But even this rapidity of transit does not satisfy the present age, and people are surprised that Government has not taken steps to organize a special communication with the head quarters of the invading force. A correspondent of the "Times" observes that the importance of such a step is so evident that there must be some insuperable difficulty in the way of its being carried out. The distance from Magdala to Annesley Bay over the roads now practicable is about 250 miles, and this distance the writer referred to presumes could be traversed by horse relays in twenty-four hours. From Annesley Bay to Suez, a distance of 900 geographical miles, a moderately swift steamer would convey a mail in four days, so that in six days a telegraphic message sent on from Suez would convey the news from Magdala to London. Hence, "if a large force of our countrymen has yet to remain for some months in Abyssinia, it would be an unspeakable comfort to receive tidings of them once a week." No doubt it would, and an unspeakable pleasure, too, for those who had to pay for the arrangement.

Turning to the despatch itself, we find it presenting an appearance much more like that of a paper read before one of our scientific societies than of a report from a military general. Railway engineering, telegraphy, photography, well sinking, trigonometry, &c., run in turns with easy cadence throughout its length, and give it an interest to our readers which otherwise it could hardly possess. Taking the above items seriatim, we shall gather from their details the important part science is playing in our military organization and its bearing upon field operations. First, then, the railways. But we recommend our readers to obtain maps of the district before reading further, unless they are not particular as to the exact latitude and longitude of all the queer-named places we shall have to deal with. According to the last report received from the commanding engineer at head quarters, 6 miles and 576 yards of the railway from Zoolla to Koomaylee were completed up to the 26th ult., leaving 5 miles and 1,184 yards still to be made. The report states that many and great difficulties have had to be contended against, from the different descriptions of plant forwarded from India. It states that the rails received from Kurrachee differ in size from those received from Bombay, that many of them are bent, and that the fish plates attached are not bolt drilled in an uniform manner. Knowing the hopeless bemuddlement of railway constructive details in India, we are not in the least surprised to learn this; indeed, we should have elevated our eyebrows had the contrary have been reported. In addition to these difficulties there has been a paucity of skilled workmen, and an insufficient amount of ordinary labour, on account of the number of other works on hand at Zoolla. But orders have been issued for every available man to be put upon this work, and the officers commanding at Zoolla and Senafé have been directed to render every assistance in their power by placing strong working parties at the disposal of the commanding engineer. It is, however, satisfactory to learn that the most difficult part of the line has been completed, and it is hoped that the work will now progress more rapidly.

The telegraph line, we are informed, is completed and in working order to Addigerat, a distance of 101 miles from Zoolla; interruptions, however, constantly occur by breaks in the line, generally supposed to be caused by natives of the country, who steal the wire. The progress of the line onwards towards Antalo is at present delayed for want of poles; none suitable are procurable in the neighbourhood, and the transport animals are so fully employed in carrying up provisions and moving troops that there is a difficulty in bringing any up from Zoolla. The 2nd Company, Bombay Sappers, and 53rd Tent Lascars, have been placed at the disposal of Lieutenant St. John, R.E., director of the telegraph, to assist in putting up posts and laying the line. But as there are no posts to put up there can be no line laid, so the lieutenant and his men may have a merry time of it. We now come to photography and signalling, which matters are, of course, in the hands of the Royal Engineers, the head quarters of the 10th Company of which corps generally march with the head-quarter camp. The photographers have been employed in photographing plans and views, as well as surveys, of the route onwards, prints of which are handed over to the commanding officers of corps previous to the march. Ten non-commissioned officers and men of her Majesty's 33rd Regiment have been instructed in the use of flags, for the purpose of signalling, and the men of the 10th Company, Royal Engineers, have occasionally been practised with the army night signals.

Well sinking is one of the most important operations, and this has been entrusted to Lieutenant Le Messurier, R.E., who, with a party of the 10th Company, Royal Engineers, has been engaged in improving the supply and the arrangements for watering animals at all the posts occupied by our troops, from Koomaylee to the front. The supply of water at Koomaylee, the largest depot on the line, is now reported ample, and is distributed by means of six Norton's tube wells, one Bastier's 2½in. chain pump, one fire-engine, and six dipping wells. Norton's tube well will be found fully described and illustrated at page 216 of the MECHANICS' MAGAZINE, for the 20th ult., and we are glad to find such ample testimony to its merits as the Abyssinian expedition affords. At Upper Sooroo troughs and tubs have been fixed, and 18,000 gallons of water stored by the roadside, and a second road, to lead to the water supply, made to avoid the high road at any time becoming blocked up. A tube well has also been driven which affords pure drinking water, and a separate tank has been reserved for the native Shohos. At Undul the supply is also reported good. One Bastier's 2½in. chain pump has been fixed over a masonry well, 32ft. deep, and two Norton's tube wells driven; troughs and shoots have been erected, to receive the supply from these wells, and one other well has been dug, about 28ft. deep, with an average depth of 4ft. of water in each. At Henderta (half-way between Undul and Raraguddy) two wells, of 30ft. or 40ft. deep, have been dug in close proximity to the road, but no water reached. Small reserve tanks have been made where the spring issues from the rock above, and ladders have been erected against the face of the three cascades, so that the water above may be more easily reached. At Raraguddy the drinking water for the camp runs from springs into six tubs, placed on stones, and tanks have been built by the road side, from which the water runs by its own gravity into 54ft. of troughing erected for animals. At the foot of the Senafé Ghaut, arrangements for the water supply have been made, a tank has been dug, and four tubs placed for watering animals. At Senafé the supply is ample and has been well developed. Drinking water has been obtained from six Norton's tube wells. Water for camp purposes is provided in eleven tubs, fed by two additional Norton's tube wells. Water is supplied to the transport animals in 80ft. of troughing, led from a pond by a stone duct, and the surplus water is utilized in irrigating the soldiers' gardens. At Goongoona, Addigerat, and Antalo, arrangements have been perfected, but reports regarding them have not yet been received. Altogether, the important item of water supply appears to have been excellently well arranged, and its details satisfactorily carried out by Lieutenant Le Messurier and his staff, wherever water was to be found, although a scarcity is reported in some parts.

We finally come to the great trigonometrical survey of Abyssinia, which is being superintended by Lieutenant Carter, R.E. This officer reports that a base line had been measured at Koomaylee, and the position of a sufficient number of peaks has been fixed to allow of the topography of the country between Koomaylee and Senafé being taken up. Lieutenant Holdich, R.E., has worked up the Koomaylee route, and, with commanding points on either side, sketched in the country between Zoolla and Senafé. Lieutenant Carter has commenced triangulating, fixing points, and taking up the topography of the country between Senafé and Addigerat; the triangulation at and near Koomaylee has been connected with that at Senafé by a traversed line, executed by Lieutenant Dumler, R.E. By the foregoing work, it is hoped that a fair survey route of the army, showing the country on either side for a distance of from ten to fifteen miles, will be obtained, and, on the return of the army, more geographical information will be furnished.

Now, does all this read like the progress of an invading army in a hostile country? Does it not rather look like the report of a band of scientific explorers, who are doing their best to promote the ends of science, and to make themselves comfortable at the same time? Certainly, there ought to be a rich harvest of papers for the various learned societies, when the engineers, the telegraphers, the photographers, the well sinkers, the geographers, and the rest, shall have returned from their work. We are certainly returning good for evil, in that we are bringing a civilizing and humanizing influence to bear upon the territory of a savage who holds our countrymen in close captivity. And when we have accomplished our mission, and have released the prisoners—which we hope to do sooner or later—it may be that we shall hardly like to quit entirely a country upon which we shall have spent so much time and money. Although we have promised only to rescue the captives, and bring them home, we shall, doubtless, at the last moment, experience a lingering fondness for a country which may be found to present advantages for this, that, or the other purpose. This is, of course, beside our present question, but the circumstances are very suggestive. At present, we can hardly fancy the proceedings are the preliminaries of war: we are simply introducing the arts of peace and civilization into a savage country. But the stern war note has been sounded, and a struggle—perhaps a severe one—appears imminent. Then it is, when the fight has commenced, that men will feel

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and appreciate the benefits resulting from those innumerable applications of science, and will acknowledge the high blessings they confer in depriving war of at least some of its horrors.

THE GOVERNMENT TELEGRAPH BILL.

WE are now enabled to place before our readers some details relative to the bill, which was brought in by the Chancellor of the Exchequer, and read a first time before the adjournment, to enable "Her Majesty's Postmaster-General to acquire, work, and maintain electric telegraphs." Owing to the forms of the House no discussion took place, and by reason of the lateness of the hour and the short time consequently permitted to him, Mr. Ward Hunt was unable to offer but few preliminary remarks. The preamble sets forth the reasons for the necessity of such a bill, viz.:—that the means of telegraphic communication within the United Kingdom are insufficient, and that many important districts are without any means of communication, and that there is nothing obligatory upon the parts of the existing companies to supply such districts, and that great advantage would accrue to the State, to merchants, and to the public generally if a "cheaper, more widely extended, and more expeditious system of telegraphy were established;" and consequently that it is considered expedient that "Her Majesty's Postmaster-General be empowered to work telegraphs in connection with the administration of the Post Office." The bill will make it lawful for the Postmaster-General to purchase out of moneys specially provided for the purpose, the "whole or such parts as he shall think fit, of the undertaking of any company," undertaking meaning the "whole or any part of the electric and other telegraphs, wires, posts, pipes, tubes, and other works, instruments, material, land, &c., and all other property whatsoever of any company;" but such purchase cannot be made without the consent of two-thirds of the votes of the shareholders of a company present in person or by proxy, at a general meeting of the company specially convened for the purpose; the sum to be paid for the undertaking to be mutually agreed upon between the Postmaster-General and the company, the distribution of which sum the Postmaster-General will not be bound to see to.

In taking over any undertaking the Government bind themselves to keep in full force all charters and grants, and to continue and complete all matters commenced by the company which would have been continued and completed by them. Provided that the Government have acquired by purchase the undertaking of any one company, the Postmaster-General shall purchase the rights of any other company if requested by them to do so, within twelve months of their possession of the first undertaking; this provision including railway companies who, possessing a telegraph open to the public, might request the Postmaster-General to purchase their right to transmit such messages or other beneficial interest they might have. Having mentioned the manner of purchasing the various telegraphs, the Act empowers the Postmaster-General to make regulations for determining the times at which offices may be open for the dispatch of messages and for fixing sums "to be from time to time paid for the transmission of messages, and for services rendered in connection therewith, and for the general conduct of telegraphic business;" but the bill itself provides that the charges for messages "throughout the United Kingdom shall uniformly, and without regard to distance, be at a rate not exceeding one shilling for the first twenty words of each message or part of twenty words, and not exceeding sixpence for each additional ten words or part of ten words." In such messages the names and addresses of senders and receivers are not to be counted; delivery by special foot messenger, if within one mile of the receiving office, or within the town postal delivery of that office, when it is a head post office, and the town postal delivery extends for more than a mile from it, not to be charged for, beyond such limits, if required; the charge for delivery to be sixpence per double mile, otherwise the message would be forwarded free of extra charge by the ordinary postal delivery next following the arrival of the message. The payments for all messages are to be made by means of stamps, for which purpose a proper supply of stamps and stamped paper would be prepared and kept for sale. A clause is also added, for appointing offices or pillar letter boxes as places of deposit for messages to be conveyed to the office of transmission, without extra charge, such messages to have stamps affixed to them of the proper value.

Such are the principal features of the bill now brought in; it is capable of many alterations, and no doubt it will receive many in committee, but of such it will at present be futile to speak. The great point is undoubtedly that the first step has been taken, that the Government are in earnest in proposing some plan to endeavour to improve our present system of telegraphy, and to bring it within the scope of all. The principal feature in the bill is that it is permissive, that if a company are perfectly satisfied with what they have got, they are not compelled to part with it, but we can hardly think that all the existing telegraph companies would in the face of this measure not respond to the overtures of the Government, and we cannot but feel certain, that if one company transfer their interest to the Government the others must speedily follow.

We have already gone into the advantages that must accrue to the public if the change really took place; but are there not advantages—indeed, great advantages—to the shareholders themselves in this transfer? We will take for instance the case of a merchant or one engaged in business, who is a shareholder in any one company. His position as a shareholder places him telegraphically in no superior situation to one of the public; if he wants to send a message, he must pay the same as any one else; his message has no prior claim; his only advantage is, if he is in a good company, an annual dividend of so much per cent.; but provided the transfer take place that advantage will remain the same, for it may be relied upon that the shareholders will look after their own interest in money matters. Everything that he gets now, he will get then, he cannot surely be worse off; with the transfer of staff and material he may expect to get his messages sent as expeditiously and as correctly. There are really no advantages that he enjoys now that the transfer will deprive him of; on the contrary, the advantages will be largely increased, extra facilities will be offered, places hitherto beyond his telegraphic reach will then be accessible, and he will in future be able to send two and sometimes more messages for what at the present time he has to pay for one. Instead of paying the high rates of one shilling for a short distance, two, three, or four shillings for greater distances, he will in future be able to send a message to any place in the United Kingdom for one shilling only. We can hardly imagine that any shareholder will oppose the pain; if he were to lose by it, well and good, but we can only see his gain. We are fully prepared to see opposition spring up amongst the administrators of the various companies; probably the ground of opposition being, as has already been advanced by them, that the Government will make a mess of it; this objection is absurd, for it amounts to the admission almost that they themselves are making a mess of it! For will not the Government work the various systems with the same *employés* that are complimented by them as being so efficient? In such a transfer there must of necessity be a decrease in the amount of administrative heads, and of course the directors would be the first to depart. Need we say more?

As regards the manner of payment, nothing is said, further than it will be out "of any moneys which may be from time to time appropriated by Act of Parliament and put at the Postmaster-General's disposal for that purpose." As to whether the purchase will be made by a transfer of the capital of the companies into a new Government Stock, we are profoundly ignorant, but we presume such will be the case. The bill has been anxiously looked forward to for some time, telegraphic enterprise and extension having been somewhat interfered with in consequence. But of all interested in it none have been more anxious than the *employés* themselves, an under-current of fear running amongst them that they will be superseded by penny postmen, and that many will have their services dispensed with. It of course stands to reason that if an amalgamation does take place under Government of four competing companies the services of a good many must necessarily be dispensed with, but we are satisfied that such a step will be accompanied by proper compensation. And we trust that whilst the shareholders and directors are looking after their individual interests, the interests of the clerks and *employés*, who have so well worked for their benefit, will have some one to see that in the change they are not neglected. To the public generally we are confident this bill will bring great advantages, the cheapness and greater expedition of messages, increase of offices and receiving stations, and consequently greater facility of intercommunication; it is a step in the right direction, and one which we hail with great pleasure as a boon and a benefit to the State and to the community generally. We shall carefully watch the progress of the bill and shall not fail to keep our readers constantly informed upon a matter that cannot be otherwise than of the greatest importance to them.

DR. LIVINGSTONE.

WHO among our readers, or who in the whole world, will not rejoice in the prospect of once more welcoming our veteran explorer, Dr. Livingstone, home? During the many alternations of hope and fear which have been experienced for long past, we have always felt, and have expressed ourselves, satisfied that positive evidence was required to convince us of Dr. Livingstone's death, and that if it had taken place we should have received proofs of it before now, if only to prove the old adage, that bad news travels fast. We do not wish to be considered as prophets after the fact, nor do we claim to have prophesied before the fact. Our view was always a hopeful one, and such as circumstances and Sir Roderick Murchison's experienced views justified. We are glad indeed, then, to learn that our hopes have not been in vain, but that a letter lately received by Sir Roderick from Dr. Kirk, at Zanzibar, gives us every reason to look for the great traveller's return at no very distant period. Dr. Kirk's letter is a long one, and will be waited for with impatient interest until the 27th inst., when it will be read before the Royal Geographical Society. In the meantime we are enabled to give our readers an abstract which has been made by Sir Roderick. The letter is dated February 4, and in it Dr. Kirk first announces the arrival of the Arab messenger, Bunduki, so long expected, who has brought despatches and letters from Dr. Livingstone himself. These letters, it is hoped, will arrive in time for the meeting at the Geographical Society before alluded to.

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The information contained in Dr. Kirk's letter completely confirms the account of the route taken by Dr. Livingstone, round the southern end of Lake Nyassa, which was brought home by the Livingstone Search Expedition. It appears that our great traveller proceeded northwards at a long distance to the west of the lake, and in course of time arrived at Lobisa, formerly a thickly-inhabited town, but now almost deserted. In these elevated lands, covered with humid forests and destitute of game, the party suffered much from hunger; but, on approaching the southern extremity of Lake Tanganyika, they reached Mtuka, in the Wemba country, where there was abundance of cattle and food, and where they recovered their strength. It was here that Livingstone met with the trading caravans from Zanzibar, and delivered the letters to Bunduki, who has had them for twelve months in his possession. Reliable information has also been received at Zanzibar of the arrival of Livingstone at Ujiji, half-way along the Lake Tanganyika, where it is satisfactory to know provisions, stores, and letters sent from England and Zanzibar have long been waiting for him. Sir Roderick adds:—"The clear and definite proofs obtained by the boat expedition to Lake Nyassa, under the command of Mr. Young, quite satisfied most of my countrymen that I had judged rightly in adopting the belief that the whole story of the murder of Dr. Livingstone was a falsehood. But, since then, many have doubted the possibility of my dear friend ever coming alive out of the heart of Africa. With our present cheering information, every one may now, however, enjoy with me the prospect of once more welcoming David Livingstone on his return to an admiring country."

THE INSTITUTION OF NAVAL ARCHITECTS.

ANNUAL MEETING.

WE regret that we should again have reason to complain of the partial conduct of the authorities of this highly important institution, in affording to one of our congeners of the press priority (undue priority as we esteem it) in the use of the papers read at the annual meeting. We should have imagined that it would be thought advantageous to all the interests, whether public or private, concerned in the matters treated of, that all should have an early opportunity of seeing the papers. That, however, has not been done. Nevertheless, we shall give a pretty full *resumé* of the subjects treated of. The chair was taken at some of the meetings by those worthy "old salts" the Earl of Hardwicke and the Earl of Lauderdale, to whom it must impart many a pang, like "a shot in the locker," to see the iron "frights" that are so rapidly displacing their earlier loves. They will never be alone in sighing over this change, for though the stern requirements of expediency may banish the old three-decker to the regions of the ichthyosaurus and the dodo, yet "the thing of beauty will be a joy for ever," and if she walks the waters no more like a thing of life, she will live in our fancy and unavailing regrets.

Having given the report of the council and the chairman's address in our last, we now turn to the papers read, and shall first notice that by Mr. Henry Sharp, of the Bolton-le-Moors Steel and Iron Works, on the treatment of steel plates. The rapid displacement of iron by steel in this manufacture, during the last few years, leads to the inquiry—Where will it end? Wood has nearly disappeared before iron, and the latter seems destined ere long to disappear before its younger brother in shipbuilding, boiler making, and most other structures of ferruginous material. Even the rails of our iron roads have, in some cases, been superseded by steel, while the axles and tires of the wheels which glide over them, and the piston rods which drive them, &c., have been changed to the same material. Even the boilers of locomotives seem to be putting in a claim to the same consideration as those of stationary engines, which have submitted to this material change, and seemingly, on the whole, with good results. The increased strength without additional weight, or the diminution of weight with unaltered strength, recommends this substitution. Experience, however, shows that great care must be used, so as not to obtain an inferior and more brittle article, by beating down the price. It is enough to save a large percentage in one way, and not seek, by grasping at too much, to lose the advantages which are really within our reach. A few failures, due to inferior articles at low prices, have tended to cast discredit on steel plates, &c., which, *per se*, they do not deserve. The same care in selection of material, and, if possible, more in manipulation, should be used than in the case of iron.

Mr. Sharp has given us here a very interesting paper on his own experiments on the tensile strength of steel, which, as he very properly states, depends in large measure on its hardness. This very hardness becomes, under bad or injudicious manipulation, its chief weakness. For instance, in the simple method of perforating the plates, it becomes of importance whether this be done by drilling or punching. The latter has been proved to deteriorate the plates to the extent of 33 per cent., or just one-third of their whole strength. Common sense *á priori* might almost predict such a result from the heavy jar of the punch on a harder material, yet, as punching is more convenient than drilling, for more reasons than one, we are glad to learn that careful annealing will, after punching, restore the "jarred" plate to all its original goodness. Such experiments go far to remove the hasty objections made to the use of steel for the wider purposes to which it is being applied.

This paper concludes with a very interesting and instructive paragraph on the value of conical, as opposed to cylindrical perforations. Tapering holes were made with much less force than the other; they injure the texture of the plate in their immediate neighbourhood much less, and do away with the necessity of countersinking. This paper fully realizes the basis of the Baconian philosophy "experiment," but we believe that each and every result which Mr. Sharp here brings before us, could be fully borne out by abstract and *á priori* induction.

On the subject of steel a second paper was read by Mr. Rochussen, in which he pointed out the mistake made by Lloyd's and the Admiralty, when iron first began to be used for shipbuilding, in fixing a standard for one element of strength only—namely, tensile strength along the so-called fibre. This led to ships being built for insurance rather than for safety. Builders, whose interest was in the safety of their ships, made use of better iron, which would not only satisfy the regulation test, but had other good qualities which should have been recognized from the first as indispensable. These were the men who introduced steel at a later period, and are still advancing in the road of improvement. In speaking of hard steels, Mr. Rochussen pointed out that annealing was looked upon as a sovereign remedy against all accidents which might arise from the steel's having been overheated. This process of annealing, he said, would seriously affect the price of steel, as the builder would be compelled to materially increase his plant in erecting furnaces for the annealing of large plates. All this, he stated, might be avoided. In a ship of 2,000 tons there is no portion which cannot be worked cold; heat is not necessary, is even dangerous, while the fact of working cold is a conclusive proof of the excellence of the material. There was another point in this paper to which we must allude, and that is what Mr. Rochussen calls the "stored strength" of the steel. When a sufficient strain is put upon a steel rod, its elasticity is impaired, and ultimately destroyed. Its sectional area, meanwhile, is decreased. The strain on the square inch of this diminished area which is required to break the steel when in this weakened state is the stored strength. It appears that this quality is greatest in the mild steel of low tensile strength, and lowest in hard steel and iron of very high tensile strength, clearly showing that the latter kinds of metal are dangerous material to employ in structures liable to sudden strains of great magnitude.

One of the most interesting, and perhaps it is not too much to say, one of the most important, of the papers read was that of Captain Selwyn on "Liquid Fuel." He showed that by the use of the liquid instead of coal a ship could, with the same weight of fuel, be supplied for a voyage of more than three weeks under steam, instead of for one week, and that the change would be attended with two great advantages—the owner would pay less for his fuel in the first place, and, in addition, could have more room available for freight. The fluid of which Captain Selwyn spoke particularly was that generally known by the name of creosote, the price of which is at present ¾d. per gallon, or 13s. 9d. per ton. One of the great advantages of it is its heavy specific gravity, being somewhat greater than that of sea water, so that in case of fire, arising either from accident or from an enemy's shot, the fuel might be run into the hold, where it would sink in the bilge water, or, in case of still greater danger, into the sea, where it would immediately disappear. Creosote is not inflammable at less than 240deg. Fahrenheit, so that there is no danger of explosion, nor is it liable to spontaneous combustion, as coal is. The liquid fuel might be stowed in tanks, situate at any part of the ship, and thus a great saving of space obtained, which cannot be made available for the stowage of coal. From these tanks the fuel might be pumped into the cisterns from which it would run, under the action of gravity or of artificial pressure, into the supply pipe which feeds the furnace. When once the furnace is at work, the stoker's labour is confined to merely watching the furnaces, of which he may attend almost any number, merely turning the taps which supply the creosote. Two pipes are fitted to the furnace, one of which admits steam and the other the oil. The steam pipe enters the furnace just below the oil pipe, and the function of the steam seems to be merely to scatter the oil in a kind of spray so as to facilitate combustion. Air may also be admitted under pressure through a third pipe, so that the amount of oxygen supplied to the fuel may be regulated, and complete combustion thus arrived at. It is interesting to hear that a Cornish 35-horse power boiler, with Galloway tubes, has been at work for some months at Hackney Wick, doing more work with a supply of liquid fuel (which in this case is coarse naphthalin) of 230 gallons a day, than it did before with 3 tons of coal. The difference of the expense is 5s. compared with 72s. The water evaporation obtained from a fortnight's observation was 23lb. for every pound of fuel. As 7lb. of water evaporated for 1lb. of coal represents the maximum work which can be reached at present by the best boilers, we may allow that this is a direction in which we may look for great advances in economy. We are glad to hear that an experiment is being made with this system, though on a small scale, by the Admiralty. A steam launch is being fitted with the oil-burning apparatus, but we are warned not to expect too much from the results of this trial. A second Cornish boiler, without Galloway tubes, the furnace of which was arranged in a somewhat novel

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manner, has actually with 109lb. of oil done the same work that it had previously done with 672lb of coal; and the extraordinary amount of 46lb. of water evaporated for 1lb. of oil is stated to have been reached, which is double the amount generally given as the full equivalent for 1lb. of this compound. If this turns out on more exact investigation to be correct, the explanation must be looked for in the combustion of the gases admitted under the form of steam.

A paper to which we cannot afford an equal meed of praise, was read by Mr. Longridge on a monitor for harbour defence, and submarine artillery. It was proposed that the monitor should have its plates inclined at small angles to any fire which it was likely to meet with, which we cannot look upon as a new idea, seeing that an inclined target was built some time ago for experiment at Shoeburyness. The striking feature of the paper was the advocacy of an underwater gun, or, we should say, broadsides of such guns. The monitor, impervious above, is to run close up to any enemy audacious enough to enter the harbour, and give it at close quarters the full benefit of its submerged guns. It remains for Mr. Longridge to prove, first, that the guns will not burst in firing; secondly, that the firing of the guns will not be very destructive to the monitor's own sides; and, thirdly, that the shell will be likely to do more harm to his enemy than to himself. We cannot but look at the scheme of submarine artillery as wild in the extreme.

We shall discuss the remaining papers next week.

AERIAL LOCOMOTION.

LORD MACAULAY made a journey through the lapse of years and pictured future ages with a civilized New Zealander meditating on the ruins of London Bridge. The editor of an American paper a short time ago imagined the present century to have passed away, and pourtrayed the state of society in 1960-1970. A lady is entertaining a few friends just before dinner, and she tells them they will not have long to wait—her husband has only gone to pay a visit in the neighbourhood of "Boothia," and she expects him in New York on his return from the North Pole every minute!!! Wonders will never cease, and considering the earnest way in which the Aeronautical Society is going to work, we should not be at all surprised to learn that travelling in the air would soon become as easy and as regular as travelling by land or by water. Even in prehistoric times we find that men were evidently addicted to emulating birds and bats; but up to this year of grace 1868, hardly anything has been done towards rendering journeys through the aerial regions either safe or easy. Now it appears to us that the cause of failure hitherto has been the too close imitation of the means employed by birds to travel through the air. Sailing vessels or steam packets are not propelled in the same manner as fishes through the water, or even on the same principle as boats are rowed over the waves, nor do our locomotives imitate the walk of men, although it is true there is to be a steam man employed as a motive power to put trains in circulation. But he is only talked of, and has not yet given any signs of life, and besides we must remember this is an American story.

According to our ideas, after making the framework of an aerial machine hollow, so as to diminish as much as possible its specific gravity, some new motive power should be applied. Let us endeavour to find out what this should be; to do this we will examine existing methods of locomotion. Take the case of a horse and cart; the simpler the illustration the better. Here, the horse exerting the leverage of his muscles against the earth, first moves himself and then draws the cart, to which he is attached, after him, and by thus drawing he makes the wheels rotate, by which means the cart is made continually to shift its place. Now, it is exactly the reverse in the case of the locomotive, there the *που στω* (*pou sto* or fulcrum which Archimedes said if he could obtain anywhere out of the world he would be able to remove it from its solid basis and destroy its equilibrium) is inside the machine, and by forcing the tyre of the wheel to turn, effects the transplacement of the locomotive, but in a directly opposite manner to that in which the cart is moved from its position. In the one instance the horse standing on, and pushing against, the ground, moves forward and draws the cart after him, and lastly, makes the wheels turn upon their axes. In the other, the steam in the cylinder exerting its power against the ends of it, forces the piston to alternate back and forward. The pushing or pulling motion being thus converted into a rotating motion by acting on the leverage of the crank axle, obliges the wheel to change its position on the road, and by continually changing its position, to move, not itself alone as the object accomplished at the end, ultimately, but actually to move the carriage in which the motive power itself is fixed. Thus, though the ends of the cylinder are stationary as regards the piston, yet by the revolutions of the wheels they are all moved on together, cylinder, piston, wheels, and all.

Now it appears to us that for aerial navigation, instead of using screws and paddles as in steamers, or cylinders and pistons as in locomotives, it might be well to condense the air very much by means of chemical agency, and then to force it through hoppers in concentrated quantities against the circumambient atmosphere, preventing as much as possible its diffusion. We should thus make the aerial traction-engine act in the inverse way of a bullet, which is impelled by being forced, a short portion of its course, by a rush of air, wonderfully condensed by the ignition of powder behind it. We would propose that the condensed air should be manufactured in the aerial locomotive and be judiciously expelled from it with great force and in a constant stream flowing towards a point or line. It would even then only too soon dilate, and would exert, as it were, a kind of continuous impact against the surrounding aerial space, which by its elasticity would resist it and thus enable the aerial traction-engine to wend its way in any required direction, as well as to ascend or descend either vertically or obliquely. This we believe to be the true theory of the aerial traction-engine; we leave its practical development to those who are now directing their attention to the solution of the subject. When once the idea is mastered we should probably find ourselves traversing the winds with the same facility and with greater rapidity than we now do the waves.

LANDSCAPE PHOTOGRAPHY.

FOR some months past there has been an outcry in the photographic periodicals, demanding small photographic cameras for tourists, because now that enlarging is getting so common, a large picture on collodion may be taken from a very small negative, if needed. Moreover, it is a boon to amateurs, as well as to professionals, to be able to carry landscape apparatus and plates in the pocket, and the legs in the hand in the shape of a walking-stick. Although negatives so taken must be small ones, it is possible to make up in beauty what the positives want in size, by printing them as transparencies upon opal glass.

The demand for such small apparatus did not quickly call forth a supply, but Messrs. Negretti and Zambra have just began constructing pocket cameras, which, at present, sell as fast as they are made, and we hear of two or three other firms about to follow the example. The camera by Messrs. Negretti and Co. is made of mahogany upon Kinnear's principle, and takes negative plates 3¼in. square. This size has been chosen because the measurement is just right for magic lantern pictures, to be used with the ordinary 3¼-in. condensers, the most useful size for dissolving views, and the glass paintings ordinarily on sale in the shops. Hence, without enlarging apparatus, pictures taken in the little camera may be printed direct upon dry collodion plates, for the magic lantern. The camera, when shut up for the pocket, occupies a space about 4¼in. square by 2¼in. thick. The sliding backs carrying the plates, must, of course, be carried separately. These are rather thicker than desirable in outside measurement, and perfection in small apparatus of this kind will not be reached until some manufacturer devises double dark backs not much thicker than the two glass plates inclosed inside. Probably thin metal would answer better than wood for this part of the camera. The camera itself has no spare space inside for the lenses.

The purchase of a lens or lenses for small pictures of this kind demands consideration on the part of the investor. Most of the small lenses in the market take in a larger angle of view than the human eye—therefore imprint a larger range of subject upon the photographic plate. At first sight, this may seem to be an advantage, as the operator gets more in his picture; but, on the other hand, objects in the foreground appear of unduly large size when compared with those in the background, and the view, in short, seems less true to nature than it is in reality. For special subjects it is convenient to have wide-angle lenses, but for general use, in a camera like this, we recommend a meniscus landscape lens, with front stops of different sizes, and the lens should not include a larger angle of view than 50deg. or 60deg., so as to correspond with the angle included by the eye as nearly as possible. Single landscape lenses are less bulky and expensive than double combinations, and they give capital definition, but are not quite so well suited for portraits and architectural subjects as other lenses, when these objects have to be taken the full size of the plate.

As a matter of fact, "satchel" camera is a much better name than "pocket" camera for apparatus like this, when the photographer wishes to take out a dozen plates with him, to retnrn home with a dozen pictures. Anybody going out for the day in the midst of picturesque scenery, will find three or four plates too few to meet his requirements, from eight to twelve being a convenient number. This is the reason why, in portable cameras, it is necessary to devise some method of economizing space in the dark slides to a greater extent than is the case in the little instrument now under notice. A lens is an awkward object to carry in the pocket, so also is the top of the camera stand, and in practice it will probably be found that the best form of travelling appa ratus for 3¼-inch preserved plates is a rect angular box, carrying the camera inside with the lens in position, so that directly a door at the end of the box is opened, the lens is exposed to the view to be taken. Other doors in the box will give access to the dark slides, and permit the focussing screen to be seen and adjusted. By means of a simple contrivance of this kind, the tourist would not be losing time in screwing the parts of the apparatus together before taking each view, and it is not very creditable to manufacturers that most of the box cameras in the market entail such waste of time upon those who use them.

It is an excessively difficult matter to make a perfectly rigid walking-stick tripod stand for a camera; in fact, most of these are failures when exposed to the test of taking a picture in a high wind. Rigidity and se-

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curity from vibration can probably be obtained only by means of legs with the ordinary forked tops to bite the upper portion of the stand, and such legs thick enough to work efficiently will not look like a walking-stick when closed. Here, again, the tourist had better sacrifice appearances to efficiency, and furnish himself with a tolerably firm stand without folding joints. The triangular piece at the top should be made of wood, and rather small, so that when the legs are screwed to it they will not diverge much at the upper part, and will, therefore, be easy to carry "in position" when several views have to be taken at no great distance from each other. When the views to be photographed are a considerable distance apart, it will be more convenient to detach the legs from the wooden apex, and carry them braced together so as to form a rather thick staff. The danger of the present call for very small portable cameras is, that efficiency will be sacrificed to portability, and this, as all practical men know, is a mistake. The small cameras for tourists now coming into the market will make many practise photography who never attempted to do so before, for everybody likes to be able to secure pictures of familiar scenes, when it can be done without much trouble.

STEEL FROM THE CLEVELAND IRON.

A SOLUTION of the important question of the conversion of Cleveland iron into steel has long been sought, but in vain, great and manifold difficulties having hitherto stood in the way of the accomplishment of that object, owing to the overpowering presence of phosphates in the iron. The matter has, however, attracted great attention of late, owing to the circumstance that the question has advanced beyond the realms of theory and speculation, and has almost become a practical fact. To show the energy which is being brought to bear upon the subject, we may observe that experiments are now being carried on with no fewer than five different processes for making steel from the Cleveland iron. Several specimens of steel thus made have been submitted for trial and a satisfactory verdict has been pronounced upon them. There is, however, but one out of these several processes of which the details have been made public, and this is that invented by Mr. James Hargreaves. The particulars of this gentleman's invention will be found fully given in our issue for the 10th of January last. We need not, therefore, repeat them here, but at once turn to the more practical points of the question, which were considered in a paper lately read by Mr. Hargreaves before the Cleveland Society of Engineers, and were further elicited in the discussion which took place thereon. Mr. Hargreaves fully defined his method of procedure, and from the trials he has made he appears to secure the maximum results with the minimum cost, and the steel produced seems to be of the best quality. In the discussson Mr. Whitwell stated that Mr. Hargreaves had brought a chisel made from Cleveland iron to his works, the edge of which on hammering very hard at a piece of chilled iron was only dimmed, whilst the edge of a tool, made of the best Sheffield steel, when put to the same test, was turned completely up. This must be equally as satisfactory to the Cleveland iron masters as to Mr. Hargreaves, and we congratulate both parties upon the result. The increasing demand for steel in construction purposes renders it clear that if Cleveland iron cannot be converted into steel it must decrease in value, in proportion as other ores more free from phosphates advance in price.

The discussion to which we have referred turned upon another point of equal interest and importance—the utilization of the phosphorus extracted from the iron. The direction in which it might be utilized would, of course, be the manufacture of phosphorus, phosphoric acid, and other chemicals. As a proof of the importance of this matter it is stated that the phosphorus extracted from Cleveland iron would, even in its cheapest form as manure, be worth at least £56 a ton; as one ton of phosphorus is equal to 2 tons 5cwt. of phosphoric acid, or 4 tons 10cwt. of the highest qualities of Patagonian, or 7 tons of Peruvian guano. According to Mr. Hargreaves' showing iron which is now worth 47s. per ton, when containing one per cent. of phosphorus, would, if freed from this element, be worth at least as much as hematite iron, or say 54s. per ton. On this showing, the account stands thus:—

100 tons of phosphoric iron at 47s., £235.
After being freed from phosphorus—

	£	s.	d.
99 tons of iron at 54s.	267	6	0
One ton of phosphorus or its equivalent (say in the shape of phosphate of lime)	56	0	0
	£323	6	0

making a difference in favour of the purified iron of £88 6s. on 100 tons, or 17s. 7½d. per ton of iron operated on. We have thus two important questions to be solved—the first, the conversion of Cleveland iron into marketable steel, and the second—which grows out of the first—the utilization of the phosphorus. The first is now being practically worked out, the second we commend to our chemists, to whom it offers an interesting and, probably, a profitable object for study and experiments. Looking at the progress which has been made by Mr. Hargreaves, in the solution of the steel question, we cannot be otherwise than hopeful that, in the course of time, Cleveland steel will take its place amongst the choice brands in the market.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

BOTTLE TO CONTAIN LIQUEFIED GAS—A STRONG AND LASTING CEMENT—BRASS PICKLE—CAN FOR APPLYING LUBRICATING OIL—EXPLOSIONS OF RED FIRE.

THE use of protoxide of nitrogen, or laughing gas, as an anæsthetic agent, is no novelty, and would not require notice here, but for a suggestion recently made in the "British Medical Journal" which offers a problem to mechanics. It would be very inconvenient for surgeons to be driving about with large bags of gas for administration to their patients. There are inconveniences also in the preparation of the gas on a small scale which disappear when the manufacture is carried on in a moderately large way. Now, laughing gas can, by great pressure or intense cold, be condensed into a liquid, and the suggestion of the journal we mention is that liquid protoxide of nitrogen shall be sold, from which at any moment, by merely turning a tap, a bag of gas can be obtained for inhalation. To carry out this idea, bottles are required which will stand a pressure of at least 800lb. The pressure at which the gas liquefies is about 30 atmospheres at the freezing point, so perhaps for a bottle to be perfectly safe at our ordinary temperature, it should be proved to 1,000lb. There can be no difficulty, we should think, in producing such a bottle of cast steel, so light that a surgeon might take it with him on his rounds, and if there are all the advantages claimed for protoxide of nitrogen as an anæsthetic, there will probably be a considerable demand for such bottles. As regards the manufacture of the gas, and its liquefaction, these are very simple matters: the desideratum of to-day is a safe and portable bottle to hold the liquid, and we have little doubt that this will soon be furnished.

A very strong and durable metallic cement, we read in a German Mechanics' Journal, is formed when a mixture of equal parts of oxide of zinc, sulphate of lead, peroxide of manganese, and oxide of iron is made into a paste of proper consistence with boiled linseed oil.

Dr. Hiller writes that the brownish red colour often obtained when brass work is pickled in the usual mixture of acids, may be avoided by making use of a mixture of equal parts of commercial nitric and sulphuric acids. Articles dipped in this mixture and then well rinsed in cold water have, he tells us, a very beautiful dead yellow colour.

A new can for applying lubricating oil is described in "Cosmos." It is a cylindrical vessel of a size that can be grasped by the hand and is much the same in shape as that in common use. The top, however, is flexible, and there is a spiral spring in the interior. When oil is required the workman presses with his thumb on the top and forces out just the amount necessary. On removing the pressure the spring restores the can to its shape, and the oil in the long spout is forced back by the influx of air. Thus there is no waste of oil by dripping.

The frequent recurrence of such accidents as that at Nottingham—not often, however, so fatal in their consequences—justify us in giving a general caution to any readers who may be disposed to amuse themselves with making coloured fires The ingredients for red fire should be powdered separately, and they should be mixed in a sieve and never in a mortar by means of a pestle. With this precaution the mixing of the colour is perfectly safe; but the liability to spontaneous combustion some time after it has been mixed is as great as ever. The spontaneous combustion, however, is not attended with explosion.

ROYAL POLYTECHNIC INSTITUTION.

ACCORDING to custom the Easter programme of the Polytechnic Institution has been entirely changed and features of novelty everywhere present themselves. In the first place, the large theatre has been redecorated throughout, and separate entrances have been provided for the reserved seats, a boon which will be duly appreciated by visitors who desire to avoid the former scramble for seats. Then the entertainment has been remodelled in all its varied details, and presents from first to last a series of the most interesting illustrations of science in a popular but truthful form. Those who have followed Professor Faraday's brilliant discoveries in electricity and the chemistry of colours will now learn the results of that philosopher's optical experiments. They will also find much to interest them in the thaumatrope, the kalotrope, the phenakistoscope, Mr. Rose's photodrome, and the zoetrope. Professor Pepper, in exhibiting the zoetrope, skilfully throws the figures seen through one aperture only upon the disc, which produces some grotesque animated figures. The photodrome shows how objects may be put in rapid motion in the dark, and yet appear perfectly at rest when momentarily seen by a flash of light. Spirit rapping and table turning come in for their share of exposure at the hands of Professor Pepper, who, by simple mechanical means, proves himself quite at home in his exhibition of spiritual manifestations, directing the flight of persons and things through space. The shadow Blondin on the high rope amuses, whilst the lecture by Mr. King, on the Chassepot and other rifles, instructs. The optical dioramic illustrations are all new, and include a remarkable moving skeleton, which has been arranged by Professor Pepper and Mr. Tobin, his active coadjutor, who, we are glad to observe, has lately been appointed secretary to the Institution. We cannot but compliment the management on the success of their Easter entertainment, which, we need hardly add, is always thronged by those who seek to combine pleasure with the acquirement of a knowledge of scientific things.

SOCIETY OF ENGINEERS.

(Concluded from page 275).

THE foundation at starting was very good, being a sandy clay, dry and firm. This continued, however, only for a length of about 50 yards, at the end of which a small brook was crossed and the treacherous morass entered upon; although at a dry season of the year, the ground was wet and sloppy, and in some places so soft as to be dangerous to walk on. A few days previous the author had surface drains cut as deep as the level of the brook would admit, and connected with it at a point as far down stream as was practicable. The surface water was thus drained off to a depth of 1ft. or 18in., and the ground through which the

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excavation was to run rendered fitter for moving about materials; it was never, however, hard enough to admit of cartage, which necessitated planking to be laid for wheelbarrows to convey all the required materials. The depth of the sewer, from the commencement of the morass to the Brighton-road, averaged under 5ft., so that the crown of the arch was above the surface of the field. The subsoil may be described as soft peat, black, mixed occasionally with clay and sand, not fibrous like the Irish bogs, and very wet. Of course an artificial foundation was necessary on such ground, and from the three which were described in the specifications, and of which drawings were furnished, the author decided one, which was formed of hurdles interlaced with brushwood laid on three longitudinal sleepers not less than 16ft. long, and covered with concrete which reached to within 18in. of the springing of the arch. The concrete was composed of four parts of broken stone, two of sand, and one of Portland cement, or about one cask of cement to a yard of gravel and sand. In getting in this foundation, the method adopted was to excavate a 16ft. length and sink a sump hole, the sleepers were then inserted so as to break joint, the hurdles, which were 6ft. × 3ft., laid over them, and a layer of concrete 6in. thick tipped in from barrows. The hand pumps were kept at work to keep the water down until this layer had sufficiently set. A wooden template of the exact form of the outside of the sewer, and 10ft. or 12ft. long, was then suspended from cross-timbers so that its lower extremity just touched the layer of concrete, and the spaces between this template and the sides of the excavation were filled in with concrete to the required height; when this had set sufficiently the template was moved on, and another length completed in the same way. Before commencing to put in the invert in the first instance, the foundation was tested to ascertain if any subsidence would occur; for this purpose the pumps were stopped, the templates allowed to rest on the concrete bottom, and then loaded with bricks equal to 2½ times the weight of the sewer for that length, levels were taken from a bench mark on an adjacent bridge, and after a fortnight taken again: no perceptible subsidence had taken place, and the brickwork was then proceeded with. In excavating, it was found necessary to remove the material some distance from the side of the trench as it was taken out, for though the sides were close timbered the additional weight forced up the bottom. This moving away of material, and moving it back when the sewer was completed, caused this part of the work to proceed but slowly; some difficulty was also experienced in drawing the runners after the brickwork was got in, owing to the tenacious nature of the soil. The author should mention that the foundation was slightly modified:—1st. The concrete was brought up perpendicular at the sides flush with the sides of the excavation; 2nd. Square sleepers of foreign fir, 5½ in. × 5½ in., were substituted for fir poles 6in. diameter; and, 3rd, one foot of concrete was laid over the hurdles instead of 6in. The total length of the 2ft. 8in. × 3ft. 9in. sewer was 223yds. The details of the cost will be given at the close of this paper in connexion with that of the other sewers.

At the manhole, the main sewer turns at right angles along the Brighton-road, diminishing in size to 3ft. 6in. × 2ft. 6in., and at the same point is joined by a 15in. pipe sewer diminishing to 12in., which will take drainage from the high ground in the extreme south of the district. The ground traversed by the 3ft. 6in. × 2ft. 6in. sewer from the manhole to where it turned off the road was, with one exception, the worst the author had to deal with. The peat continued at the surface for a distance of about 350ft. along the road, it averaged here about 6ft. deep, and gradually passed into a sandy clay abounding in green grains, and very watery. Lower down, the clay disappeared, and a quicksand was met with for the first hundred feet; and while it was not necessary to go lower than the peat, the hurdle foundation was continued as before; but as the excavation proceeded along the rising ground the sand was encountered, and here it was found necessary to adopt a foundation, consisting of 4in. planks spiked to the sleepers and covered with concrete: the same modifications were observed in this instance, the concrete being carried up perpendicularly at the side, and a layer one foot thick tipped in over the planking. Proceeding still further, the strata sunk through were peaty clay and peat to a depth of 6ft.; under this a hard stiff blue clay quite impermeable to water, and upon excavating this, it was thought all difficulties were over, as it seemed probable that the clay continued to a considerable depth. Such hopes proved delusive, for when about 18in. of the clay had been excavated water showed itself oozing from the bottom and sides, and when another 6in. had been removed the excavators found themselves in a quicksand. The water being under pressure here, owing to the impermeable stratum overlying the permeable, was more abundant and more difficult to deal with than before, and not having been so well prepared for it caused some mischief.

The timbering had been put in, in separate frames 4ft. deep, the walings were placed across the centre of the runners, and the struts 6ft. apart. The peat on the surface necessitated the runners being placed close; had the clay continued only 2ft. or 3ft. deeper this would have been amply sufficient, but (for misfortune never comes alone) it happened that on the very evening this artesian spring of sand and water was tapped there came a thunderstorm and heavy fall of rain, which soon found its way from the steep slopes on each side of the valley to the works, down behind the timbers, joining the springs below. Pumps were kept constantly at work in the trench, but in spite of all, the lower frame of timber gave way and the sand burst in, the surface of the road at each side of the excavation sunk at the same time about 4ft., owing to the sand having been drawn from underneath, adding to the strain on the top frame and breaking many of the struts. The men, however, though drenched with rain, stuck bravely to their posts all night, fresh runners 14ft. long, extending the full depth of the excavation were obtained and driven outside the walings, and by dint of the most creditable and untiring exertions on the part of the foreman, the trench was kept open, and the water kept under until the morning. Of course, after this the system of timbering with separate frames was abandoned, runners the full depth of the excavations were used, and the thickness of the timbers increased to 4in.; these, of course, projected a great height above ground until the excavation was carried down to a considerable depth, for which reason, as well as because the material could not be taken out by shoveling it on to the stages, owing to the quantity of water it contained, shear legs were erected of sufficient length to clear the tops of the runners, a horse gear attached and the sand drawn up in buckets. As may be supposed, some difficulty was experienced in getting the brickwork dry, and even when one length had been completed, and the pumps removed preparatory to getting in the planked foundation for the next, the water as it rose would force its way through the concrete, and in some cases through the joints of the brickwork while the cement was green; to reduce the pressure behind the brickwork drain-pipes were at first inserted a few courses from the bottom of the sewer, which reached across the concrete to the side timbers, and admitted a considerable portion of the water into the sewer, where it flowed to the outfall. These, it was found, did not admit the sand, although the contrary might have been anticipated, and it may be generally remarked that, although where there is a free surface exposed, water will carry a large quantity of sand, yet a moderate amount of friction will retain the latter. Thus it was always noticed that although so much sand was drawn through the pumps as to require them to be frequently stopped for repairs, before the planking could be got in, yet directly that was accomplished the water was thrown out of the pump holes comparatively clear, and when the length of brickwork had been got in perfectly so, and the quantity of water remaining the same, to diminish the chance of the entrance of sand through the safety vents (as they may be termed), the author adopted the following expedient:—

As soon as a length of planking had been got in, and before the concrete was laid, vertical pipes were placed at intervals at each side of the trench, these were generally 6in. earthenware socket-pipes, which, from the presence of fire cracks, or from other defect, had been rejected. They were placed socket downwards, resting on the planking, and were filled with gravel; the concrete was then tipped in and the brick sewer carried up as usual until it reached as high as the tops of the pipes. Two-inch agricultural drain-pipes were laid connecting these vertical pipes with the sewer (the edge of the pipe being chipped to receive them); they were laid with a slight fall pointing in the direction of the flow: the remainder of the sewer was then completed, and the tops of the vertical pipes covered in with concrete when the pumps were moved on, and the water allowed to rise through the vertical-pipes and thence into the sewer. After this method was adopted no case of a joint being injured by the pressure of the water underneath occurred. The whole length of the main sewer where these inlets were inserted has been examined at different times by the author, particularly after heavy rains, and found to be entirely free from any trace of sand. It may be remarked here, that the admission of subsoil water into a sewer is in all cases recommended by Mr. Rawlinson, though it had been objected to by some engineers on the obvious ground of the dilution of the sewage: This objection only partially applies; first, the water admitted by this means is inconsiderable compared with sewage, which ordinarily flows even in dry weather; second, it must be borne in mind that spring water is not distilled water, that it holds in solution a variety of fertilizing salts; and thirdly, the evil of dilution is in many instances overrated, for if the sewage is so applied to the land, so to leave there all its fertilizing matter to be utilized, it seems to the author to be of no great consequence (within certain fixed limits), whether that fertilizing matter is conveyed there by a greater or lesser amount of water, the principal object being that the water as it leaves the land should contain a minimum of organic matter.

The author wishes it to be clearly understood that he would on no account recommend means to be provided in a main sewer for the admission of subsoil water properly so called, that is, water percolating from the surface, and intermittent in its flow; for when such means of ingress were not employed in letting in water, they would be in letting out sewage, and sewage gases. But it is otherwise with deep-seated and constant springs, especially if they happen to be artesian springs, derived from a water-bearing stratum underneath an impervious one, and acting under pressure; in such cases, it is better to admit it, or part of it, than go to increased trouble and expense in excluding it, providing only that nothing but water is admitted. Excepting these inlets, the sewer was practically speaking water-tight, the brickwork being laid in cement, and both rings of the arch rendered on the top with a coating of cement. That it was so was proved by sending a man through from one manhole to another after some heavy rains had fallen; the back of his coat was somewhat dusty from contact with the arch, but was perfectly dry.

The remainder of the 3ft. 6in. × 2ft. 6in. outfall sewer, after getting through the quicksand, presented no peculiar difficulty; upon leaving the road the peat was again encountered, and the same foundation used as that described for the larger outfall sewer near the temporary outfall. One thing, however, should not be omitted to be noticed in connection with these springs. Several new houses were in the course of erection on the side of the hill, west of the Brighton-road, and to supply these with water, deep wells had been sunk through the dry upper sand into the quicksand below; some of these wells were upwards of 60ft. deep, and the nearest about 200yds. from the sewer. So rapid is the flow of water in the stratum that all the wells were dried within two or three days after the trench was opened to its full depth; the bottom of these wells were exactly 10ft. above the invert of the sewer, and by levelling from them the author determined the approximate inclination of the water-bearing stratum, which was about one in twenty.

The sewers are laid out in what may be called the modern rectilineal system, *i.e.*, in straight lines from point to point, having a manhole or lamphole at every change of direction, and, with very few exceptions, at every change of gradient. The advantages derived from this method of construction need not be referred to here; but in addition to recognized utility, the author would direct attention to the facilities it affords for determining questions relating to the flow of sewage, for testing or correcting the accuracy of general formulæ and tables; for, possessing an uniform rate of inclination, a constant sectional area, and a given length in a straight line between every two manholes, we have so many independent data for basing general conclusions on. The sewer pipes were 15in., 12in., 10in., and 9in. in diameter. They were specified to be of fireclay or stoneware, to be moulded under pressure, and the socket of every pipe to be pressed on or formed with the body of the pipe, and to be truly concentric with the pipe. Pipes were to be rejected which were, first, not well nor uniformly glazed; second, not properly burnt; third, which contained injurious fire cracks; fourth, not true in section; fifth, not perfectly straight in the direction of their length. The thickness of the material of the pipes of the several sizes were to be as follows:—

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Stoneware. Diameter.	Thickness.	Fireclay. Diameter.	Thickness.
4in. ...	½in.	4in. ...	½ in.
6 „ ...	⅝ „	6 „ ...	¾ „
9 „ ...	¾ „	9 „ ...	⅘ „
10 „ ...	⅞ „	10 „ ...	1 „
12 „ ...	1 „	12 „ ...	1 1/10 „
15 „ ...	1⅛ „	15 „ ...	1¼ „
18 „ ...	1¼ „	18 „ ...	1½ „

The pipes supplied were in all cases stoneware, and of the thickness specified for that class of pipe. They were whole socketed. In laying the pipes great care was taken that each pipe was supported at every point by cutting cavities to bed each socket in, and in cases where planked foundations were required under the pipe sewers, the planks were covered with sufficient material, well trodden down and consolidated, to allow of this most important point being attended to. The jointing was executed with well-tempered clay, which was forced into the joints by means of a wooden tool made for the purpose, and rendered the joints water-tight. Under the railway, which was crossed at two points, cast-iron pipes were laid jointed with lead, and a manhole constructed in both cases on the railway at the up side of the crossing.

The fall of the ground was so rapid on the south side of the principal street (Station-road) that the greater part of the houses on that side could not be connected with the 15in. main laid in the street, and were, therefore, provided with a sewer running through the back premises parallel to this, some few of the occupiers having junctions provided in both mains, as the street main was laid sufficiently deep to drain all cellars situated in the front of the houses. The 15-inch pipe sewer in High-street may also be noticed. It runs parallel with the main outfall sewer, while the flow is in the contrary direction. It might seem at first sight more desirable to have carried the main sewer through High-street. The depth of cutting to effect this would have been about 20ft. for one quarter of its length, and nowhere less than 12ft. In ordinary soils it is possible the cost of increased depth of excavation would not have exceeded the cost of the pipe sewers, but in this case, all the houses being built on the surface, and that surface being of such a nature as to vibrate with every passing waggon, the cost of the timber which would have been left in the trenches for the security of the buildings would have soon mounted up to many times that value. The 2-foot culvert along the London-road was carried through quicksand precisely similar to that before described, except that the bed of clay was not so well defined as before. The same means were adopted in dealing with the springs, and the result was, most of the surface wells were dried—a result not at all to be deplored in a sanitary point of view, as they were largely affected by percolations from cesspools, and otherwise contaminated owing to the porous nature of the subsoil; and as the Caterham Spring-water Company have just completed laying their mains through the town, the inhabitants have an opportunity of compensating themselves for the loss of their wells by procuring a constant supply of pure and soft water at a moderate cost. The manholes which were situated at the angles of the sewers were, with one exception, elliptical in shape at the base, major and minor axis, 5ft. and 3ft. respectively. They were constructed of brickwork in cement, and in all cases carried 1ft. below the invert of the lowest sewer connected with them, the bottom being formed of brick-on-edge paving grouted in cement. The manholes we e drawn in at the top to an ellipse, 2ft. 3in. × 1ft. 10in., and were provided with the manhole covers and frames manufactured by Messrs. Sharp and Co., of Lancaster. They consist of a cast-iron framing filled in with blocks of wood. They offer no impediment to traffic, and will no doubt be found to be exceedingly durable. They have, however, one fault, which is, that road grit falls in and is forced down by the traffic between the cover and the frame, so that the former gets jammed tight, and the men, finding they can't lift it by the keys, use a pick to clear the space round the cover, which is apt to injure it. The author thinks this might be obviated by constructing the cover with a flange all round the upper edge. It need only project 3in., and should be roughed on the upper surface. This, he thinks, would remedy the evil. Ventilating shafts were connected with most of the manholes, and were also placed at intervals along the sewer. They were provided with cast-iron ventilating boxes containing charcoal trays. They have a partition in the centre, one side forming a receptacle for road grit, the other communicating with the sewer and provided with galvanized iron charcoal trays. The cover is perforated for half its area only. The trays are connected together so as to be readily lifted out of the box when it is required to renew the charcoal. The pipe sewers were constructed with a vertical drop at each ventilator. This was effected by inserting a quarter circle bend connected with a T-piece, the shaft being carried up with two or three diminishing pieces, according to the depth of the sewer, as shown on the drawing. This is in every way a preferable method to that of breaking the continuity of the pipe sewer and constructing a shaft in brickwork, as is usually done.

The ventilation of sewers by means of charcoal the author believes first took its rise from the investigations of Dr. Stenhouse, F.R.S., who, in 1853, directed attention to the subject of charcoal in connection with the ventilation of impure atmospheres. He showed that charcoal was not an antiseptic, as it was at that time generally represented to be, but, on the contrary, was a great agent in promoting decomposition, from its capability of absorbing large quantities of gas, and retaining it within its pores until it was gradually oxidized. Keeping this principle in view, the author ventures to throw out a suggestion which he cannot help thinking would be worth a trial, and which might be found to increase the efficiency of the charcoal immensely, and render the smallest escape of mephitic gases almost an impossibility. He proposes to use, instead of ordinary charcoal, oxygenated charcoal. If charcoal is exposed to an atmosphere of pure oxygen, it quickly absorbs it, retaining in its pores a quantity equal to 9⅓ times its bulk. The gas, being thus condensed, acts with magnified force in effecting the oxidation of gases exposed to its influence: compared with oxygen in an uncondensed state, *a fortiori*, compared with the oxygen of the atmosphere, which is five times diluted. That this is no mere theory may be proved by bringing sulphide of hydrogen (H S) (a gas once smelt not soon forgotten) in contact with oxygen gas at ordinary temperatures. No action takes place; but if a bit of charcoal which has absorbed the latter gas be introduced into a jar containing the former, it (the H S) is immediately oxidized, sometimes with detonation, water and sulphurous acid being produced. The expense of thus oxygenating even a large quantity of charcoal would be comparatively trifling; and we may conclude that a much smaller quantity of charcoal than is at present used in the ventilators would be sufficient to effect the complete deodorization of the gases. It must be remembered also that charcoal will not part with its absorbed oxygen, except on the influence of heat, or on being placed in vacuo; and we may reasonably infer it would retain its properties a considerable length of time before requiring reoxidization.

The gulleys used have a box for retaining road sand, which is easily removed and replaced, and the gulley traps itself. They are admirably suited for towns, having well paved channels of moderate inclinations, where the old cesspit gulley would be a nuisance. But in situations where much sand is carried down the steep inclines by heavy floods of rain, they are not so well suited, as the boxes soon get full, and any further supplies of sand overflow with the water, and get into the sewer; besides which, sand is apt to find its way into the groove on which the grating frame rests, filling it up, and then making a passage for sand and water outside of the box. Of course, these disadvantages can be prevented by proper attention on the part of the man intrusted with their supervision; but, in the unfavourable situation mentioned, the mischief may be done in one night, and on such nights, too, when it would be unreasonable to expect the most energetic inspector to be out of doors. In the Redhill sewers two or three gulleys were placed in these unfavourable situations, and the consequences were as have been described, and then Mr. Latham, the engineer, recommended catch pits for the sand to be put in at the front of these gulleys, which would obviate the inconvenience arising from sand. The author had hoped to have brought before the notice of the Society a series of experiments on the flow of water in these sewers; he has only been able, however, to conduct very few, as he was called away from Redhill to superintend the new irrigation works at Rugby. He, however, submits the few experiments he did try in a tabular form, and hopes at some future period to be able to bring forward a much more extended series on a similar plan.

Experiments on the Flow of Water in Egg-shaped Sewers, compared with Formulæ.

	i	m	V in ft. per min. Rankine.	Molesworth.	Experimental.	Q cube ft. per min. Rankine.	Molesworth.	Experimental.
Manhole A to B, mean of 3 experiments ...	1/252	0.195	154	157	180	40·81	41·6	47·7
Manhole C to D, mean of 3 experiments ...	1/455	0·29	78	79¾	76	34·81	35·26	33·58

i = height divided by length or sine of the angle of inclination.

m = hydraulic mean depth.

It would seem by this table that the experimental velocities and capacity of discharge approach nearer the theoretical, where the flow of water is slow and the inclination of the bed slight, but the author is very far from wishing to base any definite conclusions on such limited experiments, and will now conclude this paper by giving a detailed statement of the cost of the works.

Redhill Sewerage Works.—Particulars of Cost.

Description of Work.	Quantities.	Average cost per yard. £ s. d.	Cost. £ s. d.
BRICK SEWERS IN CEMENT.	Yards linear.		
3ft. 9in. × 2ft. 8in. 9in. thick	224	2 15 10	621 18 0
3 „ 6 „ × 2 „ 9 „ 9 „ „	754	1 16 2	1364 0 0
2 „ 0 „ 9 „ „	225	1 5 9½	290 0 0
2 „ 0 „ 4½ „	176	0 15 2½	134 0 0
Total brick sewers...	1324		2409 18 0
STONEWARE PIPE SEWERS.			
15in.	1696	0 9 9½	828 11 4
12 „	979⅓	0 4 8	228 9 2½
10 „	1436⅓	0 4 4½	315 2 11½
9 „	1149⅓	0 3 9	215 10 0
IRON PIPES.			
15in.	16⅔	2 10 3	42 1 0
10 „	28	1 11 9½	44 10 0
Total pipe sewers...			1674 4 6
FOUNDATIONS.			
Close planking laid on longitudinal sleepers, and covered with concrete	570⅓	1 16 10	523 10 0
Hurdles, interlaced with brushwood, &c.	581	0 18 0	733 14 1
Timber piles, &c., left in trenches	...	...	1926 7 6½
Total foundations...			3183 11 7½
	Number.	Each.	
Gulleys	17	3 10 0	59 10 0
Ventilators	40	2 10 0	100 0 0
Manholes	37	11 11 0	427 7 0
Lampholes	3	2 0 0	6 0 0
Total appendages...			592 17 0
Other expenses, including lithography, taking out quantities, engineer's office, keeping roads in repair, pumping, making good old sewers, &c.	...	...	637 12 7
Total			£8498 3 8½

The above includes only those pipes, gulleys, ventilators, &c., actually inserted in the works, and is exclusive of expenses arising from the rescinding of part of the original contract.

ORMEROD'S PATENT SAFETY LINK.

WE have from time to time placed before our readers various devices for the prevention of accidents at collieries from overwinding. We have now to draw their attention to a very important improvement in this direction, which has been invented by Mr. Edward Ormerod, the engineer at the Atherton collieries. Some time since, several serious accidents from that prolific cause of accident—overwinding—occurred at these collieries. To prevent their recurrence, the proprietors—Messrs. Fletcher and Co., directed Mr. Ormerod to select the most effective apparatus he could find for preventing overwinding. Mr. Ormerod carefully investigated a great many inventions, but with respect to all of them, there was, as he conceived, the serious defect of liberating themselves at the bottom of the contrivance. With the

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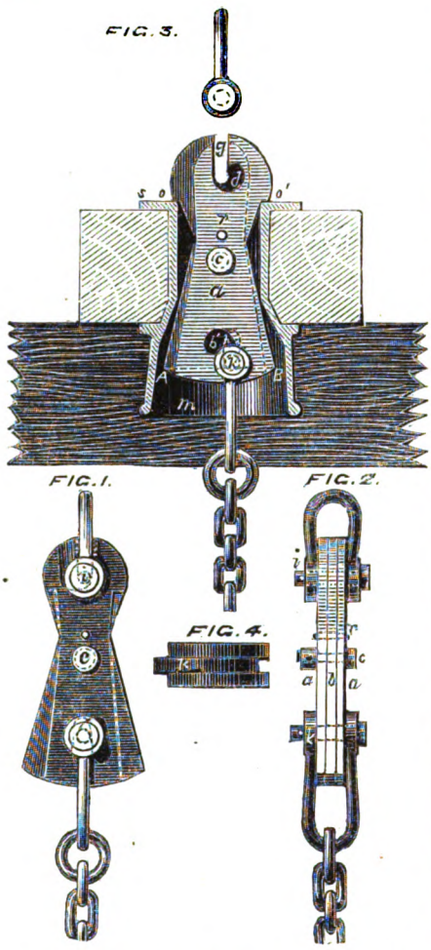
contrary view in his mind, he saw that if they were set free at the top instead of the bottom, nothing but the rope and the shackle at the end need go over the pulley. Accordingly, he set to work to invent an apparatus on this new principle, and, after much patient labour, he has at length succeeded, and the result is the exceedingly simple and thoroughly efficient apparatus we have shown in the accompanying engraving. By so constructing it that it will lock itself when drawn into the cylinder, the inventor has produced an apparatus which accomplishes the three-fold purpose:—firstly, of disconnecting itself with certainty; secondly, remaining behind whilst nothing but the rope goes free; and, thirdly, of catching the cage in falling back again. The invention consists simply of a link or shackle formed of three plates placed side by side, and connected together at a point about the middle of their length by a central stud upon which the plates turn. In these plates slots are formed, in which the shackle pins that connect the rope with the cage are contained. We have a well made working model of the link before us, which we have manipulated over and over again with invariably satisfactory and unfailing results.



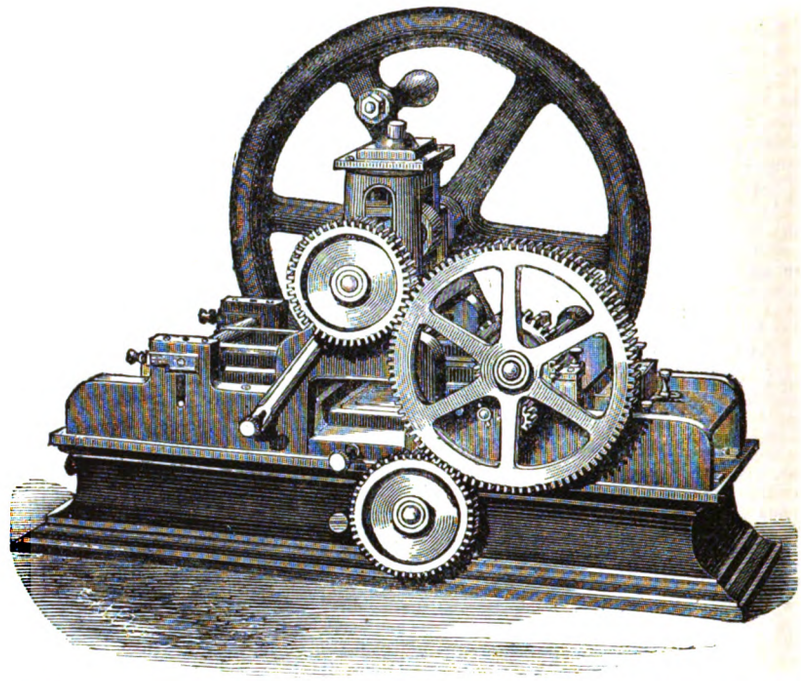
In our engraving, fig. 1 represents a front elevation of the link as it appears when duly connected, in which position it forms a permanent union between the rope and the cage; fig. 2 represents a side view of the same. Fig. 3 represents a front elevation of the link as it appears when the rope is disconnected, and the cage retained upon the top flange of the disconnecting tube. *a a* are the outside plates of the link, and *b* is the inside or intermediate link; these links are placed side by side, and connected together by the stud *c*, upon which the plates turn as on a centre. The two outside plates are provided at the top with curved slots *d d*, each having an opening extending to the edge of the plates, and the bottom slots b^1 b^1 are formed in the plates, which, however, do not extend to the edge, and have no exit for the lower shackle pin. The intermediate plate *b* is also provided with two vertical slots *g* and *h*, the upper slot *g* being open at the top, and the lower slot *b* closed. These slots, when combined in the position shown in fig. 1, are arranged so as to embrace and retain the pin *i* connected with the suspending or winding rope, and the pin *k* connected with the cage, hoist, or receptacle. A small hole *r* which corresponds in each plate (when in the position shown), is filled by a soft metal pin, which is inserted through the plates to prevent them moving without the necessary pressure, and which thus forms a permanent union or link when in this position.

The inclined edge of the intermediate plate *b* projects beyond the edges of the other plates, and in such position the rope and cage are properly connected for working. Should, however, the cage be lifted too high, so as to bring it near the winding pulley, the link enters the cylinder *m* (fig 3), which is permanently and securely fastened at a proper distance between the pulley and the shaft or pit opening, and when the link has been drawn sufficiently through so as to allow the upper end to project above the flange or collar of the tube *m*, the interior surface of the tube *n* will have forced or compressed the edge of the plate *b* level or even with the other plates *a a*, which will cut or break the soft metal pin, and cause the interior vertical top slot *g* to force the pin *i* from the curved slots in the outside plates so as to make all the vertical slots coincide, and one common opening out at the top of the links will be formed, thereby allowing the pin *i* connected with the rope to escape. The catches *o o'* of the links overlap and are caught by the flange *s* of the tube *m*-whereby the release of the cage from the rope, and the retention and safety of the cage are simultaneously effected. When the inclined edges of the plates project above the flange of the cylinder, as seen in fig. 2 (at the time the cage is released), the links become locked in such position, and are retained in and supported by the tube or cylinder until the cage is uncoupled or its weight removed from the links. This locking is effected by means of the pin *k* which enters the vertical slots in the lower ends of the plates when it is forced from the curved slots in the outside plate of the link whilst passing into the cylinder, and is further locked by means of a pin projecting from each side of the middle plate, and which passes along inclined slots into recesses cut in the inside faces of the two outside plates, as seen in the detached view at fig. 4, which is a section through the line A B of fig. 3.

We pass over the numerous trials of this apparatus, which certainly proved its perfect working, but were only experimental after all, preferring to give an instance of its utility which has just occurred in actual practice. This is the grand test of any invention, and we are glad to be able to record an instance in favour of the present one at so early a period of its career. The circumstance in question occurred at the Mesnes colliery, Wigan, where the apparatus has been adopted and was about to be tested. This, however, was accidentally effected before the time appointed, but it proved the efficiency of the link beyond a doubt, and removed the necessity of any further trials. It appears that the eccentrics of the engine got loose while the engine was at full speed. The engineman thus lost control of the engine, which ran the pulley in at full speed. The rope was released and the cage remained suspended, and thus a serious accident was prevented. We consider Mr. Ormerod's invention to be a sound, practical piece of mechanism. As such, it cannot fail to recommend itself to every colliery manager, and to come into general use, and cause accidents from overwinding to be numbered with things of the past.

MACHINE FOR PRINTING WITHOUT INK.

BY M. LEBOYER.



PRINTING WITHOUT INK.

WE have lately examined a clever mechanical adaptation of the well-known principle of the manifold writer to printing purposes. It is a small machine worked by hand, and by which printing is effected with great rapidity without ink, and without any previous preparation except, of course, setting the type. It is the invention of M. Gustave Leboyer, and attracted considerable attention in the Paris Exhibition last year. We saw it at work at the office of Mr. J. M. Powell, 3, Bouverie-street, Fleet-street. Its general construction will be seen in our engraving, which shows a perspective view of the machine. At the right end of the apparatus is a box in which the cards are deposited in a pack, a small weight being placed on them. They are fed forward, one by one, from the bottom of the pack, between two rollers, over which pass endless tapes. The types are set in a platen, and inserted through an aperture in the side of the machine at the centre. As each card reaches this point an eccentric on the shaft of the flywheel presses it down upon the type, and as a piece of carbonized paper is interposed between the type and the card, a correct impression of the former is left on the latter. The printed card passes on and is delivered at the end of the machine opposite to that at which it entered. The carbonized paper is a long strip and is wound on a roller placed to the right of the cam shaft, the end being secured to another roller to the left of this shaft. The latter roller unwinds the paper from off the former progressively as each card passes over the platen, so that a fresh surface is continually presented to the type. The printing we saw done was decidedly good, the mechanical arrangement working well, and the result being a sharp black print. We saw some excellent specimens of colour printing, which were very effective. The machine is turned by hand, and prints at the rate of about 100 cards per minute. Not cards

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alone, but circulars and bills may be printed by these machines, of which we saw two sizes—each for a different purpose.

GOLD DISCOVERY IN SOUTH AFRICA.

HERR MAUCH, the German traveller, has arrived in Natal. He asserts that goldfields, believed by him to be richer than those of California or Australia, exist in the interior. According to his statements the locality of this auriferous region is precisely identical with the description given by Dr. Livingstone in his first book of travels, and the present discovery may be regarded as being the confirmation of rumours and the justification of convictions that have prevailed from the earliest times. Mr. Mauch tells us ("Natal Mercury") that he has seen two goldfields—the northern one being of indefinite extent, and lying much nearer the Zambesi than the other. This latter one is situated about 900 miles from Natal in a north-westerly direction, beyond and to the west of the limits of the Transvaal Republic. It is in the country formerly ruled by Sekhomo, a runaway chieftain, whose place is now filled by Machin, under the suzerainty of Moselekatse. As the former chief can muster 10,000 warriors and the latter 40,000, it is evident that the chief obstacle in the way of any gold-working movement rests in them. The country itself is tolerably healthy and well watered. The geological character of the district is represented by metamorphic rocks, with slate, and the other usual indications of auriferous wealth. Vegetation is not luxuriant. In the immediate neighbourhood of the goldfield, which Mr. Mauch estimates to cover a tract of twenty miles broad, and sixty miles long, there are not many natives. When the explorer saw the white reefs of auriferous quartz glistening in the sun, as they cropped out here and there, he was startled by the conception of the wealth which he firmly believes those reefs to contain. Thousands of holes, some 10ft. deep, give evidence of old native workings, and bear out Dr. Livingstone's remark about the gold washings carried on in wooden bowls by the Kaffirs in times past. Mr. Mauch brings with him about twenty specimens. Those that are auriferous consist of pale quartz, containing minute particles of pure gold. Several of them are of iron and lead ores, and some of them come from the Transvaal Republic. It is difficult as yet to say what the upshot of these disclosures will be. Mr. Mauch explored the country in question in company with Mr. Hartley, an old and well-known elephant hunter, and, in justice to that gentleman's exertions and services, he considers that he is bound to require some recompense in his behalf. Mr. Mauch himself has no interest in the discovery, he says, beyond the scientific distinction it may bring him. He is accredited and commissioned by the Geographical Society of Gotha to do a certain work,—namely, to traverse Africa westward of the lakes from Natal to the Mediterranean, and to the accomplishment of that grand purpose he has devoted his life for the next few years. It remains to be seen whether the exact situation of the goldfields will become generally known by means of the information accorded on payment of the required reward, or by means of further private adventures. Our impression is that, as the locality of the goldfield is known already to one or two Englishmen resident in the Transvaal Republic, the discovery will be developed in the first instance by means of private expeditions. It cannot be denied that considerable risk will attend such movements, but the prize to be won offers an overpowering inducement to the adventurous spirits abounding amid the wild scenes of the interior.

NATIONAL BOILER INSURANCE COMPANY.

WE have before us the annual report of Mr. H. Hiller, the chief engineer of the National Boiler Insurance Company. We are happy to learn from it that, although the general depression of trade and manufacturing industry has been even more severe than in the preceding year, the Company's connection has steadily and considerably increased. This is the best testimony to the value of this and kindred companies. Mr. Hiller embodies in his report practical information of a character likely to be useful not only to boiler owners but to their engineers, so that their attention may be directed to the superior advantages of first-class apparatus, and to the necessity for that constant and careful attention to the condition and working of boilers which cannot be safely omitted.

The report is divided into three portions; the first relating to the defects met with in the boilers inspected; the second containing a few practical remarks on boiler construction; and the third a summary and report of the boiler explosions which have been reported to Mr. Hiller during the past year. The chief engineer states that many cases of dangerous external corrosion have been reported which were due to dampness of flues or leakage at riveted seams, the boiler plates being thinned where in contact with the brick seatings. Also leakage at the blow-out pipe joint, careless slaking of ashes, or leakage at mudhole joints, the corrosion being hidden by the excessively thick brickwork of the front cross wall. External moisture, causing wasting of the plates in contact with the brickwork at sides of boiler, and neglected leakage from the fittings. Some of the boilers inspected were found dangerously weakened by internal corrosion, the plates in some cases being reduced to less than half their original thickness. In one instance, the flue tube of a second-hand boiler was so much weakened that, on being submitted to the hydraulic test, it collapsed at a pressure little beyond that to which the safety valves were usually loaded. Numerous cases of deep grooving were met with in the end plates of internally-fired boilers, at the edges of the angle irons of upper part of tubes, and, in some instances, the plate was quite broken through.

Under the head of defective fittings, Mr. Hiller observes that no fitting attached to boilers requires more constant attention and frequent testing than the water gauges, and attendants cannot be too strongly impressed with the necessity for special care on this point. It is only too true that gauge fittings with no glass, or taps so leaky that the gauge cannot be tested, and floats so stiff as to give no reliable indication, are frequently met with; and, occasionally, instances of great ignorance or gross recklessness on the part of the attendants or of the owners of the boilers. The safety valves of many boilers were found excessively overloaded in various ways. Others were corroded quite fast through neglect. In one instance the valve lever of a new boiler was actually held down by a prop placed against the floor above. The danger incurred in such cases is too evident to require comment, and we can only suppose that explosion was arrested by the timely visit of the inspector.

Under the second head of the report, boiler construction, Mr. Hiller gives some sound practical information, insisting on points which are but too often regarded as of minor importance, both by makers and users. We shall refer again to these points in a future number, as they are somewhat lengthy for our present purpose. Passing on to the third head, boiler explosions, we find the remarkable statement that a boiler under the care of company has actually exploded! This is unprecedented; it is the first accident which has occurred to a boiler under the company's inspection, and forms the exception which goes to prove the general rule of safety. We are glad to be able to state that the explosion was not of a very severe character, as the boiler was not moved from its seating, nor was anyone seriously injured. We cannot take this accident as militating against the interests of the company when we find that although generally the inspector's suggestions are well received and appreciated, yet in some cases, through misapprehension of their object or meaning, or of the danger which is pointed out, they are not attended to. Mr. Hiller states that in a number of instances this neglect has been followed by the accident or damage it was wished to avoid. We need not follow Mr. Hiller through the list of explosions for the past year; they have for the most part appeared in our columns from time to time. The list is a long one, and when contrasted with the immunity enjoyed by those whose boilers are under inspection, the value of such companies as the National Boiler Insurance at once becomes apparent. We trust that boiler owners will, by their voluntary action, procure such inspection of their boilers as will render unnecessary that Government interference which we have so often recommended for adoption.

INSTITUTION OF CIVIL ENGINEERS.

AT the monthly ballot of the above institute the following candidates were balloted for and duly elected as members:—Messrs. W. C. Barton, James Bower, W. W. Clark, R. S. Clayton, F. J. Dennys, James Mathias, John Paton, G. L. Reid, and David Richmond; and as associates:—Messrs. H. G. Anderson, F. C. Barron, W. T. Blacklock, W. R. Browne, R. H. Brunton, C. T. Casebourne, R. G. Clutton, C. H. Croudace, H. A. S. Fenner, W. R. I. Hopkins, W. S. Howard, Alfred Longsdon, Robert Reynolds, F. W. Robinson, R. B. Smyth, William Sykes, J. J. Wallis, and D. W. Young; and Sir A. W. Mackworth, Bart., R.E. It was announced that the Council, acting under the provisions of Section IV. of the Bye-Laws, had recently admitted as students of the Institution, Messrs. J. A. Carfrae, J. M. Gibson, C. S. Harris, G. E. Page, and F. G. Wynne.

ABYSSINIAN EXPEDITION—WATER SUPPLY.

WHEREVER in the progress of the expedition water springs are to be met with, and the superincumbent material is capable of being pierced, Mr. Norton's pumps will furnish the readiest, cheapest, and in every way the best source of water supply; but these conditions are not in all cases to be calculated upon with confidence, and other sources of supply are accordingly of vital importance. Assuming that the expedition will keep its communication with the coast open, and that the means of transport can be found, the apparatus for distillation in the vessels lying near Annesley Bay will give about 80,000 gallons per day. There are 78 vessels, including transports, furnished with condensing apparatus. Some of the transports are only capable of distilling a small quantity—from 30gals. to 200gals. a day—but many of the larger vessels are capable of much greater performances. The "Hydrabad" from Bombay is equal to 10,000gals. a day, the "Semiramis" condensing vessel 4,000gals., the "Californian" and the "West Indian" 2,780gals. each, and many other vessels 1,200gals. each, and upwards. It is to be hoped that the supply by the pumps may prove sufficient, as the cost and tediousness of water supply from the coast is of course great and growing. However, here is a resource should the wells fail in their supply.

PEAT FUEL.

THE practical application of peat as a fuel for steam purposes still continues to receive attention in several quarters. The question, however, appears to be surrounded with difficulties, as, after years of trial, its definite solution has not been arrived at in England, although in Ireland it is largely manufactured by Mr. C. Hodgson, both for steam and household purposes. There is not in England — so far as we can find—any establishment where the manufacture of peat is carried on upon a commercial scale in a condensed form suitable for steam purposes. We have been told by some, that condensed peat is being made in some parts, but is of such value in the form of charcoal for the manufacture of iron and steel, that none can be spared for steam fuel, the ironmasters taking all they can get, at high prices. We know that peat, properly prepared, is invaluable to the iron smelter, but were there a brisk trade in peat manufacture, there would be enough for all purposes. The fact is, we do not appear to have quite arrived at that point at which the manufacture can be called a commercial success. It was nearly done at the peat works, at Horwich, but, just at that point, we believe, the works were burnt down, and the company has become extinct. Another company, however, we hear, is now engaged in practically developing the question, and, with Mr. W. Austin as their engineer, are erecting machinery for producing peat fuel in large quantities for land and marine engines. We are informed that the works of this company will shortly be opened, and that public trials of the condensed peat will be made in a few weeks. We shall then hope to place our readers in full possession of all particulars. For the present, we can only say that having examined some of the peat produced, we find it to be of excellent quality, and apparently well adapted for use as a steam fuel.

ROYAL MICROSCOPICAL SOCIETY.

AT the ordinary meeting of the above Society held on Wednesday week, Mr. James Glaisher, F.R.S., President, in the chair, one new Fellow was elected, and a large number of presents to the society were announced. A paper was read by Major Ross, R.A. on micro-crystals, and iridescent Films, obtained by the use of the blow-pipe; the subject—which was illustrated by experiment and by specimens exhibited under the microscope—gave rise to an interesting discussion, in which Messrs. Charles Brooke, F.R.S., Jabez Hogg, F.L.S., and H. J. Slack, F.G.S., took part. A paper was also read by Mr. Jabez Hogg, on the lingual membranes of mollusca, the subject being illustrated by a series of beautifully executed coloured drawings. The thanks of the meeting were presented to the readers of the papers, and the President announced that the annual soiree of the Society would be held on the 22nd.

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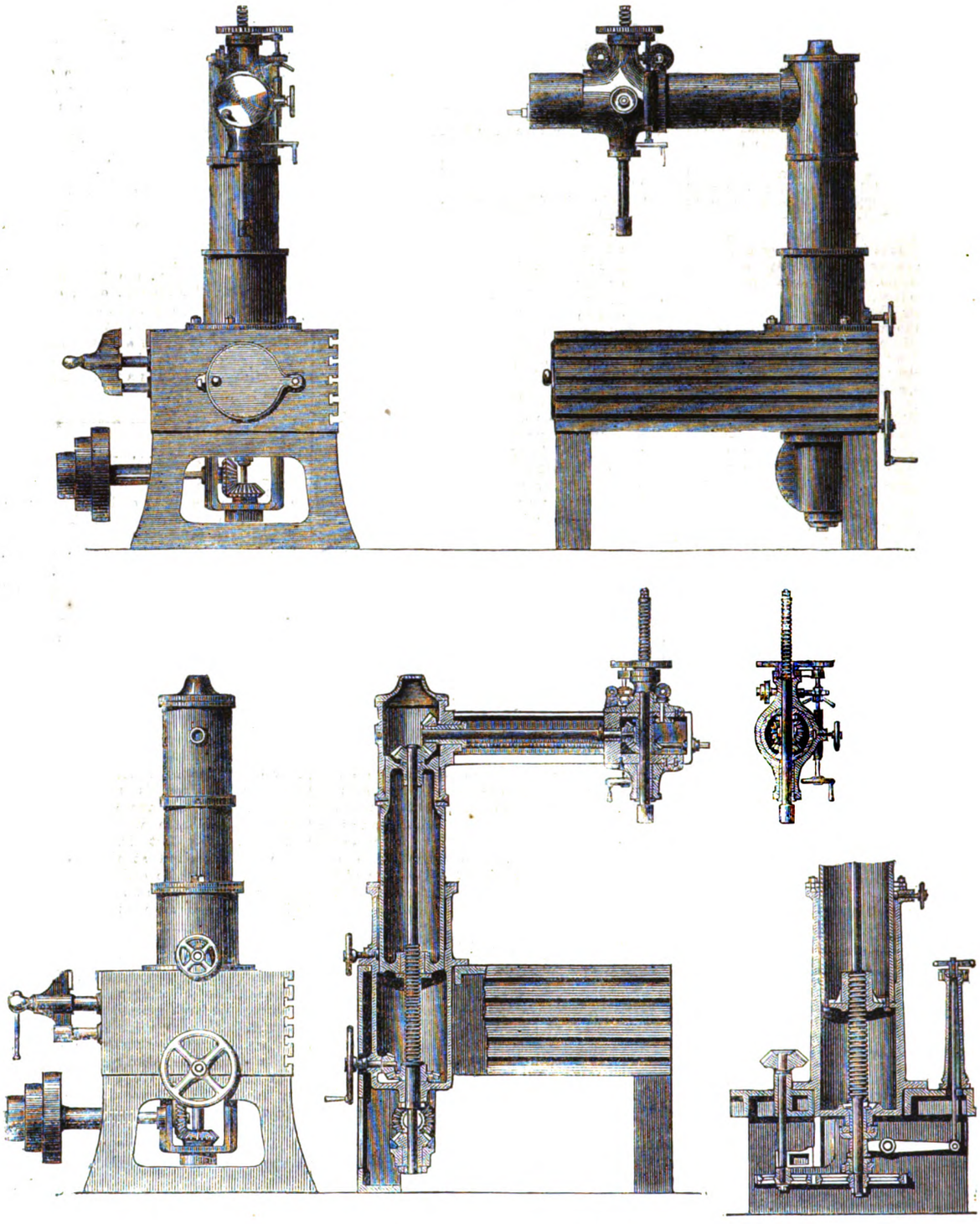
ALLEY'S RADIAL DRILLING MACHINE.

MANUFACTURED BY MESSRS. NEILSON BROTHERS.



RADIAL DRILLING MACHINE.

THE above engraving represents a radial drilling machine, which has lately been introduced by Messrs. Neilson Brothers, of Glasgow, and was designed by Mr. S. Alley, of that firm. It possesses some novel features in its construction, and doubtless will prove itself a very useful tool, especially for light work, for which, probably, it will be most extensively employed. The chief peculiarity in the machine is that nearly all the gearing is enclosed within the hollow pillar and radial arm, thus protecting it from the dust and from contact with surrounding objects, whilst the tool as a whole is rendered very compact. The pillar, which is of the telescope form, is raised and lowered by hand in the smaller machines, but for larger sizes Mr. Alley has adopted an arrangement which is represented in the sectional view. The wheel and screw on the top of the vertical pillar on the left-hand side of the main pillar is employed for raising a coupling on the driving shaft, by which means the lifting screw is coupled to it. The drill spindle is provided with a self-feeding motion, which can be engaged and disengaged at pleasure by means of a friction clutch. The other parts of the machine are so clearly shown on the woodcut, that a further description is not required.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending April 11, was 3,662; total number since the opening of the museum, free daily (May 12, 1858), 1,274,425.

MACHINERY FOR CUTTING CORKS.

CORK cutting would seem to be a simple operation, but there are so many points to be attended to that those who best know what the work is, will admit that it requires no ordinary amount of ingenuity to design a machine which shall meet all the requirements of the case. We, however, illustrate a new cork cutting machine, which is said to fulfil every requisite condition, turning out its work with perfect accuracy and great rapidity. The inventor is Mr. J. W. Dudley, of Drummond-road, Bermondsey. By these machines the sheet of cork is first cut by a circular knife into strips the width of the length of the cork. It is then fed endways to the machine. The first knife cuts off a square which rotates as the segmental knife passes over it, and

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CORK CUTTING MACHINE.

BY MR. DRUMMOND.

FIG. 1.

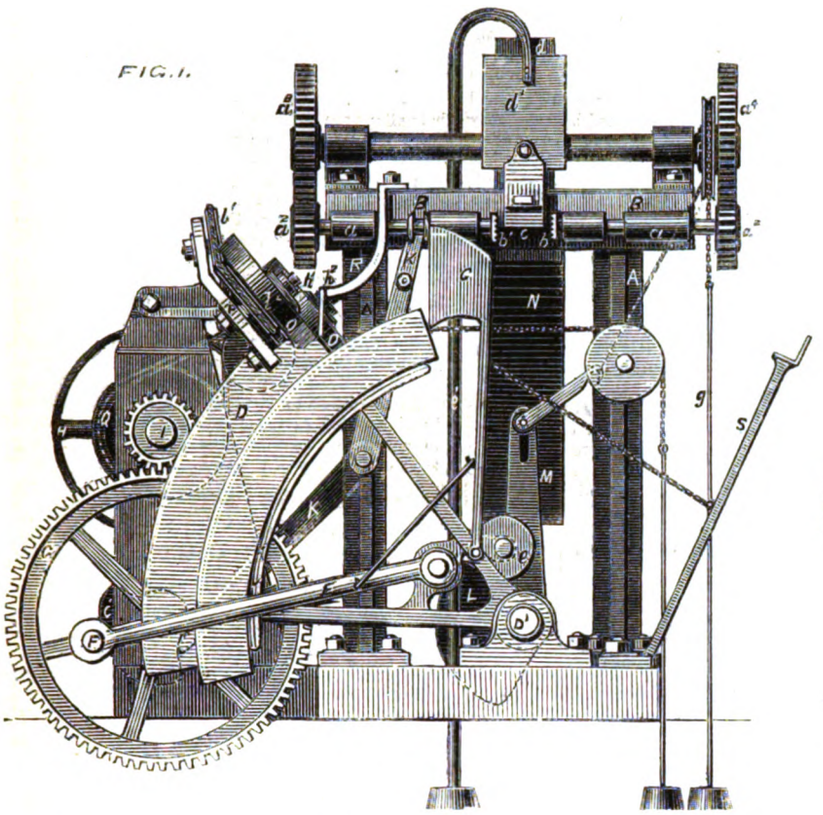
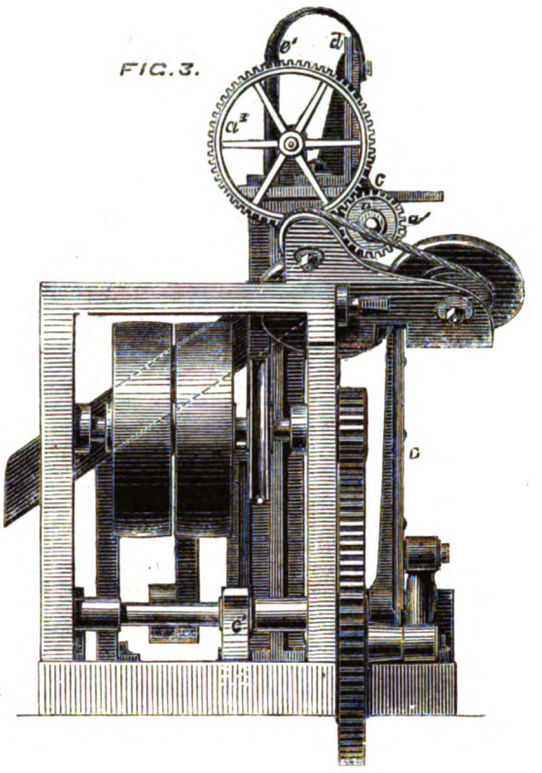


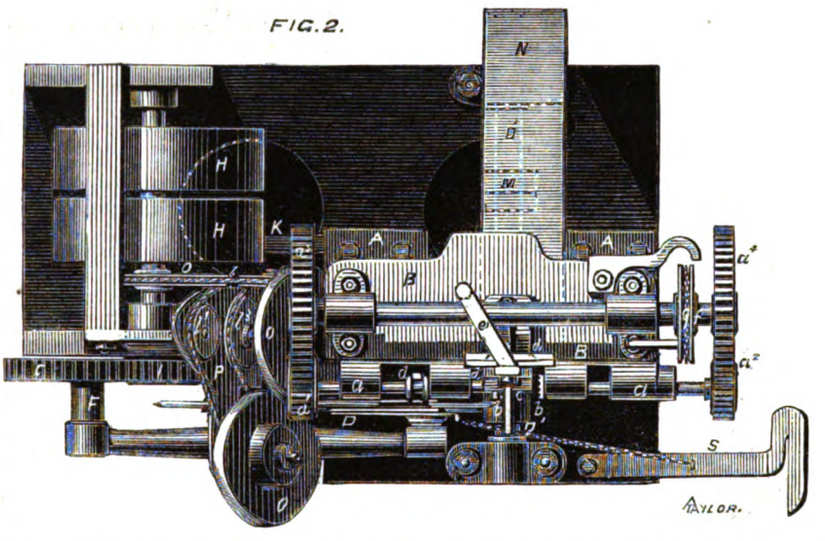
FIG. 3.



gives it a circular or an oval form as required. The corks leave the machine complete. The economy of this manufacture is apparent in various ways. First, in time and cost of labour; an ordinary day's work for a man cutting corks by hand is from ten to twelve gross, whilst with the machine a boy turns out eighty gross in ten hours. Next there is an economy of material, for the shavings are as thin as they well can be, and thus there is less material cut to waste; the number of corks cut from a given weight of wood is much greater than by any other process.

Passing on to the details of the machine itself, it will be noticed that our engraving shows at fig. 1 a front view, and fig. 2 a plan, and fig. 3 an end view on the side of the driving gear. A A are standards mounted on a bed plate at each end of the machine, on which standards is bolted a plate B carrying the adjustable bearings a a of the dog b b^1, and between which the strip of cork is gripped on being fed to the machine by hand. The strip of cork is previously cut of a width corresponding to the length and also to the thickness desired to make a certain sized cork. The spindles of dogs b b^1 carry pinions a^1 a^2 at either end, gearing with toothed wheels a^3 a^4, mounted in bearings on plate B. After the strip is gripped by the dogs b b^1, it is immediately severed by a knife C moving across the face of the machine and suitably attached to a second knife and frame. The knife C which is fitted to move in close proximity to the bearings a a is adjustable together with the paring knife D, according to the size of cork desired. The knife C in its forward motion severs a piece of cork from the strip of sufficient size for a cork, the diameter of which is regulated by a gauge c rising and falling in a guide d at the upper part of the machine. The piece of cork in the form of a parallelopiped being gripped by the dogs b b^1, is then subjected to the action of a second knife D of segmental form mounted in bearings on the bed plate of the machine. This knife has reciprocating motion imparted by the aid of a connecting rod E connected to a crank pin F of a toothed wheel G, to which motion is communicated from the driving pulleys H and pinion I. The shaft of the wheel G is provided with a cam G^1, by the aid of which one of the dogs, b^1, is operated for seizing or releasing the cork when fed into the machine; this cam G^1 acts on a counterbalanced lever arm K mounted on the framing A, its upper end being connected to a collar d formed

FIG. 2.



on the spindle of dog b^1, so as to effect its sliding movement in one or other direction for gripping or releasing the piece of cork.

Fig. 1 shows the position of the knives C D, and cam G^1 at the moment of commencing the forward movement for cutting and shaping the cork, the gauge c being at same time brought to its lowest position in contact with the strip by the aid of slide d^1, the rising and falling movement being operated by a cam L keyed on the knife shaft D^1, through the aid of the truck roller e carried on the rod e^1 of slide d^1, the rod being weighted. In this position, the cork being held by the dogs b b^1, is first severed by the knife C in its forward motion, and the pinion a^1 of dog b^1 being thrown into gear with weel a^3 by the action of cam G^1 and lever arm K, both the dogs will immediately rotate with the piece of cork between them during the whole of the forward motion of knife D, so as to pare off the angles and produce a cylindrical cork. Rotary motion is imparted to the dogs b b^1 by means of a lever arm M fixed on the knife shaft D^1, and connected to a pulley f mounted on the wheel shaft of a^3 a^4 by a chain and counterbalance g. The rotary motion of the dogs b b^1 continues until the knife has completed its oscillating forward motion, after which and during the return motion of the knife D the projecting part of the cam G^1 acts on the lever arm K for drawing back the spindle of b^1 by the aid of collar d, when the dogs will no longer turn, and the rounded cork will be released and fall into the shoot N.

We may here observe that immediately the knife C has severed the square of cork from the strip, the cam L on the knife shaft D^1 raises the gauge c by the aid of the slide d^1 and rod e^1, so as to permit of the free rotation of the piece of cork held by the dogs. In order to keep the oscillating knife D in a constantly sharpened condition, two grindstones O O are mounted towards one side of the machine, in such position that both edges of the knife moving between and at right angles to the direction of motion of stones may be constantly in contact with them during the whole time of the oscillation of the knife in both directions. These stones are mounted on stud pins h^1 h^2, fixed on a plate P bolted to the frame in which the driving gear is mounted. The

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stones receive motion from a pulley Q mounted on the driving shaft by means of an endless band encircling the pulleys l l^1 l^2 l^3, the two latter being fixed on the spindles carrying the stones. R is a guard iron fixed to the top plate B, its lower end being in close proximity to the face of knife D, and serving to prevent any cuttings of cork liable to be carried back with the knife from fouling the stones. The backward movement of knife C is limited by a cord or chain, so as to prevent its coming in contact with the collar d of dog spindle, it being necesssary to adjust the knife as close as possible thereto for cutting small corks. It also permits of the oscillating knife D moving back sufficiently to sharpen the whole length of its curved edges. S is a rest supported on an arm fixed to the bed plate of the machine, on which the operator places the strip of cork with the end slightly projecting for the knife C to sever in its forward motion whenever there may happen to be any imperfection in the cork strip it is desired to remove before presenting it to the gripping dogs.

As already mentioned the corks instead of being turned cylindrical may be made of taper form by slightly lowering and altering the direction of one of the dog spindles b by the aid of the adjustable bearings a a. The knife frame D can also be made to move to and fro on its shaft, if desired, in order to produce a cork of oval form. A simpler mode of effecting the same purpose consists in making the bearings a a, carrying the dogs b b^1, to move slightly backwards and forwards by means of a cam mounted on the shaft before mentioned, as giving motion to the dogs, a projecting stud or pin on the bearing a in contact with the cam being regulated so as to give more or less motion for producing a more or less oval cork.

ON ALLOYS AND THEIR USES.*

By PROFESSOR A. MATTHIESSEN, F.R.S.

THE object of this discourse was to show experimentally why alloys are used in preference to their component metals. Alloys may be, chemically considered, divided into three classes:—1. Chemical combinations. 2. Mechanical mixtures. 3. Solutions of the one metal in the other which has become solid, or for shortness sake, solidified solutions of the one metal in the other. Under the term chemical combination such alloys may be considered which are the result of the combination of two metals when these unite together with great energy and evolution of heat, producing an alloy the physical and chemical properties of which we cannot foresee. As an example of such alloys those of gold, with tin, lead, or zinc may be quoted; for if to melted tin, lead, or zinc, gold may be added, the two metals unite together with great energy and produce an alloy which is exceedingly brittle and totally unfit for practical purposes. It is for this reason that the more expensive metals, silver and copper, are used for alloying gold for the purposes of coinage, &c.

With regard to such alloys which may be looked upon as mechanical mixtures, like oil and water, or rather as ether and water, for no two metals are known which, like oil and water, do not dissolve at all in one another, but a few metals are known which, like ether and water, dissolve slightly in one another, for ether will dissolve a certain amount of water, and water a certain amount of ether. If ether and water be mixed together, say in equal parts, two layers will be formed, the top one being ether containing a little water, the lower one water containing a little ether. Two metals, for instance, which behave in exactly a similar manner to ether and water are lead and zinc, for lead when fused with zinc will dissolve 1·6 per cent. zinc, and zinc in its turn will take up 1·2 per cent. lead. If these two metals be fused together, say in equal parts, they will separate into two layers, like ether and water, the top one, being the specifically lighter, zinc, with a small per centage of lead, the lower one lead, with a small percentage of zinc. If such an alloy be made and cast in a mould, the difference in the behaviour of the two ends may be easily shown; for the top one is so brittle that it cannot be bent without breaking, whereas the lower one may be bent with ease. Such chemical combinations and mechanical mixtures are, however, comparatively rare; and for alloys in common use, practice has almost invariably chosen such alloys as may be considered as belonging to the third class, rejecting those of the first and second as worthless for practical purposes.

* Read before the Royal Institution.

Under the term solidified solutions of the one metal in the other, such alloys may be considered, which, like the chlorides of potassium and sodium, when fused together, produce a mass having some of the physical properties totally different from those of the component salts. It cannot be assumed that the chloride of sodium enters into chemical combination with the choride of potassium. One important property of a solidified solution is, that the components are homogeneously diffused in one another, so that even under the most powerful microscope they can no longer be distinguished from one another. Alloys are used because they possess certain physical properties to a far greater extent than their component metals. The physical properties may be divided into two classes. 1. Those which in all cases are imparted to the alloy, approximately in the ratio in which they are possessed by the component metals. 2. Those which in some cases are, and in others are not, imparted to the alloy in the ratio in which they are possessed by the component metals.

To the first belong specific gravity, specific heat, and expansion due to heat. It is easy to show this experimentally; the specific gravity of an alloy may be shown to be equal to the mean of those of its component metals, by hanging on the one side of a balance the alloy and on the other side the metals composing it unalloyed, and then placing them both in water. The specific heat of an alloy may be proved equal to that of its components by placing the alloy and its components in boiling water, and then in equal volumes of cold water; when the rise of temperature in the two cases will be found the same as may be shown by a differential-air thermometer. A brass bar placed in any apparatus for showing expansion by heat is seen to expand exactly as much as a composite bar, of which one portion is of copper, the other of zinc. The length of the zinc portion being proportional to the amount of zinc in brass.

To the second class of physical properties belong, conduction for heat and electricity, hardness, tenacity, &c. As a basis for the conclusion which will be drawn, the electric conducting power for alloys may be taken. Researches into this subject have shown that when tin, lead, zinc, or cadmium are alloyed together, such alloys conduct electricity in the ratio of the relative volumes of the component metals, whilst in all other cases no such simple relation exists between the conducting power of the metals and their alloys. If, for instance, gold be alloyed with silver, say in equal volumes, the conducting power of an alloy will be 15, that of silver being 100, and that of gold 80. If curves be drawn to represent the conducting power of different series of alloys, three typical forms will be observed; the first represented by nearly a straight line, the second by the letter L, and the third by the letter U.

Wiedemann and Franz have proved experimentally that the values obtained for the conducting power of metals and alloys, for heat and electricity, are identically the same; and the truth of this statement may be shown by the following experiment:—If bars of gold and silver and some gold-silver alloys be fixed so that one end of all of them is in a hot-water box and the other end in the bulb of a small air-thermometer, the depression in the columns of the liquid in the tubes of the air-thermometers will indicate the relative conducting powers (approximately) of the several bars; and if through the tops of the columns of liquid a line be drawn, such line will form a curve similar to that referred to as obtained for the electric conducting power.

That this is true is thus shown:—By the side of this apparatus is placed another of this construction:—Into the bulbs of several air-thermometers are fixed wires of the same size and length, and of the same materials as were used in the heat-conducting experiment. One end of each wire is soldered to one thick copper wire, and the other end to another similar wire. These two wires are connected to the poles of a battery. The current will then divide itself, and a portion will pass through every wire proportional to the conducting power of that wire. This current will heat the wire and cause the liquid in the tubes connected with the air-thermometers to descend, and the line drawn through the top of the columns will be nearly similar to the curve already mentioned, which is formed by the bulbs in which the heat-conducting bars are fixed.

The analogy between the relation existing in this case and in some others may be shown experimentally as follows:—

Sonority.—When bars of alloys and their component metals are struck, a great difference will be found in the note produced; and in almost every case where the experiment ha been made, the most sonorous alloy was found to correspond in composition approximately with that at the turning point of the electric conducting power curve.

Tenacity.—When wires of the same diameter of metals and alloys are broken by traction, those of the alloys will require a much greater force than their component metals; and it may be deduced from what is known, that those alloys the composition of which corresponds to the turning point of the conducting power curve are more tenacious than any other alloy composed of the same metals.

Elasticity.—When spirals of wires of metals and their alloys are weighted to an equal extent, the alloys will be found on removing the weights to possess the property of resuming their original form in a much higher degree than their component metals. Here again the alloys corresponding in composition to those of the turning point of the conducting power curves are the most elastic.

From what has been said, and from the experiments described, the conclusion may be drawn that the chemical composition of the practically-used two metal alloys correspond to those situated at the turning points of the heat and electric conducting power curves, and that if a two-metal alloy of a special physical property be required, it would be as well to try that alloy the composition of which would correspond to the turning point of the curve representing the electric conducting power of the alloy of the two metals.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

(Concluded from page 280).

THE discussion on Mr. Alexander's paper was opened by Mr. Wenham, who said:—The mode shown by the writer of the last paper of estimating the force of the bird's wings, appears to be quite reasonable. It is certain that the force exerted during the downward stroke cannot much exceed the weight of the bird. If the data are taken from the largest bird that I have noted, viz., the pelican, in which the number of the wing strokes per minute can be easily counted, they will stand thus—Number of strokes per minute, 70; arc of vibration at middle of wing, 2ft.; weight of bird, 21lb. These three quantities multiplied together will give 2,940 foot-pounds, or 1-11-horse power, or about half that of a man. In my first essay, read before this Society, I reckoned the power exerted during the flight of a pelican in a different manner to this, and the results of the two calculations agree very nearly. I do not see, according to this simple and obvious mode of reasoning, that the power of the bird in flight can possibly exceed, and it probably falls far short, of the quantity named. The impulsive force of a bird's wing being intermittent, considerable weight is absolutely necessary for flight, and were the creature lighter than its bulk of air, it could not fly at all; but the power is accumulated in the body, as in the flywheel of a steam engine, to be subsequently made available during the cessations of impulse. Consequently, by means of this stored-up power, the bird can, with motionless wings, glide long distances upon its aerial support, till its previously acquired momentum is expended. When the requisite speed for the supporting power of flight is once obtained, it is instructive to note, in the case of sea birds, how little the loss of power from the friction and yielding of the air must be, for after the bird has darted suddenly down, so as to touch the waves, the velocity acquired by its descent and the momentum due to the weight of its body carries it up again, without a movement of its pinions, to near its original level.

On various occasions, members of our Society have urged the importance of defining a law by which to estimate the absolute forces and conditions required to perform flight before any contrivance made without principle can be successful, but ere the discussion has come to maturity, and science has determined the conditions, practice has outstripped its preceptor, and the flight of man has become a fact of the day. I have further to state that the honour of this discovery is to be credited to one of our own countrymen and a member of this Society. Legends have reached us of men having performed flight in other countries—the Marquis of Bacqueville, at Paris, and Deger, of Vienna—but in both these cases the experimenters launched themselves from lofty eminences. This was not strictly flying but the mere expenditure of force from a falling body, and serves no other useful purpose but to demonstrate the hazard of such feats, the first of these gentlemen breaking his

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leg on his descent, and the second eventually meeting with an accident that terminated fatally. But within the last few weeks, Mr. Charles Spencer has succeeded in taking short flights of 100ft. from level ground by a machine of his own invention and construction, and entirely by muscular force. The time since the realization of this fact has been so short, that it was found impossible to prepare the diagrams and models for illustration this evening, but Mr. Spencer will give personal demonstrations at our forthcoming exhibition at the Crystal Palace, as far as the limits of the ground will permit, with improved apparatus. I look upon this achievement as being something more than the first steps of infancy, for it has overcome what, to me, has been an almost insuperable difficulty—that of making the first start. This being accomplished, perfection will rapidly follow. I may state, in conclusion, that from early youth Mr. Spencer's mind has been directed to the subject of aeronautics. He is son to the well-known Mr. Spencer, the solicitor, who accompanied Mr. Green in some of his aerial excursions. This celebrated aeronaut is also the godfather of the present Mr. Spencer, who possesses the gift of mechanical construction which has enabled him speedily to carry his experiments into successful practice.

The Duke of Argyll remarked that the meeting would have been better satisfied had Mr. Spencer himself been present.

Mr. W. F. Brearey next read a communication from Mr. Artingstall, of Manchester, detailing the construction of his flying engine, illustrated by a diagram, which after describing, he writes:—"I find that the rising of the wing gives far greater hold upon the air to the down-stroke than if the wings were elevated, and allowed to be still, and then suddenly driven down; it appears as if a wave of air follows the wing in its ascent, which is caught and taken advantage of by the down-stroke before it can make its escape. From my present view of this subject, I believe that the up and down-stroke of a bird's wing are so dependant upon each other, that the two are essential to produce one complete pulsation, &c., the unbroken succession of which causes steady buoyancy or uniform progressive flight, and enables the bird to maintain its equilibrium in so subtle and light a medium as air, although the buoyant or propelling power of the wings may not be operating in a line with the centre of gravity. This is an astounding wonder, and seems to be at variance with all our theories of the properties of matter and motion. Take, for example, the bat, which has no tail, and a great expanse of wings that vibrate above and below the centre of gravity, yet, when the wings are propelling above, the head is not depressed; neither is it elevated when they are propelling below the centre of gravity, and the animal, if it pleases, can progress as steadily as any bird; indeed, some of the larger species of foreign bats are said to float with all the ease of a large and long-winged bird. If there were not some strong steadying power, the bat would be more erratic in its flight than a common rocket without a stick, or an elongated solid bullet shot from a smooth-bored gun. How is this wonderful steadying power produced? for, according to the common theory of resistance of fluids, a bird in the air represents the most delicate balance that can be imagined, the body being its centre, and the two wings the arms or scales; therefore, the least power applied above or below to one wing more than to the other would instantly destroy the equilibrium. It may be said, that a bird feels when it is balanced; perhaps so, but one thing is certain—that no machine constructed by man could do likewise; but a bird not only represents a balance transversely, but longitudinally; in this case, the wings are the centre, and the head and tail the arms or scales of the balance.

I find great difficulty in managing compressed air; the power is either too much or too little. I shall have to make a regulating valve. In one experiment the power turned on was not sufficient to cause flight, but by a very little movement of the tap which supplies the air the engine made a sudden bound into the air, and dashed itself against the opposite wall. There are two questions respecting flight, which may be of great importance to the Aeronautical Society, and which I have omitted in my former communications.

The first is this. If the two great pectoral muscles that depress the wings of a bird are so prodigiously stronger than the muscles that elevate them, how is it that the vibrations are apparently equal? I have endeavoured to account for this by reaction, not by compressing the air underneath the wing, but by the succeeding wave of air, &c. The second question is, are the electric or calorific conditions of the air materially altered by the vibration of a bird's wing. We must not be too sanguine that flight is purely a mechanical operation, entirely dependent upon the inertia of the air. In conclusion, allow me to remark that the great problem of flight can only be solved by experiment: it is beyond the powers of mere college or school mathematicians, however profound, and can only be dealt with by the experimental philosopher; that is, a man who can put in practice his mathematical theories. A Newton, a Watt, or a Faraday has not yet appeared in aeronautics.

This closed the business of the evening, when the President remarked that the next meeting would be held at the Crystal Palace, where a number of models would be shown, and some practical experiments, and amongst them this gentleman flying. The Society had provided refreshments for the members and their friends, who agreeably passed the remainder of the evening in conversation.

VARIABLE CUT-OFF STEAM ENGINE.

AT the meeting of the Massachusetts Institute of Technology, held March 5, Mr. Horace McMurtrie read a communication on a variable cut-off steam engine, exhibiting a working model driven by steam. It is of the class known as variable cut-offs, having a peculiarity of valve motion and regulation invented by Mr. William Wright. He made some general remarks on steam valves for controlling the admission of steam to the cylinder, from the earliest automatic valve gear to the present system of working steam expansively, and the variable cut-off, the last being of very recent date. With the fixed cut-off, the uniformity of speed was maintained by means of a governor which virtually contracted or reduced the steam passage, not reducing the volume of the steam as the load on the engine decreased, but impairing its vitality, producing the effect known as wire drawing. The nearer an engine approaches the following conditions, the more economical and perfect will be its operation:—1. When first admitted to the cylinder the steam, under all conditions of load, should be the same pressure as that is in the boiler, and so continue until cut off. 2. The variation in the load should be communicated to the cut-off apparatus as quickly as possible. 3. The process of cutting off should be completed in the shortest time possible. 4. Uniform speed should be maintained—the last being of special importance. The inventor claims to have fulfilled these conditions in the engine exhibited, securing also strength, great simplicity, perfect regulation of speed, and economy of fuel, to a greater extent than in previously constructed engines.

The general features of the engine are as follows:—the steam is admitted on the side of the cylinder by two separate balanced poppet valves, which are operated by the governor alone, without the aid of belt, crank, or eccentric, in the following manner. The steam valves are horizontal, the spindles terminating in a steel block, and are opened by small toes, which project from a revolving vertical sleeve, which is hollow, and contains a spiral and pinion. The rise and fall of the spiral and pinion are produced by, and instantly correspond to, the rise and fall of the governor balls, thereby increasing and decreasing the projection of the toes which effects the entire variation of cut-off. The governor revolves at precisely the same speed as the engine, and the valves by the above means being directly operated by the governor, the slighest variation of the load on the engine instantly produces a corresponding effect upon the admission of steam. The exhaust valves are directly under the cylinder, and entirely independent of the steam valves, and from their position relieve the cylinder of water, should there be any, at once. He stated in relation to the economy of fuel, that this engine consumed only two pounds of coal per horse power.

Mr. E. B. Bigelow spoke of the importance of the variable cut-off, which may be said to be essential to the economical working of steam expansively. He requested a statement from Mr. McMurtrie, of the difference between the Corliss engine and the one exhibited, to which it was replied that the principle of the cut-off was the same in both, but that the eccentric and its appendages, used in the Corliss to regulate the cut-off, was dispensed with in the Wright engine by a system claimed to be much simpler, cheaper, and less liable to derangement.

FIELD'S TEA FLOAT.

IN the Patent Office list of inventions we often meet with ludicrous attempts to improve upon our ordinary domestic processes. We have, however, lately had an invention submitted to us, by Messrs. Field, of Grey-street, Newcastle-upon-Tyne, which commends itself alike to reason and common sense. It is an improved method of making tea, the apparatus for which purpose consists of a cylindrical sieve which is surmounted by an air-tight chamber which forms the lid, and causes the whole to float when placed in water. The tea is put in the sieve and placed in the tea pot, the required quantity of water being added. The result of practical trials is a saving of 25 per cent. of the tea used, a fact which will be duly appreciated by thrifty housewives. The *rationale* of this useful invention is as follows:—The hottest particles in a body of water are always those which are uppermost. Now we know that to boil the tea itself is to utterly spoil it, as the active principle (theine) becomes dissipated, much of the virtue of the beverage is lost, and it becomes unpalatable. On the other hand, the successful brewing of tea depends upon the herb being exposed for a sufficient time in water of a temperature as near the boiling point as possible. This then is done in Mr. Field's simple contrivance, and the result is the thorough extraction of the theine and a good cup of tea with a saving of about 25 per cent. in consumption.

VENOM OF TOADS.

THE toad, formerly considered as a creature to b feared, does in reality possess a venom capable of killing certain animals and injuring man. The "British Medical Journal" says that this poison is not, as is generally thought, secreted by the mouth; it is a sort of epidermic cutaneous secretion, which acts powerfully if the skin be abraded at the time of contact. Dogs which bite toads soon give voice to howls of pain. On examination it is found that the palate and tongue are swollen, and a viscous mucus is exuded. Smaller animals coming under the influence of the venom undergo true narcotic poisoning, soon followed by convulsions and death. Experiments made by MM. Gratiolet, Cloez, and Vulpian, show that the matter exuding from the parotid region of the toad becomes poisonous when introduced into the tissues. A tortoise of the species "Testudo Mauritanicae" lamed in the hind foot, was completely paralysed at the end of fifteen days; and the paralysis lasted during several months. Some savages in South America use the acid fluid of the cutaneous glands of the toad instead of the curara. The venom exists in somewhat large quantity on the toad's back. Treated with ether, it dissolves, leaving a residuum the evaporated solution exhibits oleaginous granules. The residuum contains a toxic power sufficiently strong, even after complete desiccation, to kill a small bird.

LAMP CHIMNEYS.

EVERY person who has had any experience with lamp chimneys is aware of the seemingly singular want of uniformity in the length of time they will stand use. Some will last for months, while others, apparently as sound and good, will break after a short use, without any apparent cause. The great cause of their being brittle and breaking so easily lies in the material they are made from. There is "shoddy" in glass as well as in cloth. Cheapness being the order of the day, a great many manufacturers make chimneys from silicate of lime instead of silicate of lead. The glass made from the silicate of lime has about the following proportions:—Sand, 100; soda, 45; lime, 20 to 25; nitre, 7 to 10. Lime being a non-conductor of heat, the chimney will not bear the expansion caused by the heat; and, if by gradual heating, the chimney does not break on the lamp, a few times heating makes it so brittle that it breaks with the least effort at cleaning it, no matter how much care is used. The silicate of lead has about the following proportions:—Sand, 100; lead, 40 to 50; soda, 20 to 25; nitre, 10 to 15. Lead being very ductile and a good conductor of heat, a chimney made from this formula will almost melt before it will crack with the heat. The uninitiated may tell the difference of the chimneys made of these different qualities of glass by ringing them; the vibration from the lead-glass chimney has a sweet, bell-like sound, whilst the lime-glass has a short harsh sound. The difference of the cost of manufacture is only, in material, about 8d. per dozen. Another point

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is in annealing; chimneys, as a general rule, are not annealed. Under a powerful microscope the difference can be seen in the glass; the particles in the annealed glass lie close and compact, while the unannealed seem ready to diverge.—"American Inventor."

Correspondence.

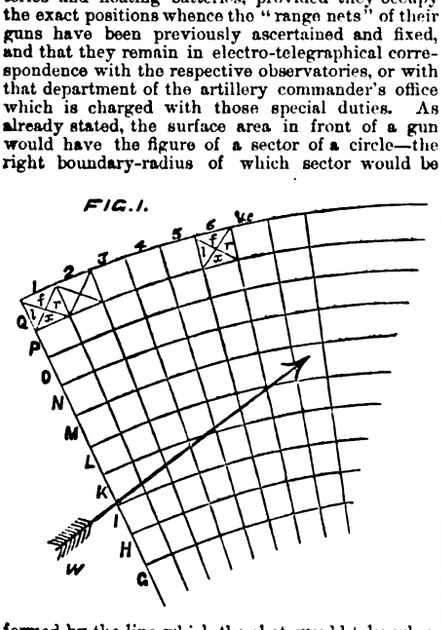
SUGGESTIONS ON THE DEFENCE OF FORTRESSES.

No. VI.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In a former letter I alluded to the matter-of-course necessity of there being in the possession of the defenders very correct topographical plans or models of the surface configuration of the land and surface and bottom of the sea surrounding a fortress or fortified harbour. I also alluded to such artificial modifications of the surface of the ground as would tend to deprive the enemy of any possible shelter against our fire; and, as regards the latter suggestion, I wish it to be understood that a short-sighted economy should not be allowed to cause the defenders to shrink from carrying out such changes on a very large scale wherever, on consideration of the great improvements in the means of attack, such should be necessary, in order to insure an undoubted superiority in the defence. For the sake of greater brevity and clearness in the following suggestions, let us suppose the surrounding ground to be a level plain. It should also be borne in mind, that under the observatories to which I shall occasionally have to allude, I do not mean only those observatories which may be placed on the high armour-plated watch-towers, but also other observatories which it may be deemed expedient to erect here and there throughout the works at a less height. For instance, at a certain carefully-measured distance from each other on each side of an important battery, and situated on a level with the same, we may have such observatories for measuring distances and guiding the fire of the guns—the object fired at being visible from each observatory, though invisible to the gunners of the battery. The reasons why such observatories should be sufficiently distant from the batteries in action and from the aerial and terrestrial oscillations, and the smoke and turmoil, caused by the discharges of very heavy guns, are obvious. Besides, now, the generally-practised subdivision of a general plan into various large scale sections, in order to be thus able to express clearer the minute detail-features, I should suggest another subdivision of the area of ground in front of the various works into as many sectors of circles as there are guns whose fire we wish to guide by means of our observatories. To avoid complication, let us suppose only our big stationary guns to be included in that arrangement—although it will easily be seen that the arrangement could be applied to all our guns, including also our movable artillery, and even our locomotive batteries and floating batteries, provided they occupy the exact positions whence the "range nets" of their guns have been previously ascertained and fixed, and that they remain in electro-telegraphical correspondence with the respective observatories, or with that department of the artillery commander's office which is charged with those special duties. As already stated, the surface area in front of a gun would have the figure of a sector of a circle—the right boundary-radius of which sector would be

FIG. 1.



formed by the line which the shot would take when the gun is trained to its rightmost bearing, the left boundary-radius by the left fire-line of said gun—while the front arc is formed by the longest range the gun could reach, or by any shorter range the judgment of the defenders may fix upon as the front boundary of such a sector or "range net." Fig. 1 shows a portion of such a range net, and it will be seen that the area of it is subdivided by a number of arcs and radii intersecting each other at (say) equal distances, the distances between the arcs being lettered, and the distances between the radii being numbered, so that any single one of the quadrangles or targets composing such a range net could be easily and distinctly indicated by a letter and a figure (like the squares are marked on a chess-board.) Then each individual target of the range net may again be subdivided by drawing diagonals, joining its four angles (*vide* diagram fig. 1, Q 1, Q 6, &c.), thus creating four triangles, respectively marked

f—front
l—left
r—right
x—rear

So that, for example, the telegram Q 1 *f.* received from the observatory, would sufficiently and clearly indicate to the gunners that they would have to give to their guns such a horizontal and vertical angle as to hit that particular triangle. But, further, each such triangle may again be subdivided into four triangles, by simply drawing straight lines from centre to centre of the sides forming the larger triangle (this subdivision is not shown in the diagram) and each individual one of these subdivisions (if not specially marked) could also easily be indicated in the telegram, in target Q 1—

Q 1 *f. c. t.* . . .	Q 1 front,	centre	triangle.
„ *l. t.* . . .	„	left	„
„ *r. t.* . . .	„	right	„
„ *x. t.* . . .	„	rear	„

or

Q 1 *l. f. t.* . . .	Q 1	left front	triangle.
„ *l. t.* . . .	„	left	„
„ *c. t.* . . .	„	centre	„
„ *x. t.* . . .	„	rear	„

Thus it will be seen that sixteen spaces or subdivisions in each individual target could easily and clearly be indicated to the gunners by the telegrams of the observatory department. Now, let it be borne in mind that an exact copy of the range net of each individual gun is in possession of the gunners, and that from previous careful practice the corresponding angle at which the gun has to be fixed in order to hit any one of the subdivisions has been determined, and is recorded in carefully-prepared tables of aim lines, so that in calm weather there is every chance of hitting the exact spot that may be indicated, even if the said spot be not visible. But before proceeding on the subject of the tables of aim lines, permit me a few remarks on the mounting of the guns. Already, in a former letter, I mentioned that the guns should be mounted somewhat like a theodolite on a large scale; thus the turntable or the parts by means of which the gun is turned (trained) from right to left, and *vice versa*, may be graduated in conformity with the radial subdivisions of the respective range; while correspondingly vertical arcs may be in connection with the trunnions or other parts of the body of the gun; but in order to insure very exact firing, it would be desirable to have the arrangements by which the exact horizontal and vertical angle of each aim-line is to be given to the gun, should be independent of the effects of the recoil, &c., of the gun; and the horizontal goniometer might hence be contrived either on the floor, or the roof, or the rear part of the place where the gun is situated, and the vertical goniometer on either one or the other, or both sides, the gun after each discharge having to be carefully placed into the exact fixed position in which its elevation, &c., could be determined to a nicety by reference to the goniometers and the exact lines and other marks contrived for that purpose on the body of the gun. As already stated, in calm weather, thanks to previous constant practice and its carefully recorded results, there is every chance of our guns hitting the exact spots we desire them to hit; but during windy and rainy weather it will be far more difficult to do so.

Being a mere "outsider," I would not venture to say whether it should be left to the judgment of the gunners to make such allowance in taking their aim as the direction and force of the wind should appear to them to require (in the which case a wind table would be in connection, or form certain columns in the aim-line tables), or whether said modifications in the aims had not better be controlled by the scientific department which is in charge of that branch of the defending forces. Certainly the latter plan would appear the simpler and hence more effective, as will be seen by the following example. Say the wind blows in the direction of the arrow W in the accompanying diagram, and we desire to hit the spot marked Q 6 *f.* (target Q 6 front). If, now, it be left to the gunners to fix their aim line so as to make allowance for the pressure and direction of the wind, it will, even with the best constructed tables, give them some trouble and cause delay, besides rendering it necessary that in each battery there should be dials, connected by means of wires with the central apparatus, for indicating the direction and measuring the pressure of the wind, so that the exact direction and degree of force of the wind could be seen. If, however, that matter is taken in hand by the proper scientific department, it is far more probable that very small, if any, errors would be made in order to adjust the aim-line so as to cause the projectile, exposed as it is to the influence of the wind, to hit the desired spot. By this means the accustomed mode of aiming the guns by reference to the simple aim lines would not at all be interrupted; for, if we wish to hit the spot Q 6 *f.*, but find out that in order to hit said spot with that particular gun of that particular range net we have to point our gun at the spot Q 5 *l.* (target Q 5 left), then we simply order the gunners to point their gun Q 5 *l.*, the—by us—carefully ascertained influence of the wind carrying the projectile so far to the right that it hits Q 6 *f.*, and thus our gunners could work away without need to care for wind or weather.

It will not be difficult to perceive that the department or departments in charge of regulating the fire of our guns should have in their possession also carefully-made topographical plans, comprising the areas of the range nets of all the guns of that section of the works which is under their charge; in the which plan obviously the range nets of various guns would necessarily overlap each other, so that, for example, if it is wished to bring the fire (say) of four guns to bear upon a certain spot in front, the orders would be to say—No. I. gun, P 4 *f.*; to No. II. gun, N 3 *x.*; to No. III. gun, O 1 *l.*; and to No. IV. gun, Q 5 *r*, the range nets of the four guns overlapping each other at such angles that the spots of the targets above mentioned coincide or cover each other. It might hence appear advisable that in the above alluded-to plan, the lines marking the different range nets should be drawn in different colours. There are various circumstances under which the above-indicated mode of guiding the fire of our guns would prove very advantageous to the defenders. At night, for instance, the trained look-outs of our observatories may, with the aid of their good instruments, discover certain hostile movements that would escape the men in the batteries; or at daytime a heavy fog or mist may cover the surrounding ground and sea, while, from our high armour-plated towers, the ground beyond or parts of approaching ships above the stratum of vapour may be visible; or the space immediately in front of some of our batteries may be covered with an artificial dense smoke caused by ourselves for certain purposes, &c. Still, in any of these cases we should be enabled to bring the fire of our guns promptly to bear upon the enemy, even though the spots or objects fired at may be invisible to our gunners.—

I am, Sir, yours, &c. G. J. GÜNTHER.

London, April 4.

Meetings for the Week.

MON.—Royal United Service Institution.—Captain T. R. Heathorn, R.N., R.A., on "A Muzzle-pivoting Gun-carriage on the Lever and Fulcrum Principle," at 8.30 p.m.

Society of Engineers.—Discussion on the paper by Sydney A. Reade, M.A., on "The Sewerage Works at Redhill," at 7.30 p.m.

TUES.—The Institution of Civil Engineers.—1. Mr. Allan Wilson, M.I.C.E., on "Irrigation in India"; 2. Mr. Thomas Login on "The Benefits of Irrigation in India, and on the Proper Construction of Irrigating Canals"; 3. Mr. George Higgin, M.I.C.E., on "Irrigation in Spain, Chiefly in Reference to the Construction of the Henares and the Esla Canals in that Country," at 8 p.m.

Royal Institution.—Dr. M. Foster on "The Development of Animals," at 3 p.m.

THURS. — Royal Institution. — Professor Odling on "Chemical Combination," at 3 p.m.

FRI.—Royal Institution.—Dr. Gladstone on "Some New Experiments on Light," at 8 p.m.

Royal United Service Institution. — Commander Frederick Warren, R.N., on "Cooking for Troops," at 3 p.m. Mons. Johan Sorensen will exhibit his Norwegian Self-acting Cooking Apparatus.

SAT. — Royal Institution. — Professor Odling on "Chemical Combination," at 3 p.m.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

A SUBSCRIBER will find his enquiry respecting condensed peat answered by a short article in another column.

RECEIVED.—J. R.—W. L. W.—T. E. C.—R. T.—C. C.—Messrs. K. and K.—T. W. T.—W. T. C.—J. W.—G. E. P.—R. J.—C. W. M.—R. M.—E. S.—R. F.—B. S.—H. H.—E. O.—S. K. M.—J. R.—T. C.—R. S.—A. J.—H. M. T.—S. A.—W. H. H.—G. W. H.—E. F.—R. S.—J. N.—J. T.—B. F. N.—R. J.—L. A.

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Naval, Military, and Gunnery Items.

THE vessels employed in the Indian seas in connection with the Abyssinian Expedition now number 261, the total monthly expenditure for freight, exclusive of coal, being £413,000.

WE hear that the whole of the high-pressure twin-screw steam launches constructed and fitting at Chatham Dockyard are in future to mount a single rifle gun, which will be carried in the bow.

IT has been resolved by the directors of the Royal Mail Steam Packet Company to recommend to the proprietors, at the meeting to be held on the 29th inst., the payment of a dividend of £1 per share, free of income tax, for the half-year ending the 31st December last.

ACCORDING to report Messrs. Dudgeon have been selected to construct two Monitors for the defence of Bombay harbour, as their designs, price, &c., have met with the approbation of the Council for India, and recommendation of the Constructive Department of the Admiralty, at Whitehall.

ONE of the greatest continuous marches ever made by U. S. troops was made by Colonel Kearney's command in 1845, in his expedition to the Rocky Mountains, when his men marched twenty-five hundred miles in ninety-nine days, including all delays as well as time lost in councils with the Indians.

THE "Nymph," a composite screw of 810 tons gross register, and 100-horse power nominal, the second of two steamers intended for the China trade—built by Messrs. C. Connell and Co., and engined by Messrs. J. Howden and Co.—has made a trial trip, in which she attained a speed of 10¼ knots per hour, or one knot above the contract speed.

ON Saturday afternoon Robert Kidnard, one of the divers engaged at the wreck of the Greek vessel Boubolina, which it will be remembered blew up in the Mersey in November last, found the body of a man in a very decomposed state. The body has not yet been recognised, but it is supposed to be that of one of the crew of that vessel.

ABOUT two months ago the Prussian frigate, "Frederich Carl," then completed at La Seyne, near Toulon, lost her iron masts on the trial trip to England. The Prussian Government wished a commission of English naval officers to decide whether the shipbuilder was not by his contract bound to furnish new masts gratis, but we understand that the English Government declined to interfere.

THE guns ordinarily used for the equipment of Prussian men-of-war having at a recent experiment failed to make any great impression upon a 7-inch iron-plate target will be probably superseded by cannon of heavier calibre. The target consisted of 4½-inch soft iron, with a steel cover 2½-inch thick; the heaviest gun tried was a 9-inch breech-loader, made on the Prussian system.

A NEW engine of war is said to have been tried last week at Meudon, and has been found to exceed in rapidity and power of destruction even that secret gun of the private trials of which by the Emperor we have heard so much. The trial was strictly private, but a general officer who was present remarked that it was the most wonderful weapon he ever saw; and with it a battle would now last about half-an-hour.

MESSRS. W. DENNY AND BROTHERS, of Dumbarton, have launched two screw gunboats, built by them for the Viceroy of Canton, and named the "Kwang Tung" and the "Shang Tung." The vessels were launched with their engines and boilers on board. They are built on the composite system, with iron frames and wooden planking. The engines are of 70-horse power nominal, and the armament of each boat is to consist of one 70-pounder Armstrong gun amidships, two 20-pounder Armstrong bow and stern chasers, and four 6 and 12-pounder brass howitzers on the broadside.

TRIALS have recently taken place in Prussia with an assortment of breech-loading rifles from every country, the object being to ascertain their merits as compared with the needle-gun. Of the weapons tested, two—it is not said which—were found to admit of firing from one to two rounds more in a minute than the Prussian arm. This result, though counterbalanced by certain disadvantages, said to have been discovered in the foreign rifles, has led to the appointment of a commission charged with perfecting the needle-gun to the highest pitch known. It is thought that this object will be obtained by a simplification of the lock.

Miscellanea.

THE heat which the earth receives from the sun does not penetrate more than from 50ft. to 100ft. At Paris this stratum of invariable temperature is found at a depth of 86ft.

POUILLET has made observations with a pyrelio-meter from which he estimates that the amount of heat annually received by the earth from the sun would melt a crust of ice surrounding the earth 101ft. thick.

THE proprietor of the "Philadelphia Public Ledger" has erected new premises for that journal containing 64,812 square feet of space, and lighted by 354 windows. To pass round all the above-ground apartments constitutes a journey of 1,798 yards, or rather more than a mile.

THE administration of telegraphic lines has issued a notice that of the five submarine cables which connect France and Belgium with England, four have been ruptured by a tempest. The only one that remains in working order is that which starts from Dieppe.

THE anniversary dinner of the Horological Institute of Great Britain will be held at the Guildhall Tavern, on the 19th of May; the Right Hon. the Lord Mayor has consented to preside. We would urge on the members the importance of a full attendance on the occasion.

THE Suez Canal Company has for more than a year been conveying merchandise and passengers between the two seas. The receipts from this service have gone on steadily increasing; they were, in January, 1867, 47,664f., and during the corresponding month of the present year, 197,317f.

THE Steam Man which has furnished a number of paragraphs for the press, is on exhibition at 538, Broadway, New York, nearly opposite the site of Barnum's Museum; but owing to some objection on the part of the owner of the hall, he is not permitted to "travel on his muscle," but is hung in slings and merely marks time.

IN consequence of the immense number of visitors on Easter Monday and Easter Tuesday, who viewed the Houses of Parliament, far exceeding those in the Exhibition year, it is understood that the Lord Great Chamberlain has decided that the "Houses" shall be open to the public on Whit Monday and Tuesday.

AN important conference of railway shareholders was opened on Tuesday in the Town Hall, Manchester, to take into consideration the most desirable course of management to be adopted by railway companies in the future. Mr. Thos. Bazley, M.P., presided. There were about 160 shareholders present.

THE obituary of "The Times" of the 8th inst. contained some rare illustrations of prolonged existence in five ladies and two gentlemen, whose united ages amounted to 603 years, giving an average of upwards of 86 years and one month to each; of the ladies the oldest had reached the great age of 93 years, and the youngest 82; of the opposite sex, one was 89 and the other 82 years of age.

M. ALVERGNIAT, of Paris, has constructed a new apparatus for proving that electricity cannot pass through an absolute vacuum. Two platinum wires are inserted into a tube so that their free ends are within about an eighth of an inch of each other. The air is then exhausted from the tube by means of a mercurial column, after which the electric spark will not pass from one platinum wire to the other.

THE visitors to the South Kensington Museum during the week ending April 11 were—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 11,280; on Wednesday and Thursday, (admission 6d), from 10 a.m. till 6 p.m. 1,366. National Portrait Exhibition, by payment, 2,616; Total—15,262. Average of corresponding week in former years, 11,501; total from the opening of the Museum, 7,294,633.

IT is proposed to establish an exhibition of living insects in the new public garden which is being formed at Montsouris, in the outskirts of Paris, and M. Hamet, professor of agriculture at the Luxemburg, is directed to draw up a report on the subject for the municipal council. Without taking into account the parasitic creatures that could not conveniently be exhibited alive, there are more than 20,000 species and varieties in the insect world.

THE only rolling mill at Wisconsin is that of the Milwaukee Iron Company at Milwaukee. It was projected about one year ago, and is now nearly ready for work. The main building is 211ft. by 180ft, and is without supporting inside pillars. It contains seven combined furnaces. The engine which drives the machinery is of 1,000-horse power, the fly-wheel of which weighs thirty tons and is 32ft. in diameter.

THE resistless power of frozen water is illustrated in a lecture on heat and cold, delivered by Professor Tyndall before the Royal Institution of Great Britain. Among his experiments, an ordinary bombshell was filled with water, and securely plugged, and then placed in a bucket filled with pounded ice and salt, to freeze it. In about half an hour the bombshell was burst into fragments by freezing of the combined water.

THE Jean of Arc Tower at Compiegne fell down on Saturday week, and the crash caused great terror in the quarter of the Rue Jeanne d'Arc. There was no loss of life; but a little girl, the daughter of a wineshop keeper named Gruing, escaped death by a marvellous accident. Owing to a temporary illness she was taken out of her bed a short time before the accident occurred to sleep with her parents in another part of their house. When the tower fell the bed which the child had recently quitted was smashed into atoms.

A COMMUNICATION from Moscow gives an account of the trial of the Borodino Bridge just terminated over the Moskowa river. The water butts of the fire brigade, all filled, and sixty carts laden with sand, weighing together about 100 tons, were brought on the structure, after which the people who had assembled on the banks were naively invited to stand also in the centre. The bridge was fortunately proof against this foolish experiment, for had any accident occurred the consequences would have been terrible.

THE Paris Numismatic and Archæological Society has inaugurated its fourth year of existence by the opening of more spacious rooms for its conferences, collections, and library, at No. 58, Rue de l'Universite. In addition to some interesting publications, this comparatively new society has established weekly conferences; and it is divided into sections for the study of inscriptions, historic geography, and the history of ceramic art. It was commenced by the Vicompte de Ponton d'Amecourt and eleven other gentlemen, and now numbers 120 members and 220 correspondents.

FOUR parts by weight of yolk of egg rubbed in a mortar with five parts of glycerine, according to the Philadelphia "Journal of Pharmacy," gives a preparation of great value as an unguent for application to broken surfaces of the skin of all kinds. The compound has a horny-like consistency, in unctuous-like fatty substances, but over which it has the advantage of being quickly removed by water. It is unalterable, a specimen having laid exposed to the air for three years unchanged. Applied to the skin it forms a varnish which effectually excludes the air, and prevents its irritating effects.

THE "Opinione" of Florence announces that the Italian Government have come to an understanding with the administration of the railway companies, to allow travellers entering Italy at Susa, and leaving it at Ancona or Brindisi to have their luggage conveyed *in transit*, without submitting them to any examination of the Custom-houses, either on coming in or going out. The main object of this measure is to avoid any stoppage or delay to travellers on their way to India, who, even before the completion of the Mont Cenis Tunnel, might wish to embark at Brindisi rather than at Marseilles.

TWO public works belonging to the highest grade of modern civilization are going on at Athens—a telegraph line to Kephisia, and a railway to the Piræus whence the people of the capital draw every article of consumption. The railway is only six miles: all the earthwork and about half the bridging are finished, and if the rails arrive soon, the company can easily complete the line before the end of August, which is the term fixed by the contract for opening the railway. This railway is much wanted, and will doubtless prove a profitable undertaking.

AN electrical clock in the rotunda of the Philadelphia Merchants' Exchange has a running gear of the simplest description, consisting merely of two cog-wheels and a ratchet-wheel. The driving power is supplied by a weak galvanic battery, the currents from which, transmitted through two galvanometer coils placed one on each side of the clock-case, act upon steel bar magnets set within the pendulum-ball. The latter swings between the two coils, so that when one of them is "positively charged" the ball is attracted until by contact it becomes similarly electrified, and consequently repelled, then swinging over to the "negative" coil, it becomes negatively charged, again repelled, and thus the vibrations are kept up indefinitely, or as long as the battery continues working. The alternate positive and negative charges are made and broken by a simple slide bar moved by a wire pin on the pendulum rod.

THE prospectus has appeared of the Indo-European Telegraph Company (Limited), with a proposed capital of £450,000, in shares of £25 each, of which only 17,000 will now be issued. The object is to establish a direct and independent line of telegraphic communication overland between England and India. The new line will also connect Europe with Asia, passing from London through the North Sea, Prussia, Southern Russia, and Persia, and thence by the lines of the Indian Government to India. An agreement, it is stated, has been concluded by the concessionaires with Reuter's eTlegram Company, and the Electric and International Telegraph Company, for the exclusive use of one wire, and when necessary two wires, between London and Norderney. A submarine cable of about 200 miles will be laid in the Black Sea, in order to avoid the Circassian mountains, where the existing lines are subject to interruption by snow. By the terms of the tender the line is to be completed within the year 1869.

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—2674, 2679, 2689, 2722, 2745, 2752, 2757

BUILDINGS AND BUILDING MATERIALS—2677, 2712, 2729

CHEMISTRY AND PHOTOGRAPHY—2678, 2680, 2685, 2711, 2721, 2731, 2736

CULTIVATION OF THE SOIL, including agricultural implements and machines—2697, 2702

ELECTRICAL APPARATUS—None.

FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2690, 2706, 2710, 2724, 2727, 2738, 2747, 2754, 2758

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—2753

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—2723

GENERAL MACHINERY—2675, 2676, 2687, 2688, 2705, 2716, 2718, 2720, 2728, 2732, 2733, 2744

LIGHTING, HEATING, AND VENTILATING—2701, 2708, 2741

METALS, including apparatus for their manufacture—2704

MISCELLANEOUS—2681, 2683, 2691, 2692, 2693, 2694, 2696, 2698, 2699, 2700, 2703, 2707, 2709, 2714, 2715, 2719, 2726, 2734, 2735, 2737, 2742, 2746, 2749, 2750, 2751

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2684, 2730, 2739, 2740, 2755

SHIPS AND BOATS, including their fittings—2748

STEAM ENGINES—2682, 2713

WARFARE—2695, 2725, 2743

2675 J. GRIFFIN and F. GREEN. *Improved machinery or apparatus to be used in the manufacture of envelopes.* Dated September 23, 1867.

The first part of this invention relates to certain improvements in envelope folding machines on the rotary principle, and consists in making the cheeks straight instead of in an angular or irregular shape, and carrying the rollers on gun metal journals in slot holes in the cheeks; also increasing the back and front flaps of the envelope by causing the knife on the upper roller to make the crease on a small slit of india-rubber set in a groove in the under roller instead of on a band; also in a dishing piece which receives and folds the first flap after it has passed through the rollers above mentioned, and two pieces or guides of thin steel which hold down the envelope and keep it from puckering. It further consists in the use of a templet fixed so that the envelope may pass under it when it leaves the roller and creaser which has creased the end flaps; in two pieces of steel with bevelled edges which fold the end flaps over as they pass from the templet; and, finally, in a piece of metal fastened to a bar carried on the frame of the machine into a cavity in which piece of metal the envelope passes for the folding of the last flap, the envelope passing thence bottom upwards into a box the size of the envelope, and from which the envelopes are withdrawn by the bottom in regulated numbers. The envelope is gummed and stamped in passing through the creasing rollers, as in other machines on this principle, and by simply altering the adjustment of the parts of the machine it folds envelopes of different sizes. The second part of the invention relates to a novel apparatus for feeding envelope shapes into folding machines.—Patent completed.

2676 J. FLETCHER. *Improvements in steam or other power hammers.* Dated September 23, 1867.

This invention relates, first, to the hammers driven by a crank or cam shaft actuated by steam or other power, and consists in an improved mode of starting, stopping, and regulating the speed of the hammer by a lever upon a shaft having two cams, one of which applies a break to the fly-wheel, and the other throws the driving power out of gear, or shuts off the steam. The invention consists, second, in making the top or upper part of the hammer block hollow for the reception of two spiral springs acting above and below a disc or piston, which is connected by a link to the crank shaft driven by steam or other power. As the crank shaft revolves, the disc or piston, acting on the springs, raises and lowers the trip or hammer block, the force of the blow depending upon the weight of the trip or hammer block, and parts connected therewith, the speed of the crank shaft and the strength of the springs. Instead of springs, atmospheric air, or other elastic medium, may be employed.—Patent abandoned.

2677 W. COOKE. *Improvements in apparatus for the regulation of up and down currents of air.* Dated September 23, 1867.

This invention consists of an apparatus that effectually regulates the up and prevents the down draught in shafts or chimneys by the application of outer flanges or breaks to an upright tube or shaft open at both ends, having angular or other shaped openings in the sides, with inner tubes perpendicularly arranged, so as to direct the upward current of the air or smoke, permitting it freely to ascend, the whole apparatus acting as an exhauster of the air, facilitating the upward current, the openings at the sides serving as escapes for the downward current.—Patent abandoned.

2678 J. HARGREAVES. *Improvements in separating pyrites, shale, and other impurities, from coal.* Dated September 23, 1867.

Here the separation of impurities from coal is effected by the employment of a solution or liquid, called by the inventor the separating solution, of a density intermediate between the specific gravities of the coal and the impurities to be removed. When the impurities are of higher specific gravity than the coal, the separating solution is of such a density that the coal will float, whilst the impurities will sink to the bottom of the vessel containing the said separating solution; but when the impurities are lighter than the coal, then the separating solution is made of less density than the coal and heavier than the impurities, so that the coal will sink while the impurities will float. The separating solution can be obtained by mixing sulphate of soda, chloride of calcium, chloride of iron, or chloride of manganese in water, or by using any other salt or suitable agent or substance.—Patent abandoned.

2679 W. BEARDMORE, W. BROCK, and A. C. KIRK. *Improvements relating to furnaces.* Dated September 23, 1867.

This invention relates to a convenient means of regulating the internal condition of a reverberatory or similar furnace, in order to deprive its interior of free oxygen when desired, and consists in introducing into the interior of the furnace (at some convenient point over the fire, or between the fire and the object to be heated) materials having a strong affinity for oxygen, such as the various hydro-carbons, other products of the distillation of carbonaceous or organic substances, hydrogen, carbonic oxide, or any mixture thereof.—Patent abandoned.

2680 J. BLAIR. *Improvements in revivifying animal charcoal.* Dated September 23, 1867.

This invention consists in passing or forcing through the animal charcoal a suitable heated gas or mixture of gases. It is desirable for the gas or mixture of gases to contain as small a proportion as possible of free or unsaturated oxygen, or similar gas that would act injuriously on the animal charcoal.—Patent abandoned.

2681 R. WAPPENSTEIN and A. LAIDLAW. *Improvements in envelopes.* Dated September 23, 1867.

This invention consists in the addition to an ordinary envelope of a metallic ring or plate with indents or teeth bending upwards or downwards. This ring or plate is placed in or upon the envelope, and by means of pressure with the thumb or a stamp, the teeth are bent upwards or downwards, and thereby grasp the flaps or folds of the envelope, and secure it from being opened without detection.—Patent abandoned.

2682 L. R. BODMER. *Improvements in the construction of air cylinders of blast engines, and in the valve arrangements for the same.* (A communication.) Dated September 23, 1867.

This invention consists in the combined application of the elastic hoop, ring, or belt valve, with the flap valve, and in the peculiar construction and arrangement of the cylinder and its parts for this purpose, the object of the invention being to combine the advantages which the elastic belt valve possesses over other valves when used as suction valves with those possessed by the flap valve as pressure valves.—Patent abandoned.

2683 A. M. CLARK. *Improvements in boots and hoes.* (A communication.) Dated September 23, 1867.

This invention consists in fixing a metallic frame to the insoles of boots and shoes provided with mortises of the forms indicated for receiving pins or projections fixed on a separate sole, by which means the latter may be readily adjusted and fixed in position on the inner sole by a sliding movement without other aid.—Patent completed.

2684 S. BEVAN. *Improvements in apparatus for ventilating underground railways and other like structures.* Dated September 23, 1867.

Here the inventor mounts on a suitable truck or carriage, which may form part of a train, a fan or other suitable apparatus for introducing a current of fresh air into the underground railway, or other like structure to be ventilated. This is accomplished by the axis of the fan or other suitable ventilating apparatus being driven from the axles of the truck or carriage.—Patent abandoned.

2685 A. ZIEGELE. *Improvements in the manufacture of Epsom salts.* (A communication.) Dated September 23, 1867.

This invention consists in manufacturing Epsom salts from the kiserit contained in the Stassfurt and Duhalt Abraum salts; also from the refuse obtained in the manufacture of muriate of potash in the form of kiserit.—Patent completed.

2686 H. FORBES. *Improvements in the construction of rotary pumps.* Dated September 24, 1867.

The patentee claims, first, forming the outlet aperture of the pump casing as a narrow slit of equal width at all points, and with rounded ends, substantially as and for the purposes set forth. Second, forming the inlet aperture of the pump casing as a narrow slit of equal width at all points, substantially as and for the purposes set forth. Third, the employment of the dome described and shown in the drawings, for conducting the water from the long narrow outlet aperture of the pump casing to the circular discharge tube, as set forth.—Patent completed.

2687 W. WINTER. *Improvements in sewing machines.* Dated September 24, 1867.

This invention relates to means of working or operating the needles and shuttles or other thread carriers employed in sewing machines, and the improvements consist in the combination of a bell or boss cam with a plate cam on the same shaft, and in the application thereof to an arrangement of levers or other connecting parts for working the said needles or shuttles or other thread carriers of sewing machines.—Patent completed.

2688 G. BATCHELDOR. *Improvements in trough water-closets.* Dated September 24, 1867.

The object here is to provide trough water-closets at a less price with rounded surfaces, or surfaces sloping towards the outlet valve, and in part, that is to say, as regards the trough part, of non-absorbent and more durable materials than those now in use. For this purpose the patentee makes or constructs the troughs of earthen or stoneware, and in or over the soil pipe leading therefrom he fixes or forms a valve seating, the valve of which is connected to a lever or its equivalent, and is led into a locked-up space, the key of which is in the possession of a person whose duty it is to see that from time to time the trough is emptied and flushed. The seats are of the ordinary form.—Patent completed.

2689 J. LEWIS, W. HUNTINGTON, and W. ANYON. *Improvements in movable firebars.* Dated September 24, 1867.

Here the inventors construct a frame consisting of a dead plate, two side bars, and a bridge plate, which they bolt together, the whole of which is secured to the furnace front by bolts; on the inside of each side bar they screw or cast on three pedestals to carry three rocking shafts, one in the centre and one at each end; on the centre rocking shaft every alternate bar is fixed, which bars extend the whole length of the furnace; the other bars are made in two lengths, one of which is secured to each rocking shaft; the other ends meet in the centre, and rest when level on the centre rocking shaft. On the underside of each long bar is cast or fixed a stud halfway between the centre and the rocking shafts; the centre rocking shaft is moved by lever underneath to the front end of the furnace, and when moved the aforesaid studs projecting from the side of long bars and underneath the short bars lift the ends of the short bars, thus giving an alternate motion at each end to all the bars. The effect of these arrangements will be obvious.—Patent abandoned.

2690 J. H. BROWN. *Improvements in the manufacture of paper and articles of paper.* Dated September 24, 1867.

This invention has for its object the incorporation of animal substances with vegetable fibres in the production of paper, and thereby to give greater strength thereto. The patentee employs either skins, or refuse parts of the skins, of buffalo, bull, ox, cow, calf, or other animal substances from which glue and size are generally made.—Patent completed.

2691 P. H. COLOMB and F. J. BOLTON. *Improvements in the production of light and heat for signalling and other purposes.* Dated September 24, 1867.

This invention refers to the production of light and heat by the combustion of imflammable powders. The patentees use receptacles so constructed that the lower ends, mouths, or orifices of the tubes or passages by which the powder is conveyed or guided to the flames or heated surfaces for consumption, extend down to and are closed by the surface of the powder contained within the main bodies or casings of the receptacles.—Patent completed.

2692 T. H. WILLIAMS. *The improvement of gas burners.* Dated September 24, 1867.

This invention consists in the application to gas burners of a small metallic vertical disc or plate arranged above and across the centre of the nipple, the object being to divide the jet of gas and consequent flame, thereby increasing the light by causing a larger quantity of oxygen from the atmospheric air to mingle or combine with the gas and flame, and effecting complete combustion of the coal or other gas, and also preventing the rushing or humming noise so common in ordinary gas burners.—Patent completed.

2693 R. WILSON and J. NUTTALL. *Improvements in the manufacture of cranked axles, cranked shafts, and other heavy forgings.* Dated September 25, 1867.

The patentee claims piling together several layers of bars of iron lying at right angles or diagonally to each other to form a bloom for the manufacture of cranked axles, cranked shafts, and other heavy forgings.—Patent completed.

2694 C. D. ABEL. *A new or improved method and apparatus for converting the gaseous products of combustion into combustible gases.* (A communication.) Dated September 25, 1867.

This invention has for its object to utilize the waste heat of furnaces and fireplaces, and consists, mainly, in employing such heat to effect the regeneration of the gaseous products of combustion from the furnace or fireplace that is to convert such gases, which consist, mainly, of carbonic acid and vapour of water, into combustible gases, such as carbonic oxide and hydrogen.—Patent completed.

2695 J. C. BAYLEY and D. CAMPBELL. *Improvements in projectiles and their manufacture.* Dated September 25, 1867.

Here the inventors do not claim or confine themselves to any particular form or size of elongated projectile, but, by way of illustration, they refer to the present pattern used by the British Government for the Snider rifle, in which a parallel hole of about ¼in. deep is formed in the front of the projectile, and afterwards filled with wood, the object being to lighten the missile in front, and thereby to secure more accurate firing. The improvement consists in dispensing with the said wood, at the same time retaining all its advantages, thus considerably reducing the cost of manufacture. In forming the projectile, as claimed by the inventors, the hole is made as before stated, but, instead of filling it with wood, they leave a projection of metal at the front, which they afterwards close over the said hole, thus forming the point and leaving a cavity. They likewise arrange that the metal shall be so distributed as to compensate for the loss of weight by the extraction of the wood.—Patent abandoned.

2696 D. R. RATCLIFF. *Certain improvements in the manufacture of safes and other depositories.* Dated September 25, 1867.

This invention relates to the construction of safes, and other similar depositories, and is designed to render the corners or angles, where the sides of such chambers meet and are connected, stronger and better able to resist violence than hitherto. The improvements consist in the application and use of solid metallic bars for the angles (that is, at the extremities of each end and side of the safe), which bars are provided with deep grooves into which all the plates forming top, bottom, sides, and back fit and are embedded, and through certain parts of the length of each bar taper or wedge-like slots are formed, into and through which corresponding pieces of the side, top, bottom, and back plates enter, the plates being so cut as to leave these pieces projecting so as to enter the slots. The safe or chamber is constructed or put together by fitting the plates into the bars at each angle, and then hammering out or riveting the pieces of plate projecting through the wedge-like slots, so as to spread out or expand the said projecting pieces into dovetail form, and to fill the slots by the expansion of such pieces, whereby the sides are securely held together, and cannot be burst asunder without withdrawing all the dovetail pieces of the sides from the taper slots to the angle bars, which would require enormous force.—Patent abandoned.

2697 W. M'I. CRANSTON. *Improvements in implements for digging potatoes.* (A communicaiton.) Dated September 25, 1867.

This implement, which is in the nature of a plough, is constructed with a mould board so formed that the earth and roots together rise up on to a number of inclined fingers or prongs between which the earth in part passes, whilst the crop rising up falls off over their upper ends on to another set of fingers beneath. These fingers are more nearly horizontal, and form a grid which effects a further separation of the earth from the crop before the latter falls on the land in the track of the implement.—Patent abandoned.

2698 J. MUSGRAVE. *Improvements in fittings for cow*

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houses, saddle-rooms, and stables, the ventilators of the latter being also suitable for other apartments. Dated September 25, 1867.

This invention is not described apart from the drawings. —Patent completed.

2699 A. TOD and J. HEATLEY. *Improvements in the manufacture of tobacco.* Dated September 25, 1867.

Here the tobacco in the prepared state for twisting is placed upon a table, at one end of which a revolving frame is situated, and through an opening in the end of the frame the tobacco to be twisted is entered. The revolving frame contains a bobbin upon which the tobacco as it is twisted is wound, a separate revolving motion perpendicular to the motion of the frame, being imparted to the bobbin by means of a cord or belt passing over a pulley in its axis, being led thence over a pair of pulleys and over a grooved ring concentric to the axis of revolution of the frame, so that as the frame revolves, the belt is by the motion of the frame caused to travel. When the bobbin is filled the machinery is stopped and the tobacco taken off, the machinery being provided with suitable engaging and disengaging gear, and driven by a belt actuating a pair of live and dead pulleys.—Patent completed.

2700 G. CLAYTON and W. MARBECK. *Improvements in water meters.* Dated September 25, 1867.

Here the inventors place upon a cylinder of small dimensions, say 2in. diameter, by 6¼ in length, a valve chest, having ports similar to those of an ordinary steam engine slide valve, that is to say, two inlet ports connected by the valve itself with an exhaust port. The valve is worked from a small transverse shaft passing through the admission chamber, and connected with it by catch levers attached on the outside to a bearing, having an angular toothed formation, and supported by small runners projecting from the side; they impart to a longitudinal shaft extending the whole length of the cylinder, and connected to force pistons working through the ends of the same, a reprocating motion; a water piston works freely within the cylinder. This latter piston is constructed of two metallic plates perforated and having a ferrule to keep them apart, whilst leathers are flanged outwards and secured in the centre of the piston, the flanges being kept tight against the cylinder by the water admitted through the perforations. The action is as follows:—The water is admitted alternately by each port, and by the alternate or reciporatory action of the pistons fixed in the ends of the cylinder, the water piston (so termed for distinction sake) accordingly forces out the water through the several ports, each stroke of course indicating a given amount of water, which is registered by any of the ordinary clock apparatus used for such indications.—Patent abandoned.

2701 W. WOODCOCK. *Improvements in apparatus for warming and ventilating buildings.* Dated September 25, 1867.

This invention, under one head, has reference to improvements applicable to stoves of the character of Gurney's stoves, or any stove having a number of plates from its outer surface, with the plates vertical in a trough of water, or any stove of analogous construction or action, and consists in constructing the said stoves with feeding door, fire door, and ash pit door, so arranged that they shall open into a stoking chamber or compartment, which is otherwise entirely separated from the stove, such stoking chamber or compartment being wholly separated from the building to be warmed and ventilated.—Patent completed.

2702 R. WAYGOOD. *Improvements in machines for cleaning rice and other grain or seed.* Dated September 25, 1867.

The object here is to construct machines to be worked by manual power, and the invention, mainly, consists in the combination (as described) of a disc and a wheel between which the rice, grain, or seed is fed, and by which it is cleaned.—Patent abandoned.

2703 A. ROOKER. *Improvements in taps for beer casks and other vessels.* Dated September 25, 1867.

The main object here is to do away with the necessity of driving in, by means of the tap itself, the cork or bung which closes the tap hole of beer casks, and the invention consists in so constructing the inner end of the tap that it will cut out a circular piece of the cork, or bung, and will at the same time close the aperture thereby formed in the cork or bung. In carrying out the invention the patentee constructs the inner end or portion of the tap tubular, and open at the inner extremity, and he forms this circular extremity with a cutting edge which is saw-toothed or serrated; or it may be a plain cutting edge.—Patent completed.

2704 J. BOWER. *Improvements in the manufacture of iron and steel.* Dated September 25, 1867.

This invention relates, chiefly, to the manufacture of malleable iron, and iron applicable for manufacturing into steel, and consists in purifying the iron as hereafter described, whereby the inventor obtains a strong fibrous metal. He takes, say, 4cwt. of cast iron, which he melts in a puddling furnace, and while it is in a fluid state he introduces and mixes with it about 2 per cent of chloride of aluminium, with a little carbonaceous matter, such as charcoal or sawdust, which he prefers to use in a moist state. The iron is then puddled in the usual manner.—Patent abandoned.

2705 A. M. CLARK. *An improved combined tuck creaser and self-guide or baster.* (A communication.) Dated September 25, 1867.

We cannot here give space to the details of this invention.—Patent abandoned.

2706 J. and J. KIRK. *Improvements in the manufacture of lace or wearings made on bobbin net or twist lace machines.* Dated September 25, 1867.

This invention consists in making the woven portion of each breadth by means of the warp threads alone, without the employment of bobbin threads intervening between the selvedges or edges of the woven portions of each breadth, but at each extremity or selvedge of such woven portion the patentees employ one or more bobbin threads to twist with the warp thread or threads, as in the ordinary way.—Patent completed.

2707 J. OXLEY. *Improvements in refrigerators for cooling worts and other liquids, which improvements are also applicable to condensers.* Dated September 26, 1867.

The patentee claims, first, the use of air and water together in refrigerators composed of separate flat tubes, with internal partitions contained in a case, such air and water being used in the manner and for the purpose described; and, second, the use of air and water together in condensers composed of separate cells or chambers, with internal partitions contained in a case, the tubes for the aeriform fluid passing through the cells or chambers, and being cooled by the water and air therein, as described.—Patent completed.

2708 G. H. J. SIMMONS. *Improvements in lamps for burning hydrocarbon and other oils.* Dated September 26, 1867.

This invention relates, first, to the receptacle for the oil being away from the burner, and for this purpose, for lamps with one burner, the patentee employs two tubes of different sizes, a smaller tube enclosed in a larger tube, the ends of such tubes being soldered, screwed, or otherwise fastened to the receptacle for the oil, and to a small chamber, attached to which is the burner; the smaller tube is longer than the larger tube on the end that is fastened to the receptacle for the oil, to allow of the atmosphere to escape while it is being supplied with oil; the ends of the tube attached to the small chamber are nearly level with each other, consequently the oil flows from the receptacle through the larger tube until it covers the opening of the smaller tube enclosed within it, preventing admittance of the atmosphere to the receptacle, and more oil flowing into the small chamber before mentioned than is required to supply the burner. Second, the improvements relate to lamps with more than one burner. Attached by means of a screw to the receptacle containing the oil are two tubes parallel to each other, the tubes are furnished with stopcock or piece of metal to slide over their opening, and enable the receptacle to be moved without the oil spilling; the ends of the tubes not attached to the receptacle are unequal in length, and are inserted into a small chamber, the effect of which is,—the oil flowing from the receptacle down the longer tube rises in the small chamber until it reaches the opening of the shorter tube, and, by preventing admittance of the atmosphere, the receptacle containing the oil keeps the oil at one level. Attached to the said chamber are pipes communicating to other small chambers, the bottoms of which are lined with wire gauze, and to which are attached the burners. The improvements also relate to the lamp first mentioned, the receptacle of which is flat on one side, and to the top of such flat side is attached a metal loop to permit of its being hung against a wall, and at bottom of such flat side is hinged a piece of wire or metal to admit of its being placed upon a table or other flat surface, and remaining upright.—Patent completed.

2709 J. A. SMYTH. *Improvements in cinder sifters.* Dated September 26, 1867.

The box or case of this cinder sifter consists of an oblong rectangular chamber supported on four legs. The box or case is surmounted by a hopper into which the cinders to be sifted are put. The bottom of the hopper opens over the top of the sieve, which is situated within the case. The sieve is supported upon a pivot near the middle of its underside, upon which pivot the sieve is capable of performing an oscillating motion. The said sieve is inclined, the end on which the cinders are received from the hopper being the highest point. Underneath the sieve is a drawer into which, when the sifter is in operation, the ash falls, and immediately under the bottom end of the sieve is an opening in the bottom of the box or case, from which opening, when the sifter is in operation, the cinders fall. In that end of the box or case at which the upper end of the sieve is situated is an axis workefi by a winch. The inner end of this axis carries a wheel with a series of large teeth or tappets. When the winch is turned the teeth or tappets strike against the upper end of the sieve, forcing it away from the axis. A spring connected with the end of the case and top of the sieve produces the return motion of the sieve. By turning the winch there is produced an oscillatory motion of the sieve upon its pivot. In using the cinder sifter, a scuttle of mixed cinders and ashes is put into the hopper, and the empty scuttle is placed under the before-mentioned hole in the bottom of the box or case. The winch is turned a few times, when the oscillatory motion given to the sieve causes the cinders to roll down the said sieve and fall from its lower end through the opening in the case into the empty scuttle, the ash at the same time passing through the meshes of the sieve into the drawer.—Patent abandoned.

2710 A. TAYLOR. *Improvements in weaving ornamental fabrics.* Dated September 26, 1867.

The patentee claims the producing of ornamentally spotted fabrics by weaving spotted chenille threads along with ordinary warps and wefts, and by means of heddles or healds, substantially as described.—Patent completed.

2711 R. W. BENNIE. *Improvements in the manufacture of moulders' blackening.* Dated September 26, 1867.

This invention consists in employing the following ingredients, namely, first, shale, or the earthy deposits left in retorts in the first distillatory process for obtaining crude shale or other mineral oils, or other spent bituminous substance; second, still bottoms, or the coke or carbonaceous deposit left in stills in distilling shale oils, petroleum, tar, or other mineral oils; third, blind coal or anthracite; fourth, gas coke; fifth, wood charcoal; and, sixth, fireclay.—Patent abandoned.

2712 J. SYME. *Improvements in supporting window sashes, shutters, doors, and other similar structures.* Dated September 26, 1867.

This invention consists in supporting window sashes by elastic rollers formed of india-rubber, gutta-percha, or compounds thereof, or other similar elastic substance affixed to the sash, and working against the frame in which the sash slides. The rollers are supported with capability of revolving in bearings affixed to the edge of the sash, and should be of such a diameter that, when the sash is in position, they may be slightly compressed by the frame in which the sash slides, and, by the friction obtained by such compression, hold the sash securely in any position required.—Patent abandoned.

2713 J., B., and R. WOOD. *Improvements in steam engines.* Dated September 26, 1867.

This invention consists of an arrangement of apparatus whereby the admission, cutting off, and release of steam is attained by distinct and separate means, and the arresting of the travel of the cut-off valve is effected before the admission valve arrives at the termination of its stroke, and in such manner as will not affect the set "lead" of admission. It will also admit of the full indicated steam pressure in the boiler being thrown on the piston at all times, and the varying loads or weights to be driven will cause the cut-off which is connected to, and actuated by, the governor, to act instantly, as may be required, according to the varying loads or weights thrown on and off, thereby effecting the utmost economy possible in the using of steam in proportion to the power exerted. The apparatus consists of a curved valve of similar construction to the valve commonly known as the "Corliss valve," having openings through it, and on the inside of which is another valve, also of similar configuration to the "Corliss valve," which is moved along with the main or admission valve until arrested, when it closes the ports or openings in the admission valve, thereby cutting off the steam before the termination of the stroke without the aid of intervention of the ordinary equilibrium throttle valve. With this method it is necessary to have two induction and two eduction valves, all four receiving a reciprocating motion from a disc or cross lever connected to an eccentric or its equivalent. The cut-off apparatus consists of a cylindrical box through which, and in the direction of its diameter, protrude two bushes, one on each side, capable of sliding therein. Motion is imparted to these bushes in the direction of their length by two plates having angular guides formed on them, and which are connected to the governor in such manner that any variation in speed of the engine will move the plates at right angles to the length of, and will thereby give motion to, the said bushes. Through these bushes is a sliding rod, having adjustable stops or nuts thereon, which sliding rod being connected to a lever on the spindle of the inside valve will drive motion from the said valve through the bushes until arrested by the adjustable stops or nuts, while the outer valve continues its motion, and the ports or openings in it will be closed by the arresting of the inside spindle.—Patent abandoned.

2714 A. MORRALL. *Certain improvements in the manufacture of fish hooks.* Dated September 26, 1867.

This invention consists of a piece of wire bent into, or otherwise caused to assume, such a shape that, when in a normal condition, it nearly represents the letter V, it being understood that at the upper ends of the wire are the barbed hooks. When it is desired to bait the hook, the said upper ends are pressed together, and the lower part or shank of the V-shaped wire being flattened is passed through the mouth of the fish, which is to form the bait until it has passed completely through it. In this manner no separate baiting needle is needed.—Patent completed.

2715 J. JAMESON. *Improvements in the preparation of paper which cannot be tampered with for the removal of writing thereon without detection.* Dated September 26, 1867.

This invention consists in the preparation of a paper which will indicate any tampering therewith whatever. The inventor prints a design or designs in different colours, in or on different media, the nature of the colours and the media being such that part of the design will be effaced or injured by the action of heat, part by the action of chemical gases, part by attrition, part by the action of water, alcohol, ether, or other solvents.—Patent completed.

2716 G. WILKINSON. *Improvements in pumps.* Dated September 26, 1867.

Here the patentee arranges the suction pipe of the pump to rise up at the side of the pump cylinder in a chamber provided for it. The cylinder communicates at its lower end with this chamber, and the cylinder contains a valved piston or bucket having a short and rapid stroke given to it usually by a crank and multiplying gear. The suction valve is mounted on the top of the suction pipe at a level above the piston or bucket, so that this is necessarily at all times immersed in the water. The water is delivered through the piston or bucket passing the clack or valve therein, and it escapes by a spout or delivery pipe at the upper end of the cylinder above the piston or bucket.—Patent completed.

2717 E. T. and C. HORSLEY. *Improvements in the production of a glazed or vitrified surface on cast iron or other cast metal.* Dated September 26, 1867.

In producing castings of iron or other metal, the patentees coat the mould, and any core which may be employed, or either or part thereof, with powdered glass, or it may be furnace cinder or enamel, or other material capable of being vitrified by the heat of the melted metal when it is poured into the moulds, so as to form a glaze or enamel on the surface of the casting.—Patent completed.

2718 J. BRUNTON. *Improvements in machinery for raising water.* (A communication.) Dated September 26, 1867.

Here, on an axis mounted horizontally in suitable bearings, and driven by a bullock mill, or in other convenient manner, are two discs, at a distance apart, and connected the one with the other by bars parallel to the axis, and equidistant from it, and from each other. It is preferred to employ eight such bars, which, with the discs, form a skeleton drum of an octagon form. Over this drum two endless chains pass; they are made with links of iron plate corresponding in length to the sides of the octagon drum, and jointed the one to the other. The chains carry between them buckets which are riveted to them, every alternate link of each chain being riveted to the end of a bucket. The buckets are rectangular, of a depth of about equal to the length of the links from centre to centre, and somewhat less in width; they are riveted to the chains in an inclined position, so that, as each bucket ascends with the water which it has taken from the source, its inner side is higher than the outer. A trough is placed beneath the drum outside the chains on their descending side, and the buckets as they come round discharge the water into it. The apparatus should be driven at a speed which is just sufficient to cause each bucket as it comes round to discharge its water into the trough, throwing it outwards clear of the bucket beneath.—Patent abandoned.

2719 J. JAMESON. *Improvements in the indication of value on cheques, bills of exchange, and other documents.* Dated September 26, 1867.

Here the patentee perforates the cheque, bill, or other document in such a way, or in some conventionally fixed manner, to indicate the amount written on it, and so arranges the perforations that any additional perforation will indicate a reduced value; or, he prints, water marks, or otherwise indicates on the cheque, bill, or other document a scale or scales of amount, cutting through, tearing or perforating which at a certain place or places will indicate the amount, or an approximation to the amount, stated in writing; or, he cuts off certain parts, or cuts, perforates, or tears the bill, cheque, or other document in any convenient conventionally understood manner, so that any further cutting, perforation, or tearing would indicate a reduced value. Silk threads may also be run through the paper, so as to be involved in the perforation if desired. This mode of indication of value could also be applied to affixed stamps, the cutting, perforation, or tearing of which might be made a legal obliteration.—Patent completed.

2720 A. V. NEWTON. *Improved apparatus applicable to*

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turning and screw cutting. (A communication.) Dated September 26, 1867.

This invention relates to cutting screw threads on pipes, bolts, and rods, whereby the work may be done with far greater rapidity than hitherto, and consists, first, in an improved clamp for clutching the pipe or rod to be acted upon, and causing it to turn with the mandril whenever the latter is turned, the pipe or rod being released when the rotation of the mandril ceases, the clamp being consequently self-acting, and admitting of the pipes or rods being inserted in and withdrawn from it without any appreciable loss of time. The invention consists, second, in a die for cutting the screws on the pipes or rods, whereby the die may be made at the will of the operator or attendant, to grasp the pipe or rod, or be released therefrom.—Patent abandoned.

2721 J. FORDRED. *Improvements in bleaching and purifying paraffin.* Dated September 26, 1867.

This invention is performed in the following manner:—Having melted the crude paraffin and allowed the impurities to subside in the usual way, the inventor runs the liquid paraffin into a vessel, and having raised the temperature to 260deg. Fah., or thereabouts, he adds thereto sulphuric acid, and agitates the mixture well (preferring hot air for that purpose). He then keeps it warm to allow the tar and colouring matters to deposit. After it has become clear, he draws it off from the sediment, and boils it in contact with a weak solution of glue, by the aid of free steam, until the glue has taken up and combined with any free sulphuric or sulphurous acid the liquid paraffin may contain; or it may be washed with the solution of glue by mechanical means; on allowing the whole to repose, the liquid paraffin will become transparent and bright. Or in lieu of this glue treatment he draws off the clear liquid paraffin and mixes it with ground Fuller's earth, agitates it, and allows it to settle. It is then drawn off and mixed with about 15 per cent. of spirit (more or less), and run into tins and allowed to cool. When thoroughly set, the cakes are submitted to hydraulic pressure in the usual way, and, finally, filtered through animal charcoal, as is well understood.—Patent abandoned.

2722 J. H. JOHNSON. *Improvements in apparatus for supplying steam boilers with water.* (A communication.) Dated September 26, 1867.

This invention relates to a peculiar construction and arrangement of self-acting feed apparatus for supplying water to steam generators, and consists in the use of a vibrating or oscillating horizontal hollow lever or beam, working on a centre in three brackets or supports attached to a bed plate, which bed plate is secured to the top of the boiler. On each end of this lever or hollow beam there is formed a closed chamber in free communication with the interior of the beam. A central partition formed transversely across the middle of the hollow beam prevents any communication between the two opposite ends of the beam, and between the two chambers carried thereby. To one of the supporting heads or brackets there are fitted a steam and a water supply pipe. The steam pipe descends inside the boiler to a little below the proper water level. The water supply pipe may consist of an injector, or it may receive its supply from a head of water, or otherwise, a cock being provided for shutting off the water when required. In the faces of the two buckets or heads immediately adjoining and in contact with the sides of the beam there are formed ports or passages which communicate with the interior of the generator, and with other ports or passages made in both sides of the beam, and situate on opposite sides of the internal partition. When the beam is caused to vibrate on its centre,—that is to say, when one end or the other is depressed, a communication is established by the ports and passages hereinbefore referred to between the interior of the boiler and one or other, as the case may be, of the closed chambers carried by the beam, and also with the water supply pipe.—Patent abandoned.

2723 T. and O. VAUGHTON. *An improved necktie ribbon or other connector for ladies' or gentlemen's use.* Dated September 26, 1867.

This fastener is adapted for holding and attaching the bow ends or parts of a neck-tie, ribbon, or kerchief, and is composed of a front part (which may be ornamented to any extent by being chased, engraved, jewelled, enamelled, or otherwise), and to this part a back is attached by a convenient joint, to which part, by preference, a stud or other convenient elastic or non-elastic projection is applied, for the better holding (from lateral action) the tie or ribbon on its inside; an additional stud may be used for attachment with the collar or neck-band of the shirt, or other part of dress. The back and front parts are united by a spring snap or other joint.—Patent abandoned.

2724 J. E. H. ANDREW. *Certain improvements in looms for weaving.* Dated September 27, 1867.

This invention is not described apart from the drawings.—Patent completed.

2725 R. ADAMS. *Improvements in apparatus for extracting cartridge cases from breech-loading firearms.* Dated September 27, 1867.

This invention relates to improved arrangements of mechanism for extracting or withdrawing exploded cartridge cases from breech-loading firearms having hinged breech-blocks for closing the breech end of the barrel, the act of opening the breech being the means by which the extractor is actuated to withdraw the cartridge case out of the breech end of the barrel. For this purpose, the inventor mounts the finger of the extractor (which acts upon the rim of the cartridge case to withdraw it from the barrel) upon a slide, mounted so as to move to and fro in a groove formed in the breech-piece, in a parallel line, or nearly so, with the barrel. Upon the upper surface of the slide which carries the extractor an incline is formed, which is acted upon by another incline formed on the breech-block, so as to move the slide and extractor outwards from the breech end of the barrel when it is opened. When the breech-block is closed, the slide carrying the extractor is moved back to its former position by a lever arm actuated by a spring mounted upon the breech-piece.—Patent abandoned.

2726 M. SAMUELSON. *Improvements in sewing machines.* Dated September 27, 1867.

Provisional protection has not been granted for this invention.

2727 F. FREW and J. SPEIRS. *Improvements in looms for weaving ornamental fabrics such as leno and muslin curtains.* Dated September 27, 1867.

In carrying out these improvements a plain heddle leaf is arranged to act on one half of the warps, and is placed behind the harness. The other half of the warps, and of course alternating with those acted on by the back heddle leaf, are acted on by the harness to produce the pattern in the ordinary way, and may be termed the harness warps. In front of the harness there is placed a gauze or "doup" heddle leaf arranged for producing a full gauze weaving action. The warps acted on by the back heddles are passed through the "doup" loops or heddles, whilst the harness warps are passed through the spaces between the front heddle loops. There are four sheds in the cycle of movements, and separate single weft shots are passed through each shed. The jacquard apparatus is actuated by a cam movement so as to operate at every alternate shot only. After one harness shed the back heddles are raised for the second shed, and with them the bar to which the "doup" loops of the front heddles are attached, which action raises the heddle warp threads on, say, the left hand sides of the respective adjacent harness warp threads. After the third shed, which is a harness shed, the front heddles are raised for the fourth shed, and have the effect of raising the heddle warp threads on the other or right hand sides of the harness threads. The heddle warp threads are passed over a separate bearer at the back of the loom, and by a periodical cam movement this bearer is moved forward so as to slacken that portion of the warps sufficiently for the gauze action at the same time that the "doup" loops are made free to be drawn up by the raising of their bar, and unequal strain on the warps is thereby prevented.—Patent abandoned.

2728 A. M. CLARK. *An improved hat-blocking machine.* (A communication.) Dated September 27, 1867.

This improved machine consists of three different elements combined in one machine. The first element is a mechanism for blocking the crown of the hat, consisting of a number of expansible bars, any suitable mechanism being employed, and the patentee does not claim any improvement thereon. The second element consists in a ring for breaking the band of the hat, which is constructed so as to be capable of a downward motion, which motion is to be given to the ring after the blocking of the crown and the stretching out of the brim has been completed. The third element consists in a series of clamps placed in a circle to seize the brim, which clamps are in an inclined position nearly fitting the conical shape of the hat body when the hat body is to be placed on the machine. These clamps, when the stretching of the brim is to take place, receive a double motion, they being brought up to a horizontal position and then expanded.—Patent completed.

2729 S. PARR and A. STRONG. *Improvements in the construction of buildings, arches, bridges, and such like structures, and in the floors of buildings and in other situations.* Dated September 27, 1867.

This invention comprises various features, among which are the following:—As regards the roofs of buildings, the inventors propose to construct them as follows:—The framework of the roof being principally of metal, they cover the same by fixing a wood centre to the framework by any convenient means, the said centre being made the desired shape and covered with sheet metal, if necessary. Upon these centres they arrange metallic or earthenware tubes or half tubes, in combination with concrete, or they form a coating of concrete only, in which case they mix together ballast, broken brick, or pottery, and Portland cement in varying proportions, according to the strength required, and this concrete they lay or spread on the wood centre, or not, as required, to the desired thickness, the outer surface being worked into shape, as in plastering. Where half round tiles or half tubes are used, they might simply be laid on the wood centre, and their outer surfaces be covered with liquid or semi-fluid cement, or flue concrete; they then apply a coating or covering of ordinary concrete to make up the required thickness. Cylinders or tubes may be laid in the above manner, and be similarly covered. They propose to so fix and dispose some of the tubes of the roof or covering as that they may be used as ducts for the passage of air, water, gas, or smoke when required. They also propose to fix the chimney pots on the roof, and thus dispense with chimney shafts. They propose to form openings for windows by employing burbs of wood, iron, or terra-cotta to receive the sash frames or skylights, and they further propose to bed iron fastenings in the concrete for attaching internal or external framings.—Patent abandoned.

2730 P. and F. S. COCKER. *Improved apparatus for transmitting signals in railway trains.* Dated September 27, 1867.

The object here is to enable signals to be communicated to the guard or to the engine driver, or simultaneously to both guard and engine driver, of a train in motion from a passenger in any compartment of the train, and also from the guard to the engine driver, and vice versa. This the inventors effect by fitting to the roof of each carriage an apparatus which will transmit an endway motion imparted thereto by the pulling of a pendant cord, throughout the length of the train, which motion may be made to sound an alarum, throw up a visible signal, or set the whistle of the engine in action.—Patent abandoned.

2731 L. DE LA PEYROUSE. *Improvements in the treatment of paraffin, fatty, and resinous matters.* (A communication.) Dated September 27, 1867.

Raw or crude paraffin of commerce is a mixture of paraffin, tar, carbonaceous matters, heavy mineral oils, and colouring matters, and the purification or refining of such paraffin, as well as its decoloration, consists in the separation of the before-mentioned substances. In order to effect the separation of the tarry and carbonaceous matters the patentee employs certain chemical agents which possess the property of removing the before-mentioned impurities, and of concreting a portion of the heavy oils contained in the paraffin. He also employs such chemical agents as will effect the precipitations of the tarry matters contained in the crude paraffin, as well as the precipitation of the colouring matters, so as to yield paraffin entirely free from tarry matters, and both limpid and transparent, and of a white or grey or pale yellow colour. He also adopts as a method of separating the tarry matters from the crude paraffin, maintaining the same in a state of fusion for a given time at a temperature of about 60deg. Centigrade. The tarry matters and other impurities, being denser than the paraffin, sink, and the paraffin is withdrawn in a purified condition.—Patent completed.

2732 F. BRANSCOMBE. *Improvements in means or apparatus employed in drilling, cutting, and ornamenting metal, wood, and other substances.* Dated September 27, 1867.

Here the inventor employs revolving cutters of forms suitable to the work to be produced, such cutters being mounted upon an axis to which rotary motion is given in any suitable manner, as is well understood. The material to be operated upon is fixed in any suitable manner to a table or holder, which is mounted upon a pin carried by a slide, which is capable of being worked to and fro upon suitable guides by a screw, in a similar manner to the slide rest of a lathe, such guides being carried by a circular plate, on the periphery of which are formed teeth into which a suitable screw takes, and by which rotary motion may be communicated to such circular plate. The screw above mentioned is also carried by a slide working upon suitable guides, as before described with reference to the first-mentioned slide. To the last-mentioned slide is fixed a bar or rod provided with a suitable groove, in which moves a stud or projection from a suitable rod or bar, carried by the table or holder to which the material to be operated upon is fixed. The last-mentioned guides are fixed to a plate which is capable of being turned into any desired position, and the edge or surface of which is provided with suitable marks or divisions to enable it to be turned to any desired angle.—Patent abandoned.

2733 J. and J. A. HUGGETT. *Improvements in the manufacture of horse nails and other nails, and in machinery used therein.* Dated September 27, 1867.

Here the patentees employ a hammer worked by power, by which a regular reciprocating motion is given to it. On the face of the hammer are two dies, one corresponding in form to the side of the nail, and the other to its edge. This hammer works upon an anvil, also having the incline or bevel of the nail formed upon it. The bar of iron which is to be drawn down to form a nail is received in a holder which turns it one quarter round, and shifts it sideways from one die of the hammer to the other after each blow, so that the bar may be alternately struck on the side and edge, and alternately by one and the other of the dies which the hammer carries. The holder for the bar to be drawn down may conveniently be an axis carried by a slide; the axis is connected with the hammer so that it turns one quarter round between each stroke, first one way, then the other.—Patent completed.

2734 F. MEYER and W. WAINWRIGHT. *Improvements in the manufacture of candles, and in moulds for the same.* Dated September 27, 1867.

Here the end of the candle which fits into the socket is made with grooves or recesses in it which penetrate towards the centre of the candle below the surface of the shaft, so that, by rubbing away from the end of the candle the ridges or projections which separate such grooves or recesses, the candle may be made readily to adapt itself to a socket of smaller diameter than its shaft.—Patent completed.

2735 C. MOLE. *Improvements in the preparation of soles and heels for boots and shoes.* Dated September 28, 1867.

Here the inventor proposes to render soles of boots and shoes, made of leather, gutta-percha, india-rubber, or analogous material, stronger and more durable in wear without destroying the elasticity of the material. He proposes to use bolts or pins of solid metal or composite metal, and to insert them (through holes prepared in the leather or other material) into the sole before the boot or shoe is made, in order that boot or shoe soles thus prepared may be supplied to the bootmaker perfect, and ready for use.—Patent abandoned.

2736 H. A. BONNEVILLE. *A new and improved process of treating skins in order to separate therefrom the hair and wool, and in the preparation of the hair for the manufacture of hats.* (A communication.) Dated September 28, 1867.

The patentee claims, first, the use of the sulphuretted sulphydrate of calcium engendered in the very tissue of the skin for depilating. Second, the leather obtained by means of this process with the skins of rabbits, hares, rats, and beavers. Third, the preparation of the hair to be used in the manufacture of hats with a solution of sulphur.—Patent completed.

2737 L. LAINE. *An improved fan.* Dated September 28, 1867.

The object here is to combine with or affix to fans, whatever form they may assume, or whatever material they may be made of, either a hand glass, binocle, or spy glass, or any other such-like or analogous optical instrument, and the invention consists in lodging these objects in a cavity provided in one or both of the fan sticks, as may be required. The hand glass, binocle, or spy glass, furnished with its mounting, is retained in the cavity by a spring actuated by a thumb-piece projecting on the side of the fan stick, which has only to be pressed to open it by the barrel spring actually in use.—Patent abandoned.

2738 A. WARD and C. G. VIRGO. *The adaptation of materials specially prepared for the manufacture of certain articles of wearing apparel.* Dated September 28, 1867.

Here the inventors impart to such linen or cotton, or linen and cotton fabrics, a glossy surface by means of heat and pressure, jointly applied in what is known as a hot press of ordinary construction, care being taken that each side of the fabric is glazed equally. The materials thus prepared (which may, if desired, be embossed, figured, or illuminated by well known means) will have the appearance of silk or satin fabrics.—Patent abandoned.

2739 J. H. JOHNSON. *Improvements in the manufacture of railway wheels.* (A communication.) Dated September 28, 1867.

This invention relates to the manufacture of "chilled" railway wheels, and has for its object the avoiding the danger of fracture arising from the great strain or tension in the metal produced by the cooling of the periphery of the wheel after casting. According to this invention it is proposed to cut away or remove a portion of the "chill" under the flange of the wheel, so that, in moulding and casting, the outer part of the flange will rest on sand, and thereby cause the flange of the wheel in casting to have a full and perfect edge. The "chill" is provided with a number of internal recesses, in which are placed cores which form recesses in the rim of the wheel. These recesses in the wheel are filled up by driving roughened or file-cut pieces of steel therein, or by melting and pouring therein hard metal, or they may be otherwise filled up.—Patent completed.

2740 G. R. SOLOMON. *Improvements in apparatus for registering passengers travelling in public vehicles.* Dated September 28, 1867.

The patentee claims, first, the novel employment and use of lengths or ribbons of tickets rolled around a shaft, and caused to issue or unroll as required, by means of elastic surfaced delivery rollers, actuated by a handle outside the case containing the tickets and delivery rollers. Second, preventing the rollers turning in a reverse direc-

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tion, whereby such tickets might be returned to the box. Lastly, the general arrangement, combination, and construction of the apparatus as described, set forth, and illustrated in the drawings.—Patent completed.

2741 E. LEVER. *Improvements in lamps.* Dated September 28, 1867.

The object here is to enable more air to pass into the vessels containing oils, hydrocarbons, or gases to be consumed for the production of light than can be obtained from the ordinary single air holes with which lamps have hitherto been provided, the increased supply of air causing a greater intensity of light, and the prevention of noxious fumes. To the upper part of each vessel the inventor fixes two or more tubes open to the atmosphere, for causing one or more currents of air to circulate through the vessel, and thus enable more oxygen to be supplied.—Patent abandoned.

2742 H. KELLOGG. *Improvements in the manufacture of hats, and machines for producing the same.* Dated September 28, 1867.

This invention relates to a peculiar formation of or coating for hat bodies, and machinery for performing the same, and consists in taking vegetable pulp, whether perfectly dry, or in the partially fluid condition in which it is usually employed for commencing to form it into sheets of paper in paper making machinery, and then mixing the same with a sufficient quantity of water (say in the proportion of fifty to eighty parts or thereabouts of water to one of pulp), in order to entirely separate the fibre from each other, that they may all be diffused through the water, similarly to the manner in which particles or motes float in the air, then introducing in to the same animal fibre, such as wool, and from this mixture forming a hat body by placing the mixture into a vessel above a former constructed from perforated metal, or other suitable permeable material, constantly agitating the mixture to preserve the above-stated condition, then, by suction from below, or pressure above, forcing the water through the former, leaving the fibrous mixture thoroughly mingled, and packed in sufficient quantity to form the body. Reference to the drawings is essential to a full description of the invention.—Patent abandoned.

2743 J. ELDER. *Improvements in the construction and mode of propelling and manœuvring floating batteries and other vessels intended for the purposes of naval defence and attack.* Dated September 28, 1867.

The specification of this invention is too elaborate to be quoted here at sufficient length for an intelligible abstract. We may, possibly, describe and illustrate the invention in a future number.

2744 M. HAMER. *Improvements in machinery or apparatus for manufacturing india-rubber tubing.* Dated September 28, 1867.

This invention consists in manufacturing india-rubber tubing by drawing strips of the material through a trumpet-formed orifice, whereby the edges of the said strips are brought together.—Patent completed.

2745 T. PRIDEAUX. *Improvements in blast furnaces or cupolas.* Dated September 28, 1867.

This invention relates to smelting iron from the ironstone, and entirely dispenses with the water tuyeres as at present in use. The patentee constructs a passage or pipe round the furnace between the inner and outer brickwork under the boshing, and above the level of the dam; from this passage a number of perforations lead into the interior of the furnace, the blast being let into this passage and through the perforations, and thereby spreading over the whole surface of the furnace. By these means great advantage is derived, as the passage around the furnace acts as a heating stove, and thereby a great degree of heat is attained before the air or bloss passes through the perforations into the interior of the furnace. The invention also consists in a method for drying or calcining the ironstone before entering the furnace. The patentee constructs at the top of the furnace vertical gratings with valves at the dip; the stone is tipped or thrown on the gratings, the gases and heat from the furnace ascend through the gratings, and thereby dry or calcine the stone, as may be found necessary. The valves at the dip of the gratings are constructed for discharging the stone from the grating into the interior of the furnace.—Patent completed.

2746 T. SILVER. *An improved lubricating packing.* Dated September 28, 1867.

This invention consists in the employment of dry powdered substances, such as steotite, or any lubricating species of talc, brimstone, and stearine, separately or in combination, in connection with a tubular rope or gasket constructed of any suitable fibrous material, the powdered substance or filling alone forming the centre or core of the said rope. The powdered substance, during the process of construction, is distributed through the body of the rope or fibrous material, the object of the core being to lessen the cost of production and increase the supply of lubrication.—Patent abandoned.

2747 B. DOBSON and R. HALLIWELL. *Improvements in mules for spinning and doubling.* Dated September 30, 1868.

This invention relates to mules for spinning and doubling cotton, wool, or other fibrous substances (when two speeds are required), and consists in making the horizontal rim pulley shaft in two parts extending nearly the whole length of the headstock. The rim band pulley for the slow speed is on the end of one shaft, and that for the quick speed on the other shaft. The driving pulleys are placed at the junction of the above shafts, one pulley fixed to each shaft, and a loose pulley placed between the above pulleys. An endless band passes from one rim band pulley to the other over suitable guide pulleys to the pulley or pulleys inside of the mule carriage for the purpose of driving the spindles at the speeds required, and the band is tightened by making the guide pulley inside the carriage adjustable, the said guide pulley being supported in a frame actuated by a screw or other equivalent. By the above arrangement the speeds can be easily varied to suit the counts required by changing the ring band pulleys. The other portions of the mule are arranged to suit the above object.—Patent completed.

2748 C. P. JONES. *A new or improved apparatus for removing adhering matters from the bottoms and sides of ships or other navigable vessels whilst at sea.* Dated September 30, 1867.

This invention consists in employing a jointed scraper, rendered buoyant by corks or otherwise, so as to closely surround or encircle the body of the ship, and admit of being heaved or dragged fore and aft whilst afloat by means of guy ropes and lines attached to the apparatus.

The said scraper or apparatus is formed of a series of bars or plates of iron jointed longitudinally together to a keel piece through the medium of transverse rods and rivets, the said corks or otherwise being fixed between or upon the transverse bars and the sides of the said apparatus to give it the requisite buoyancy, and enable the scraper to impinge against the bottom and sides of the vessel whilst being worked from stem to stern, or in the opposite direction.—Patent completed.

2749 T. WESTON. *An improvement or improvements in the manufacture of ornamental metallic tubes.* Dated September 30, 1867.

The patentee claims making ornamental tubes by coating or covering a tube or foundation of iron, or a tubular or solid core or foundation of steel, by a drawing process with a thin metallic tube, and passing the compound tube or tube and solid steel core or foundation through ornamental rolls, whereby the outer thin tube is ornamented or impressed with the pattern or ornament upon the said rolls, substantially as described.—Patent completed.

2750 I. DIMOCK. *Improvements in apparatus to be used for boiling eggs and for like purposes.* Dated September 30, 1867.

The patentee claims, first, the use of a fluid in a vessel surrounded by a slow heat-conducting material, or an air cavity, as described. Second, the use of a fluid in a case arranged to act upon a piston or diaphragm which will transmit movement so as to release a catch and ring a bell, release a catch and allow a spring or weight to lift the eggs out of the boiling fluid, and ring a bell if required, as described. Third, the combination and arrangement of the mechanism or apparatus forming the instruments described.—Patent completed.

2751 W. JAMES and W. HILL. *An improved method of, and apparatus for, attaching and securing watch chains and similar articles to vests and other garments.* Dated September 30, 1867.

This apparatus consists of a plate formed of metal or other material possessing sufficient hardness and rigidity for the purpose to which it is to be applied, and on one side of which is placed a hook-like shank. To the other or front side of the plate is attached a ring, either split or otherwise, to which the chain is appended by means of another ring, or through which the bar ordinarily attached to chains commonly known as "Albert" chains may be passed. In order to fix this contrivance to the garment, a perforation or eyelet hole is made or formed in the latter, through which the hook-like shank of the beforementioned plate is passed. A plate of metal, or other suitable material, is then placed on the other side of the garment, the hook-like shank being passed through a hole or slot formed in the said last-mentioned plate, and to which is attached a small bent spring, which, working on a hook-like shank, securely holds the front plate in the desired position.—Patent completed.

2752 J. DONALD. *Improved arrangements for burning oil in furnaces.* Dated September 30, 1867.

These improved arrangements comprise the making of a furnace space or combustion chamber which has its bottom and sides lined with firebrick, and which is also arched or roofed over with firebrick. In the midst of this combustion chamber there is constructed, also of firebrick, what may be termed an ignition block or pier. The oil to be burned is admitted by a pipe nozzle placed so as to direct a jet of the oil towards or against the ignition block, and apertures are provided for the admission of air, by preference on the same side, so that the air will flow inwards in the same direction. In one modification no force but that due to a very small head is used for projecting the oil into the combustion chamber; but in another modification (and which the patentee prefers, as it is applicable where a more intense heat is required) a jet of steam (which he prefers to have superheated, although common steam will answer quite well) is made to project the oil in with considerable force.—Patent completed.

2753 J. DEWAR. *Improvements in preserving potatoes.* Dated September 30, 1867.

This invention consists in subjecting potatoes to the action of sulphurous acid for the purpose of preserving them in a condition suitable for food. The patentee does not saturate the substance of the potato throughout with the acid, but merely subjects the surface to the action thereof.—Patent completed.

2754 C. HONEGGER. *An improved loom for weaving figured fabrics.* Dated September 30, 1867.

This invention relates to a novel description of power loom for weaving figured fabrics, and the same consists, first, in an improved arrangement of the vertical wires or hooks of the Jacquard apparatus, and parts connected therewith, so as to allow the said hooks to work the shuttles according as required by the pattern cards. Second, in an arrangement for carrying each of the shuttles, and according as required by the pattern in the position for being acted upon by the picker or shuttle-driver, and for keeping the shuttle boxes in position during each pick. Third, in a peculiar arrangement and combination of parts for causing the main arbor to procure the working of the batten or lathe, the shuttles, the Jacquard apparatus, and other working parts of the loom.—Patent abandoned.

2755 J. CLARK. *Improvements in locomotive engines and their permanent ways.* Dated September 30, 1867.

These improvements have for their object to increase the tractive power of locomotive engines upon steep gradients. The first improvement consists in making the driving wheels with two flanges or tyres, or adding second wheels to ordinary driving axles. The inventor makes the second tyre or additional wheel of less diameter than the first or ordinary tyre and wheel, and lays down a second rail for the lesser wheel to run upon; the said second rail is to be fixed at the side of the ordinary rail when an increase of the tractive power of the engine is required. The difference in the level of the said rails is determined by the difference in the radius of the two driving wheels; the height of the second rails in all cases is to be such that, when the engine is running thereon, and bearing upon the second tyre or lesser wheels, the first tyre or ordinary wheels may run clear of the ordinary rails of the permanent way. The lesser diameter of the second tyre or wheel, and the raised rail, increase the tractive power of the engine.—Patent abandoned.

2757 T. BIRD. *Improvements in furnaces, fireplaces, and firebars for the consumption of smoke and gases arising from products and the non-consumption of firebars.* Dated October 1, 1867.

This invention has reference to a patent granted to J. Robertson, dated October 8, 1866 (No. 2586). The principal part of J. Robertson's invention consisted in having at the back of the furnace a hollow box bridge, with perforations at the top, and also placing near the front of the bridge a number of perforated tubes, the holes in the bridge and perforations in the tubes being for the supply of air from the ashpit, assisting the combustion of the smoke and gases. The present inventor employs the hollow box bridge with perforations at the top, and also the perforated tubes, but in connection with them he uses hollow firebars having apertures near their front ends, and opening at the back into the perforated tubes or perforated box bridge, for enabling the air to be heated by the fire in the furnace before it arrives at the said tubes and box bridge, and also to prevent the bars from burning and wasting so much as in ordinary practice. And where two bars are required he makes them with male and female joints to prevent the ashes from getting in, as also to insure the air passing more directly through them.—Patent abandoned.

PROVISIONAL PROTECTIONS.

Dated December 21, 1867.

3625 B. Engel, Lawrence-lane, Cheapside, merchant. A new and improved composition for extracting ink and iron mould from linen and woollen fabrics. (A communication.)

Dated January 13, 1868.

118 W. Firth, Rose Villa, Viewforth, Edinburgh. Improvements in valves made from india-rubber or other similar elastic material, the said valves being applicable in the construction of fluid or gaseous pumps, enemas, syringes, spray producers, and other instruments where valves are in use.

Dated March 2, 1867.

705 L. Roman, Paris. Improvements in apparatus for obtaining motive power from rivers or streams of water, and for facilitating boats ascending and descending rivers or streams.

Dated March 4, 1868.

753 C. Schinz, Faubourg de Saverne, Strasbourg, France, engineer. A process for the partial elimination of the nitrogen from the products of combustion and furnaces and apparatus connected therewith.

Dated March 12, 1868.

849 W. E. and F. A. Bush, Commercial-road, East. A new or improved trap for catching mice, rats, animals game, or vermin.

Dated March 13, 1868.

856 E. K. Dutton, engineer, and J. and H. Holme, merchants, Manchester. Improvements in sewing machines.

Dated March 18, 1868.

927 S. Wenkheim, Regent-street, hosier. A mode or method of combining a shirt and waistcoat, or portions thereof, so as to be worn either as a waistcoat and shirt, or as a shirt only.

Dated March 19, 1868.

941 R. W. J. Trueman, Queen-street, Belfast. Improvements in machinery or apparatus for collecting and removing mud from the surface of roads and streets.

Dated March 20, 1868.

951 W. Taylor, Driffield, Yorkshire, and C. E. Taylor, Bradford, Yorkshire. Improvements in stands or tables for sewing machines and other purposes.

Dated March 21, 1868.

961 G. Macdons, Downshire Hill, Hampstead, merchant, and O. Hilliard, Pembroke-road, Dublin. Improvements in means and appliances for conveyance, transport, and locomotion. (A communication.)

963 J. O. Spong and J. F. Haddaway, Fulham-road, Middlesex. Improvements in blow pipes.

965 H. Bessemer, Queen-street-place, Cannon-street, City. Improvements in the manufacture of refined iron and of malleable iron and steel

967 H. Bessemer, Queen-street-place, Cannon-street, City. Improvements in the manufacture of malleable iron and steel, and in apparatus used in such manufacture.

Dated March 23, 1868.

969 E. K. Dutton, Smithy-door, Manchester. Improvements in valves employed to regulate the flow of water.

971 T. Pope, Twickenham, Middlesex. Improvements in braces or suspenders. (A communication.)

973 S. Holmes, High Holborn. Improvements in lamps for burning oils and spirits.

977 C. M'Dermott, Devereux-court, London. An improved indelible pencil for marking linen and other fabrics.

979 C. N. Leroy, Rue Eugenie Levallois-Perret, near Paris. Improvements in grease cups or apparatus for lubricating machinery.

981 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in metal ties or bands for securing bales of cotton or other substance. (A communication.)

983 E. Vignier, Fowkes-buildings, City, merchant. Improvements in distilling and rectifying spirits, and in apparatus employed therein.

985 A. V. Newton, Chancery-lane. Improvements in thrashing machines. (A communication.)

Dated March 24, 1868.

987 J. S. Farmer, Canterbury-road, Kilburn, railway signal engineer. Improvements in the apparatus for, and in the means of, communicating or transmitting signals between the parts of a railway train, and for signalling on railways in connection with train working.

989 H. Burgess, Battle, Sussex, draper. Improvements in the construction of rails for railways and tramways.

990 W. E. Gedge, Wellington-street, Strand. An improved smoke-consuming fireplace or furnace. (A communication.)

991 W. R. Boothby, Adelaide, South Australia. An improved combination of mechanism to produce rotatory motion in engines.

992 T. W. Fuller, Leamington, Warwickshire, coach builder. Improvements in carriages.

993 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in watches, chronometers, and clocks. (A communication.)

994 E. Gray, Sheffield, edge tool manufacturer. Improvements in the manufacture of metal bars intended to be made into horse-shoes and other articles.

997 J. A. Farrar, master mariner, and B. R. Huntley, ship chandler, Hartlepool, Durham. Improvements in ships' hatches, and in ventilating the holds and cabins of ships.

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999 D. Lewis, Ranelagh-street, Liverpool. Improvements in portable tables.

1001 C. Harris, Manchester. Certain improvements in machinery or apparatus to be employed in the manufacture of paper bags.

1002 J. Antill, Wandsworth, Surrey, plasterer. Improvements in stench traps.

1003 A. V. Newton, Chancery-lane. Improvements in the construction of pocket knives. (A communication.)

Dated March 25, 1868.

1006 R. Little, Greenock, Renfrewshire, merchant. Improvements in reducing the temperature of air, in producing ice, in preserving animal and vegetable substances, and in apparatus therefor. (A communication.)

1007 A. Elliott, Failsworth, near Manchester, practical mechanic, and J. Barker, engineer, Oldham, Lancashire. Improvements in apparatus for lubricating axles and bearings and other frictional surfaces.

1009 A. M'Glashan, Coal-yard, Drury-lane, engineer, and J. Hendry, Arlington-street, New North-road, back and vat maker. Improved machinery or apparatus for mashing substances employed in the making of fermented liquors.

1011 J. Warburton, jun., Sandal, Yorkshire. Improvements in steam engines.

1012 G. Hayhurst, Bury, Lancashire, tin plate worker. Improvements in drying cylinders employed in sizing and other machines.

1013 W. Buck, Upper Tooting, Surrey, engineer. Improvements in machinery or apparatus for working and locking or controlling railway points and signals.

1014 T. Lane, Birmingham. Improvements in looms for weaving.

1015 C. E. Brooman, Fleet-street, City, patent agent Improvements in machinery for the manufacture of paper tubes specially intended for use in spinning machinery. (A communication.)

1016 S. Fisher, Strand, church decorator. Improvements in the ornamentation of tiles to be used for the purposes of mural and other decoration.

1017 J. Plant, Sheffield, dram flask maker. Improvements in dram flasks.

1018 A. V. Newton, Chancery-lane. Improvements in spinning machinery. (A communication.)

1019 W. Richardson, Oldham, Lancashire. Improvements in machines for burring or cleaning wool.

1020 T. Whitehouse, Wednesbury, Staffordshire, engineer. Improvements in blast furnaces.

1021 T. Sagar, machine maker, T. Richmond, cotton manufacturer, and C. Catlow, overlooker, Burnley, Lancashire. Improvements in looms for weaving.

1022 J. Anderson, Ramsbottom, Lancashire, manager. Improvements in machinery employed for carding wool, cotton, and other fibres.

1023 J. Jameson, Catherine-terrace, Gateshead, Durham, engineer. Improvements in the preparation of safety paper.

1024 H. G. P. Meade, Lieut. in the Royal Navy, Belgrave-square, Middlesex. Improvements in firearms, and in cartridges, projectiles, and torpedoes.

1026 W. P. Piggott, Argyll-street, Middlesex, electrician. Improvements in transmitting electric telegraph messages, and in apparatus employed therein.

Dated March 26, 1868.

1027 E. J. J. Dixon, Bangor, North Wales, engineer. Improvements in machinery for reducing, smoothing, facing, or otherwise working and manufacturing slate, and other stone and materials.

1028 J. T. King, Liverpool. Improvements in apparatus for dressing millstones.

1029 W. Oram, Salford, Lancashire. Certain improvements in hydraulic presses, and in the apparatus connected therewith.

1030 M. B. Orr, Glasgow, merchant. Improvements in arrangements for drying and preserving animal and vegetable substances. (A communication.)

1031 W. H. S. Aubin, Wolverhampton, machinist. Improvements in, and additions to, cocks and taps for drawing off liquids and gases from pipes, casks, or other vessels.

1032 T. Bettney, Manchester, commercial traveller. An improvement in paper cutting machines, envelope and label punching machines, and to other similar machines for punching shapes.

1033 H. Davey, Victoria Chambers, Westminster, engineer. Improvements in steam engines, part of which is applicable to steam pumps.

1034 W. Clark, jun., Dunfermline, Fifeshire, and J. Clark, Paddington, Middlesex, engineers. Improvements in locomotive engines, in part applicable to steam engines generally, and to railway and other carriages.

1035 M. Havenhand and J. Allen, Dronfield, Derbyshire. Improvements in pistons.

1036 J. Cocks, Regent-street, Middlesex, tailor. Improvements in the making of trousers, and in the manufacture of materials for the same.

1037 W. Manwaring, Banbury, engineer. Improvements in the construction of reaping and mowing machines.

1038 W. D. Cliff, Wortley, Yorkshire, brick and tube manufacturer. Improvements in furnaces or kilns for the burning of bricks, pottery, iron ore, and other similar substances.

1039 W. S. Page and R. East, Nine Elms Wharf, Nine Elms, Surrey. Improved mechanical arrangements applicable to steam boilers and the cylinders of steam and other motive power engines for preventing the priming thereof, and for lubricating the pistons and cylinders of engines.

1040 B. Browne, King William-street, City. Improved machinery for the manufacture of collars, cuffs, and other articles of dress made of paper or paper and cloth combined. (A communication.)

1041 S. Perry, Red Lion-square, Middlesex, and F. Brampton, Birmingham. Improvements in letter clips, bill files, and other similar clips or suspenders.

1042 J. Lyall, New York, U.S. Improvements in looms for weaving.

1043 J. H. Johnson, Lincoln's Inn-fields. Improvements in lamps for burning liquid hydrocarbons. (A communication.)

1044 T. Routledge, Ford Works, near Sunderland, and W. H. Richardson, Springwell Paper Works, Jarrow-on-Tyne. Improvements in bleaching esparto and other fibrous substances used in paper making.

Dated March 27, 1868.

1045 A. Warner, Laurence Pountney-lane, City. Improvements in the manufacture of cement.

1047 I. Bates, manager, and J. Taylor, engineer, Dukinfield, Chester. An apparatus for cleaning the flues of boilers and boiler seatings.

1049 J. Maurice, Langham-place, Middlesex, dentist. Improvements in the means or method of producing optical illusions.

1050 F. Bauman, Wellington-street, Strand. The preparation of a certain combination of chemical substances, and its novel application to the treatment of wood or other fibrous material in the preparation of paper pulp.

1051 G. Hodgkinson, Manchester. Improvements in the method of producing designs upon woven fabrics.

1052 G. Davies, Serle-street, Lincoln's Inn. Improvements in the construction, arrangement, and application of steam engines. (A communication.)

1053 P. Adie, Pall Mall, mathematical instrument maker. Improvements in means and apparatus for shearing sheep and clipping horses and other animals.

1054 C. E. Brooman, Fleet-street, City, patent agent. Improvements in breech-loading firearms. (A communication.)

1055 C. B. James, Redditch, Worcestershire, needle manufacturer. Improvements in securing and wrapping up needles.

1056 W. E. Newton, Chancery-lane. Improvements in engines for obtaining motive power by means of steam, air, gases, or fluids. (A communication.)

1057 H. Jones, jun., Soho-square, and W. F. De La Rue, Bunhill-row, Middlesex. Improvements in whist counters.

1058 J. G. Jones, Blaina Iron Works, Monmouthshire. Improvements in apparatus for hauling minerals in mines, and for raising water from mines and other places.

1060 S. C. Lister, Manningham, Yorkshire. Improvements in the manufacture of cut-pile fabrics.

Dated March 28, 1867.

1062 J. G. Fildes, Elton Bury, Lancashire. An improved bearer or support for conveying ladles containing molten metal.

1063 T. C. Currie, Kensington. An improved process for the preservation of milk.

1064 H. G. Warren and S. Stuckey, Deptford, Kent, and P. Froud, Greenwich. Improvements in revolving iron shutters.

1065 J. Macintosh, North Bank, Regent's Park, and W. Boggett, Lindsey Houses, Chelsea. Improvements in boots and shoes.

1066 C. Joyner, Birmingham, manufacturer. Improvements in water-slide gaseliers.

1067 J. C. Coombe, Charles-street, Holloway, chemist, and J. Poole, Riley-street, Chelsea, engineer. Improvements in coating iron and such like surfaces, and protecting them from the corrosive action of sea water, and the oxidizing influence of moisture.

1068 W. J. Addis, Tanna, Bombay. Improvements in the permanent way of railways.

1069 W. E. Gedge, Wellington-street, Strand. An improved apparatus for moistening postage and other stamps, to prepare them for application. (A communication.)

1070 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in filters. (A communication.)

Dated March 29, 1868.

1071 H. Armstrong, Tow Law, Durham, blacksmith. Improvements in the manufacture of steel and homogeneous iron.

1072 O. Ormrod, Eagley, Lancashire. Improvements in machinery for washing, bleaching, dyeing, and scouring hanks and cops of yarns and thread, woven fabrics, and other articles.

1073 C. F. Claus, Middlesborough-on-Tees, chemist. Improvements in the manufacture of iron.

1074 C. F. Claus, Middlesborough-on-Tees, chemist. Improvements in the manufacture of malleable iron, and in the process of re-heating the same for the purpose of rolling or hammering it.

1075 B. Mitford, Cheltenham, Gloucestershire. Improvements in apparatus for communicating with deaf and dumb or deaf or dumb persons.

1076 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of cast steel and malleable iron from cast iron, and in the apparatus or means employed therein. (A communication.)

1077 J. H. Johnson, Lincoln's Inn-fields. Improvements in the treatment of cork, and in the manufacture of a new compound or material therefrom applicable to various useful purposes. (A communication.)

1078 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of cast steel, and in furnaces to be employed therein, which furnaces are also applicable to the re-melting of metals generally. (A communication.)

1079 J. F. Hadland, Birmingham. Improvements in metal ties for securing bales of cotton or other substance. (A communication.)

1080 F. Wirth, Frankfort-on-the-Maine, Germany. An improved mode of, and apparatus for, stopping or retarding the progress of railway trains. (A communication.)

1081 J. M. Day, Trinity-square, Southwark, engineer. Improvements in decorticating seeds and oil nuts, and in the machinery employed therein.

1084 J. Walker, engineer, and J. Wharrie, foreman iron-founder, Glasgow. Improvements in apparatus for the manufacture of cast-iron pipes and similar articles.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated April 1, 1868.

1110 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for manufacturing horse-shoe nails. (A communication.)

Dated April 2, 1868.

1120 W. E. Boardman, Chancery-lane. A new and improved steam and water packing for use in packing stuffing boxes of steam engines, making joints, and other like purposes. (A communication.)

Dated April 3, 1868.

1128 C. W. Baldwin, Boston, Suffolk, Massachusetts, U.S. A new and useful device or instrument for measuring and registering the amount of a flowing liquid.

Dated April 6, 1868.

1159 C. Desnos, Chancery-lane. Improvements in the permanent way of railways. (A communication.)

Dated April 7, 1868.

1167 A. L. Holley, Harrisburgh, U.S. Improvements in the manufacture of iron and steel.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," April 14, 1868.

3413 J. C. Woolfield. Boilers for heating water.

3415 E. Price. Apparatus for regulating the supply of gas to burners.

3420 D. Barker. Constructing chambers for drying artificial fuel.

3241 W. Black and T. Hawthorn. Valves for steam engines.

3425 G. Breen. Steam winches. (A communication.)

3429 W. B. Leachman and J. Holroyd. Machinery for leather shaving.

3430 J. H. Wilson. Water-closets.

3447 T., G.B., and B. Stephenson. Waxing warps.

3451 E. T. Hughes. Cooking apparatus. (A communication.)

3456 J. F. Clarke. Means for melting snow.

3463 S. Perkins and W. Smellie. Manufacturing malleable metal.

3464 J. G. Scott. Means for effecting the safe transmission of money.

3466 A. C. Sterry. Engines worked by heated air.

3470 E. A. Pontifex. Condensers.

3482 P. R. Hodge. Machinery for heating and forming metals.

3484 J. B. Morrison. Construction of operating chairs.

3486 J. Blakey and H. B. Fox. Collars.

3492 R. Warry. Construction of breech-loading firearms.

3497 W. Clapperton. Machinery for shaping cask headings.

3498 W. Clark. Instrument for clipping horses.

3499 L. Rose. Preserving vegetable juices.

3509 J. Grout and E. Mathews. Apparatus for training hops.

3521 G. H. Nick. Pulley for ships' blocks.

3528 R. Roberts and P. Williams. Equilibrium slide valve.

3529 R. W. Brownhill. Water tuyeres.

3547 W. M'Ilwraith and J. Bonner. Apparatus to be applied to looms for weaving.

3566 A. M. Clark. Extraction of ammonia from fermented liquids. (A communication.)

3571 J., J., and J. Booth. Apparatus for dressing stone.

3577 W. H. Kerr. Preparation of material for manufacturing porcelain.

3587 E. M. Du Boys. Liquid meters.

3614 W. H. Richardson. Apparatus for manufacturing iron and steel.

3689 W. E. Newton. Butt hinges. (A communication.)

3690 W. E. Newton. Motors. (A communication.)

296 W. R. Lake. Pavement. (A communication.)

337 J. H. Johnson. Steam engines. (A communication.)

377 R. Morton. Refrigerators.

564 J. M. Kilner. Bedsteads.

599 W. R. Lake. Electrical signal apparatus. (A communication.)

677 C. E. Brooman. Moulds. (A communication.)

947 C. Mather. Apparatus for opening wool. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed April 9, 1868.

2846 C. Avery	2891 H. A. Bonneville
2849 A. F. Hobhouse	2912 J. Rives
2850 W. R. Lake	2917 G. M. Wells
2853 R. George	2929 J. Seward and H. Smith
2855 E. Haigh	2944 J. Schwartz
2857 J. C. Wilson	2955 J. Hunter
2861 A. Helwig	3033 C. E. Brooman
2868 J. Buckingham and J. S. Blockey	3123 A. V. Newton
2872 H. A. Dufrene	3129 H. A. Bonneville
2873 R. Canham and J. Thomson	3219 A. V. Newton
2878 B. Nicoll	3301 W. J. Murphy
2882 E. Ward	3359 E. Belknap
2883 W. Gadd and B. Walker	313 W. Guise
	464 F. Schafer

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

989 E. Welch	1046 T. J. Mayall
1024 S. Wright	1047 F. Bapty and E. B. Sayers
1026 D. Payne	1048 G. Jackson
1038 J. Haworth	1051 A. V. Newton
1039 H. Bridson	1077 A. W. Hale
1041 F. P. Warren	1104 D. Greig
1045 J. M. Hart	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

858 H. Wilde	892 T. Don, T. Smith, and L. Horsfield
876 F. Taylor	933 R. Ransome
891 J. Lancelott	1009 E. H. Bentall
927 F. Gye	

LIST OF SPECIFICATIONS PUBLISHED

For the week ending April 11, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2397	1 4	2465	0 10	2489	1 4	2501	0 6	2518	0 4	2532	0 4
2398	1 6	2468	1 6	2490	0 4	2502	0 4	2519	1 4	2535	0 4
2404	0 8	2474	0 6	2491	0 4	2505	0 4	2521	0 8	2538	0 4
2408	0 8	2476	1 0	2492	0 4	2506	1 0	2522	0 4	2538	0 4
2432	2 0	2481	0 4	2494	0 8	2510	0 4	2523	0 4	2539	0 10
2450	0 8	2483	0 4	2495	0 4	2512	0 4	2524	0 4	2540	0 4
2452	0 10	2484	0 8	2496	0 8	2514	0 10	2525	0 4	2552	3 2
2454	1 8	2486	0 10	2498	0 4	2515	0 10	2526	0 8	2575	0 10
2460	0 10	2487	0 8	2499	0 4	2516	0 10	2528	0 8	2581	0 4
2461	0 6	2488	0 8	2500	0 4	2517	0 4	2531	0 4	3016	0 4
2464	1 2										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, APRIL 24, 1868.

A CODE FOR UNIVERSAL BUOYAGE.

ON the broad highway of the ocean, where vessels of every nation on the face of the earth meet, it is a principle of the first importance that they should be able to intercommunicate with ease and certainty. To effect this, we have a code of signalling which is capable of being understood by all, no matter their nation or tongue, and which has been adopted as a universal language by all the great maritime nations. So far so good; but there is yet another matter closer inshore which demands serious attention. Every maritime nation has its coasts, ports, and harbours, and along and into these, vessels of other nations are perpetually passing. In their course they are beset with risks and dangers, and, therefore, here a simple and universally understood code of laws is demanded. This, in the shape of a uniform code of buoyage, would complete the great service rendered by the commercial code of signals to which we have alluded. This completeness, it may interest our readers to know, has been effected by Captain E. J. Bedford, R.N., who has designed a code of buoyage, which, upon careful consideration, appears to us to embody the three points necessary to recommend it for universal use. It is simple, inexpensive, and of universal application. The principle of the code is uniformity of colour, two only being employed—red and black, with a neutral white. The rule to be observed is, that a vessel entering a port, or approaching a centre, shall have all red, or red and white buoys on the starboard hand, and all black, or black and white, on the port hand, and *vice versa* on leaving port. The two colours blended, and either with or without white, may be passed on either hand. The only exception to these simple rules is the "fairway" buoy, which must be conspicuous both in shape, colour, and lettering. Captain Bedford has displayed great ingenuity in varying the arrangements of these three colours into different patterns and devices, so as to convey such further information as the peculiarities or special dangers of the channel may render desirable.

Now, this is the whole sum and substance of the arrangement, and one more simple, more easily comprehended and remembered, it is difficult to conceive. This code is adapted to seamen of all nations and languages, who would all equally appreciate the language of colour addressed to the eye. Not only has this system its own inherent advantages, which we have pointed out, but it is in accordance with that established for the coasts and channels of the sea by the United States of America (between which and this country there is so great a commerce), and also over the whole of Scotland, and at Liverpool, and other places. Hence it is extremely desirable that this system should be universally adopted, so as to reduce to a minimum the great risk and loss to life and property which are incurred at present from the confusion and uncertainty created by the want of an uniform system of buoying. We understand that the primary features of Captain Bedford's system have been adopted by the Commissioners of Northern Lighthouses in Scotland, and over several parts of the British coasts, also along the shores of the United States and some of the continental seaboards. We cannot help thinking how much anxiety and trouble might be spared were its adoption universal. What an assistance it would prove to a vessel in distress, perhaps disabled, in approaching an unaccustomed haven on a foreign shore. In the face of all this, we were quite prepared to learn that our authorities at home had done their utmost to promote its general use. But what was our astonishment to find that the Trinity Board object to the plan. For such a sapient brotherhood to object ought to mean something serious, thought we. So we looked into their objections, and found them to consist chiefly in a dislike to the particular colours which Captain Bedford advocates, and which are black, white, and red. Now, what on earth can it matter what colours are used, so that they are kept clean and made readily distinguishable? But we don't believe in these objections. The elder brethren raise a difficulty about distinguishing between the two chief colours. With respect to this, we can but regret in the interest of navigation a result which must retard any universal system.

But what is the state of the case? Why, that Captain Bedford has accumulated information from places where these colours have been longest in use, and that none of it tends to show that this difficulty has been experienced. Neither does he find that any injurious result has occurred from the use of them in juxtaposition. His own experience is that red more generally fades to white, and an authority upon this matter states that the only colour for which he considers red could be mistaken is white. The Commissioners of Northern Lighthouses have had Captain Bedford's system in use throughout Scotland for the last ten years, and since it was put in practice they have not received a single complaint either against the principle or the colours. Here is the highest testimony to the efficiency of the system. So, with all deference to the opinions of the Trinity Board, we cannot think otherwise than that the grounds upon which the elder brethren condemn Captain Bedford's proposition, and ascribe to it "grave errors," are unsupported by facts. Indeed, the objections really appear trivial and petty, and quite unworthy either of the sense or dignity of the Board. But we will hope better things of them, and trust they will be induced to listen to the memorials which they have received from various parts praying the adoption of Captain Bedford's system. At any rate, they ought to remodel the buoys in the Bristol Channel, for since these have been altered in conformity with the system of the corporation, vessels entering must leave upon the starboard-hand, black buoys and red ones; upon the port-hand, black and white, and red and white; and upon either hand, red, black, and white, and red and white; so that the navigation is entirely dependent on a local knowledge of the buoys. The local pilots confess to a difficulty here, and if this be so what must be the case of a stranger?

The whole sum and substance of the matter is that we have now before us a system resulting from the labours and observations of a hard-working practical seaman, who has spent the best part of his life in the hydrographic duties of the Admiralty. This system is at once simple, economical, and comprehensive, and the only thing to be desired is its general adoption. This the Trinity Board, either from a short-sighted policy, or from interested motives, at present refuse to sanction, as far as it is concerned. The keener northerners were by no means so slow to appreciate its value and to avail themselves of its advantages. Let their testimony convince the slower brethren, and stimulate all those who are directly or indirectly interested in the question, to petition, memorialize, and agitate until the great and dangerous roads along which the ships of our royal navy and of our mercantile marine travel, be marked and rendered so plain for safety that none can mistake their course. The advantages of Captain Bedford's system are so palpably capable of promoting this end that, in spite of all opposition, we predict that the time must come when the gallant officer will one day be universally acknowledged the benefactor of his race in having designed a practically successful uniform international system of buoyage.

AERIAL LOCOMOTION.

IN our last number we endeavoured to show that a new means of propulsion should be sought for, if travel in mid-air is ever to become general. It has been well observed that there does not appear to have ever existed a flying megatherium or a winged leviathan. Now, it must be evident that what is adapted to the movements of even the largest bird would not be suitable to move a whale on the wings of the wind! Why, to move the "Great Eastern" through the water it was found requisite, or, at all events, advantageous, to unite the principles of the paddle and screw combined. In Nature itself we find different means adopted according to size and requirements; for instance, if men were furnished with limbs as long, in proportion to their bodies, as grasshoppers enjoy, we might have been at Magdala or, for the matter of that, at Debra Tabor, a month ago; but how could the leverage of such lengthy legs be wielded on a large scale without herculean strength? James Watt tried to make a rotary steam engine, and succeeded to a certain extent, but he abandoned the plan because it was too complex, not easy to work, and liable, from the very nature of its machinery, to get out of order, for the simple reason that steam does not exert its force in a given direction only, like a blast of wind, but acts equally in every direction; therefore, if in any given sector of a circular space steam be introduced, it will neutralize its own strength, unless its pressure bear upon some extraneous diaphragm, which must be moved out of the way at every revolution to let the rotating piston pass. This introduced an element of constant complication which required intricate machinery, so that he very wisely obtained the desired result by a totally different means, viz., by the back and forward motion of the piston in a straight cylinder.

But if we suggest the adoption of some new method of propulsion, we are of opinion that something of the general form of a bird should be retained in the aerial machine, for, whatever its size, it must be of the shape best adapted to be forced through the air, and that may be calculated, although upon different data, as easily as the section of cutwater or of a ship. What can be more unsuited to move through the air than our present form of balloon, with the car suspended beneath it? In fact, it could not be moved through the air with any velocity at all worth speaking of, even with the strongest and lightest machinery that could be made and that it could carry. We may say that a breeze, with a velocity of four miles per hour, would carry the balloon with it in spite of any known motive power and machinery we could put to work in the balloon to resist it, or travel in a contrary direction. The velocity in any direction in a still atmosphere would be so small that we may practically call it *nil*. The surface to be pushed against the atmosphere is so great that a very small velocity would give enormous power. And the balloon could never carry sufficient power to be of the slightest practical use. To us it appears that the model aerial machine should be made somewhat of the shape of an egg, only more pointed; this machine, being built like armour-plated vessels, with a double skin—only not of iron plates—and then between its interior and exterior sides a suitable aeriform fluid, or something that would do away with gravity, should be introduced, by which sufficient buoyancy should be given, the space allotted to the flotation fluid being regulated according to the size of the machine.

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We have often seen men walking through the streets with several small bladders filled with air attached to strings. Well, a number of these might be fastened together sufficiently large to hold two men so as form a model of the required shape, and experiments might then be made in the first instance with what we might then term a kind of "aerial pontoon." Indeed, it seems to us that aerial flotation might be used in many ways:—Firstly, in sustaining bridges, which, in very many cases, would enable us to reduce their cost and increase their span. Secondly, by raising vessels temporarily in the water; and this, we think, might be specially useful in the case of armour-plated vessels, so as to give them better water-lines while sailing. Then, the gas or air being discharged, they might settle down to fight, and could be again raised by inflation when about to pursue their way again over the waves. In any case, what we want now is to obtain data on which to base the theory of a convenint traction engine. And an aerial egg-shaped ship might be built in the manner described, which would be sufficient for preliminary experiments; or, it might be constructed with hollow steel stays and air-tight leather skins. Such a pontoon might be attached on either side to horizontally-stretched cables with rings at the ends free to run along parallel ropes raised on poles in the air. The ropes would act as rails, so as to prevent the experimental air-locomotive from rising too high or falling too low, and would prevent its capsizing until some steadying power be adapted to act as a keel does to a vessel. As the wings, or tail, or legs, or, all together, serve to enable a bird to keep its proper position during flight, perhaps a horizontal float made like the vanes of a windmill placed round the periphery of the egg-shaped windship might give it the necessary hold upon the air, so as to enable it to float without being overturned. To describe our meaning more clearly, it would then resemble in appearance the planet Saturn with his ring, only that the oval ring would be attached by an almost imponderable web to the elliptical or ship-shaped balloon. If we could but find the aeriform fluid that would do away with gravity, such a model aerial traction engine could be easily constructed, and it might run a mile or so in leading strings attached to rope-rails. With such an arrangement, most useful information might be gained to guide us further in our progress towards aerial voyaging, and give us what we now want—data upon which to proceed.

PHOTOGRAPHY IN THE PRINTING PRESS.

NOW that the public are becoming fully aware of the necessity of obtaining photographs which will not fade, all processes which will produce likenesses and pictures with ordinary pigments without sacrificing the truth incidental to good photographs, are of interest. A large establishment has just been fitted up at Brompton, under the management of a company, headed by M. Disderi, to produce pictures by Woodbury's carbon process. The beautiful transparencies upon glass, representing different members of the Royal Family, which within the last week or two have begun to make their appearance in the shop windows of our leading philosophical instrument makers, were issued from the afore-mentioned new works, which we have just visited for the purpose of collecting information for the benefit of our readers.

Many years ago, Mr. Mungo Ponton, F.R.S.E, discovered that gelatine impregnated with bichromate of potash, and then exposed to light, became insoluble in hot or cold water. This discovery was afterwards applied to practical photographic purposes. Colouring matter, such as Indian ink, was mixed with the gelatine and bichromate solution, some of which was then painted over a sheet of white paper and dried. The prepared sheet was then exposed to light under a negative, and afterwards soaked in warm water. Where the black film had been protected from light by the negative it dissolved away in the water, exposing the white paper beneath to view, but where the light had acted and made the gelatine insoluble, the black film would not dissolve. Thus a picture in black and white was obtained, but the "half-tones," that is to say, the most delicate shadows, were lost, and the picture had consequently a coarse appearance. The half-tones were lost in consequence of the thickness of the gelatine film, which permitted a perfect picture to be formed where the film touched the negative, but not where it touched the paper. In fact, supposing half the thickness of the film to be rendered insoluble because of the half-tones in the negative, the remaining thickness of the film would still be soluble in water, and when it dissolved therein would of course detach the delicate shadows above from the white paper beneath. In later times it was sought to obviate this defect by printing from the back right through the substance of the paper. As this stopped a great deal of light, mica and other transparent substances were tried in place of the paper, but it was necessary that these substances should be excessively thin. At last the first portion of the manipulations in the Woodbury process were discovered, whereby an infinitesimally thin film of collodion only intervenes between the negative and the pigment.

In this carbon process, as it is now worked, a plate of glass a little larger than the negative to be copied is well cleaned, and then, by means of a tuft of cotton-wool, rubbed over with a few drops of a thick solution of white wax in ether. The plate is polished with cotton-wool till it is quite bright, but an infinitely thin film of wax still remains upon it, and permits the collodion afterwards poured upon the plate to be removed from the glass without tearing in a later stage of the process. The plain collodion, which is next employed to coat the plate, dries upon the sheet of glass as an invisible transparent film. The gelatine solution has then to be applied, and it consists of one part by weight of Nelson's "amber" gelatine, dissolved in four parts of warm water, three per cent. by weight of bichromate of ammonia being then added to the solution. This addition must be made in a room illuminated by yellow light only, as the salt makes the solution sensitive to the action of actinic rays. Mr. Woodbury says that bichromate of ammonia acts better than bichromate of potash. The glass plate having been placed upon a levelling stand to keep it in a horizontal position, a thick pool of the warm viscous liquid is poured over it, which liquid has previously been coloured by the addition of a little blue pigment. The solution soon sets, and then each plate as prepared is put away horizontally to dry in grooved boxes fitted at the bottom with lumps of freshly-burnt lime. When dry, four broad lines, together forming a square, including a space the size of the picture to be copied, are painted on the film with black varnish.

When the film is dry, it is cut through all round near the edge of the plate with a penknife, and one corner is gently raised from the glass. This corner is then seized with the fingers, and the whole sheet, collodion and all, peels gently off the plate, without tearing. The film is then placed in the printing frame, with its collodion side in contact with the negative, so that the picture is printed through the collodion. To be quite independent of the aid of the sun, the electric light is employed in the printing operations, and is obtained from one of the new induction machines made by the Alliance Company, of Paris, and driven by a Lenoir's gas engine. A number of frames to hold the negatives are arranged at right-angles to the plane of propagation of the light, but some of these frames are nearer to the light than others, because with a hard dense negative the best pictures are obtained when a strong light is allowed to act for a short time. Weak thin negatives are best printed in a feebler light acting for a long time. Analogous phenomena to these have been noticed in all photographic printing processes, but the causes thereof are unknown, and it is very remarkable that a strong light acting for a short time does not produce the same photographic effect as a weak light acting for a long time.

After exposure to light the film is floated, collodion side downwards, upon a solution of india-rubber in benzole, and then dried. A sheet of white paper is likewise floated upon the same solution and dried. Then the film is laid upon the sheet of prepared paper, so that the two surfaces of india-rubber touch, and the two sheets are pressed into close contact by rolling with a ruler, after which they adhere with tolerable firmness. The edge of the film is next painted round with a little shellac varnish. The film having been thus firmly supported by a paper backing, is placed in tepid water, the heat of which is then raised very slowly, till in an hour it is nearly boiling. If the water be applied at a boiling temperature in the first instance, it seems to make the gelatine insoluble. The longer the original gelatine solution has been prepared, the longer must it be left in the warm water to develope a good picture. The water dissolves away the film where it has been acted upon by light, and the picture then stands revealed, the shadows being formed by different thicknesses of insoluble gelatine, holding blue colouring matter in suspension.

Up to this point the operations strongly resemble those used in Swan's carbon process, but here they diverge widely. The shadows in the picture thus obtained stand out in relief from the whites, and Mr. Woodbury discovered a method of obtaining a cast in metal of the indentations and elevations of the dried gelatine picture. A sheet of metal, consisting of lead alloyed with six per cent. of antimony, is laid upon a block of polished iron, with a mathematically true flat surface. The dried gelatine proof is laid upon the sheet of alloy, and then a second flat slab of polished iron is brought down by hydraulic pressure upon the whole arrangement. The result is that all the irregularities upon the film of gelatine are impressed in the lead, and, strange to say, the film is none the worse after the operation is over, but may be used again. It is also somewhat curious that it does not matter which side of the gelatine film is placed in contact with the lead, except in very delicate work, when contact with the wrong side of the film results in scarcely perceptible loss of sharpness. This pressing operation should not be done in damp weather, if it can be helped. The film and lead should be left under pressure for about three minutes, otherwise the elasticity of the metal will aid it to partially regain its original form. When the film is taken out it generally exhibits strongly electrical properties.

The metallic mould thus prepared is ready for the printing operations, but as its surface consists of slight hollows of different depths, printing ink cannot be used. The ink must be partially transparent, so that the thicker the ink the darker will be the shadows of the finished picture. Accordingly, the ink is made of colouring matters dissolved in a solution of gelatine, which solution, at a temperature of 175deg. Fah., is slightly viscous. We saw it worked at this temperature last Monday, the heat of the flasks holding the solution being kept up by hot water apparatus. The cold mould is placed, face upwards, on the base of the press, then a pool of the coloured pigment is poured over

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its centre. Next, a sheet of clean white paper is laid upon the pool, then the pressure is brought to bear, and squeezes the gelatine all over the mould, as well as all over the paper in contact therewith, the surplus solution escaping at the sides. The handle of the press is held down by a catch, and the gelatine takes from one to five minutes to set, according to the temperature of the air. It is then taken out of the press. The mould is rubbed with a little salad oil, after each fourth or fifth picture has been taken. A dozen or two of these presses are kept at work to economise time. In the next operation the prints are soaked for five minutes in a saturated solution of alum, which transforms the gelatine into a leathery substance, insoluble in water; then the prints are washed well in water, dried, the rough edges cut off, and the finished pictures mounted on cardboard.

The paper on which these pictures are taken is specially prepared for the process, it being treated with lac, and afterwards rolled, to give a surface as hard and as much like glass as possible. As to the finished pictures, there is apparently no limit to their durability. The pigments used are Newton's transparent colours, as sold in tubes. If these change (and transparent reds and blues are not usually very durable), the black portion of the colouring matter is not likely to alter. Therefore, as regards the durability of the picture, the practical question at issue is, how long will a thin film of gelatine last when it is painted upon paper, and changed into leather by the action of alum. Evidently, it throws the present silver prints quite into the shade in the matter of permanency.

The very beautiful transparencies produced by this process are simpler to complete than the prints upon paper. A pool of the gelatine pigment is poured upon a mould, and then a sheet of glass, free from all traces of grease, is pressed down upon the mould with the fingers. The eye can see what is going on through the glass, and when it is seen that sufficient pressure has been applied, the whole is left for a few minutes to harden. Then the plate with the picture attached is taken off, is soaked for five minutes in the alum bath, is well washed in water, and is finished. Thus the colouring substance forming the body of these pictures resembles a thin film of leather. If these pictures were further screened altogether from contact with the atmosphere, and from scratches, by cementing another sheet of glass over them by means of Canada balsam, a still further guarantee of durability, and freedom from injury, would be given.

This process is patented, not only in England, but throughout the greater part of Europe. Already great preparations have been made in France to produce pictures by its aid, and Mr. Woodbury has just returned from Austria, where it also is to be brought into commercial operation. At present, the only establishment actually at work is the one at Brompton. There are two other carbon processes now at work in England, one, the invention of Mr. Swan, and the other, the invention of Mr. Pouncy, but neither of these call the printing press into operation. Mr. Swan and his coadjutors are producing permanent pictures commercially, but Mr. Pouncy is not doing so on any large scale.

Permanent photographs are the crying want of the present age, and the want is now on the point of being met by the above two or three patented processes, and probably by others of a promising character now under experiment. If these new processes make headway at a rapid rate, it will be a very serious thing for those photographers who stick in the old groove, so that the intelligent portion of the photographic community would do well to educate themselves practically in some of the permanent processes before they find the ground cut away from under their feet. One very pleasing feature of the establishment so freely thrown open to our inspection by Mr. Woodbury, is the department for the production of transparencies. Transparencies are the most perfect and delicate pictures producible by photography, and when good transparent likenesses are turned out on sufficiently moderate terms to suit the public, such pictures are likely to become "the rage," and to cause a demand like that experienced for cartes de visite some years ago. Already, there is a run upon the Brompton establishment for the transparencies of the members of the British royal family.

A NEW METHOD OF PRODUCING MAGNESIUM.

OUR chemical contemporary reports in its "Foreign Science" a new process of preparing magnesium, by M. Reichert. He takes 1,000 grammes of the anhydrous double chloride of magnesium and potassium, pulverizes it, and mixes it with 100 grammes of finely powdered fluor spar. This mixture is fused with 100 grammes of sodium, which reduces the magnesium chloride, or, at least, a part of it. Now, we should like to know wherein this differs from Deville and Curon's process, except slightly in the proportions of the ingredients. Deville and Curon make a mixture of—

Anhydrous chloride of magnesium	6 parts
Sodium in fragments . . .	1 ,,
Fluoride of calcium	1 ,,
Chloride of potassium . . .	1 ,,

This mixture is thrown into a red-hot crucible, and instantly covered. When the fusion is complete the mass is stirred. After cooling, the crucible is broken and globules of magnesium are found, which are agglomerated by fresh fusion. Here the sodium displaces the magnesium, as it must do in M. Reichert's. The chloride of potassium forms a double chloride with the magnesium, which is more easily acted upon than the single chloride of magnesium. M. Reichert simply forms his double chloride of potassium and magnesium first.

The fluoride of calcium is said merely to facilitate melting, which, we suppose, is the same in M. Reichert's process. In fact, the reaction in the two cases would appear to be identical, the only difference appearing being the different proportions of the ingredients. M. Reichert takes ten parts of the double chloride of magnesium and potassium to one of sodium and one of fluoride of calcium, and Deville and Curon take six parts of the chloride of magnesium and one part of chloride of potassium—that is, seven parts of the chlorides to one of sodium and one of fluoride of calcium. Now, since it is the sodium that displaces the magnesium in this reaction, we should like to know what difference there is in the two processes. The only difference we can see is that there will be a little more of the chloride of magnesium unacted upon in MM. Deville and Curon's process than in M. Reichert's. Does this constitute a new process? We cannot see that it does.

THE INSTITUTE OF NAVAL ARCHITECTS.

IN resuming our notice of the interesting papers read at the annual meeting of the above institution, we will first notice two papers upon tonnage. The first of these was contributed by M. A. Dekke, of Bergen, a member of the Norwegian Commission appointed to examine into the English system of measuring tonnage with a view to its introduction into Norway; the second, by M. Eugene Flachat. The object of M. Dekke's paper, was to lay before the naval architects of this country, assembled at their annual meeting, a comparison of the rules adopted in Norway for the measurement of ships, and those adopted in England. He hoped to be able to introduce the English method into Norway, but he thought the introduction would be facilitated if the English naval architects would recognize, and consent to, certain improvements which he proposed, namely, the use of fewer stations for the calculation of areas than are at present used. While, under the system now used in England, ships of lengths less than 180ft. are divided into four, six, or eight parts, M. Dekke would have all ships of 150ft. and under divided into four parts only, and all ships of 250ft. and over, into ten parts only. A table was furnished of the calculations as applied on the different English rules to six or seven existing Norwegian vessels of different builds, but we cannot enter into that here. The meeting declined to lend its sanction to the alterations proposed by M. Dekke.

M. Flachat's paper touched more upon the effects of the restrictions virtually imposed upon the forms of ships by the present methods of measurement. Tonnage dues have given rise to the rules for calculating tonnage, which, at present, is what mathematicians would call a function of the three variables—the length of the vessel, its beam, and its depth. Certain deductions are made for engine room and coal bunkers, and also for the accommodation of the crew. How far any of these deductions is desirable is very questionable; but neglecting them, this question of tonnage in itself has seriously affected the form, and also the safety of ships. A ship of 5,000 tons displacement, built for passenger traffic, might have a freeboard of 12ft. and a volume of 9,000 tons, while a ship of the type of the unfortunate "London," built for goods traffic, with the same displacement, would have a volume of only 6,500 tons, and a freeboard not half that of the other vessel. The former is safe in a heavy sea, which breaks over, and after carrying away the hatchways, at last swamps the latter. But why this difference between the two ships? It is the consequence of the tonnage law. The luggage boat cannot afford to pay the same dues as the passenger boat; its tonnage is, therefore, decreased for economy's sake, without regard to safety. If the foundering of the "London" can be put down to the score of the present law, as there really seems some reason to believe, the sooner that law is changed the better. M. Flachat proposes that tonnage should be made a function of one variable only—the length of the vessel. We cannot agree with him in this; as we believe as much would be laid to the charge of the new law, if this change were made, as is now laid to the charge of the present law. Why should not different methods of rating be adopted for different classes of vessels? It is not the practice for railway passengers to pay their fares by weight, nor do goods pay exactly in proportion to the distance they are carried. If one method be used for all ships, it seems to us that value is the only fair basis for all dues to be reckoned on, and to thwart all frauds by undervaluation, the ship should be liable to be purchased by Government at the price at which it was valued. The same rule might be applied to insurances of all kinds, the option of purchase resting with the insurance office in each case.

We now come to a very different subject—the testing of iron by magnetism. What the mysterious connection between iron and the magnet is, may never be discovered, but we are already well acquainted with some of its results, and have learnt to subject them to our use. Electricity, magnetism, and the kindred sciences, are still only in their infancy, yet we have made of the infant a giant in bearing our messages, to the annihilation of both time and space. The oldest form of service which we derive from magnetism is, as all well know, in the mariner's compass. This has, however, of late been severely tested in the case of iron ships. The compass was, in them, so much affected

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that it was feared that the "guardian angel" of old England's wooden walls was to become the "destroying angel" of her iron ones. Such and so great is the sympathy existing between the magnet and iron in every shape, that we cannot but feel that in some subtle form they claim and find a kindred in nature or origin. In Mr. Saxby's investigations into the character and condition of iron forgings, &c., by magnetism, he has probably only discovered (if his theory be ultimately proved sound) some scattered and obscure fibres of the, so to speak, umbilical cord, which unites parent and child, cause and effect. Confessedly, no great discoveries have yet rewarded Mr. Saxby's researches, but we think he need not despair. What he has found should stimulate to further inquiries. The sparks of light which gladden him from the darkness may fail, it is true, and prove only an *ignis fatuus*, but, on the other hand, such sparks have, ere now, led to paths of light in the regions of science. If breaks of continuity in the goodness and condition of masses of iron can be detected by the simple application of a magnet to them, no doubt much danger will be avoided, much expense saved, and a greater degree of safety be secured in the uses of man's best servant in the mineral world. The evils consequent on the present modes of testing work of all sorts will be got rid of. Who can say how many girders have snapped when placed in position from the injury caused by testing—how many lives been lost by the bursting of guns which had received their fatal flaw in the "proof house?" As we have said, Mr. Saxby's experiments are yet too limited in extent and result to enable us to hazard an opinion as to their final issue, but we think he has shown enough to encourage him in the path on which he has entered; nor shall we be surprised if next year he has some further fruit to exhibit under the influence of the motto *Nil Desperandum*.

A paper by Mr. Arthur Rigg, jun., was read on the subject of the reverse currents and slip of screw propellers. This is a subject on which so much has been written, and of which, nevertheless, so little is understood, that we are always inclined to shudder at the mere mention of slip, especially negative slip. We think that it is a pity that all attempts to explain—or to further confuse—this subject are based on the action of the screw. Why should not more observations and calculations be made as to the slip of paddle-wheels, seeing that the action of the floats of the paddle on the water is of so much simpler a nature than that of the blades of the screw? We quite agree with Mr. Rigg in his remarks on what we may call the aberration of the water thrown off by the blade of the screw. Each particle of water (neglecting friction) is projected in a direction at right-angles to the surface of the blade which strikes it. If a vane could be fixed in the water close behind the screw at any instant, it would, no doubt, give the actual direction of the current thrown off by the blade. If, however, the vane be attached to the ship, the direction it will take will be, not the actual direction of the current, but the direction of the current relative to the vessel.

Mr. Rigg has not, in our opinion, been so successful in expressing his meaning when he speaks of the action of the blade of the screw on the water. He represents the "total work" of one revolution of the screw by a straight line, part of which he supposes to represent the "reverse current," and the remainder the "coincident advance of the screw and the ship that is being propelled." Unless we are mistaken, Mr. Rigg seems to think that no work is expended in giving motion other than sternward to the water, while, under the term "reverse current," it does not appear whether we are to understand merely a velocity or a definite mass of water moving with that velocity. However, Mr. Rigg goes on to apply his theory (which he, no doubt, has clearly imprinted in his own mind, though it is not so manifest to the eyes of his readers) to a few examples. He gives us a few figures showing the difference for three different screws in the two cases of a ship steaming alone and towing a barge. He considers that the "closeness" of the results obtained from calculation and from observation is presumptive evidence in favour of his theory; but, as in one out of his three instances, we find that, for the vessel going alone, the observations gave 25deg. in place of 20deg. obtained from calculation, while, for the vessel towing a barge, the observations gave 31deg. and the calculations 39deg., we would advise him not to lay too much stress upon the closeness of the results, nor, in consequence, on the truth of his theory. Mr. Rigg refers to the absurd notions some persons have on the resemblance of the screw's action on water to that of a corkscrew on its subject cork. The persons who hold this opinion, obtain the speed of the ship by the simple process of multiplying the pitch of the screw by the number of revolutions, and, although we can afford to smile at their simplicity, we cannot allow, with Mr. Rigg, that the assumption of the advance of the ship's being due to the pitch is unsound. Mr. Rigg tells us that, with a screw with 3ft. pitch, there was a positive slip of 7¼ per cent., and an advance of 33¼in. per revolution, while, with the same screw, with a pitch of 2ft., there was a negative slip of 4½ per cent., and an advance of 25in. per revolution. These results indicate, we are told, the loss of power well known to accompany negative slip. We are far from considering them as conclusive indication of this or anything else, unless we are told how many revolutions were made in a minute, and what the indicator diagram evidenced in each case.

A paper of very considerable importance was read by Captain E. J. Symonds, R.N., on the subject of fixed central batteries. Now that millions after millions are being voted by Parliament for the rehabilitation of our navy by iron and steel armour, it is of the greatest importance that the best principle of application should be ascertained. Shall the ships which are hereafter to defend our coasts at home, or win our battles abroad, have their coats of mail equally distributed over their whole surface, or over those parts only where damage would be most detrimental or fatal? That is the important question here discussed by Captain Symonds. It is manifest that, if "central" batteries alone be used, then the heavy iron plating may be confined to that part of the ship, provided the water line be, in addition, effectually protected. For, if the ships be built with well-secured water-tight compartments, a shot in the non-vital parts would be comparatively innocuous. But before we can decide o limiting our naval batteries to this central position, we must show that the guns there placed could do execution in all directions—with end-on fire as well as broadside. For if a ship be able to fire effectively in one position only, it is clear she must be for a considerable portion of her time when in action more liable to receive injury than adapted to inflict it. Now, Captain Symonds shows that ships carrying only central guns can render good service through nearly the whole circle. This point, then, being established, it follows that no need exists for forecastle batteries, and the heaviest armour need not be used on this part of the ship. In this way we are shown how to construct vessels able to sail safely as well as fight effectively, which is impossible with "complete protection." The "Warrior," which has only central protection, still stands pre-eminent for her sea-going qualities, both in her form and handiness, affording a happy model for what a large class of our ships of war should be.

Following Captain Symonds through his several examples of vessels now afloat, and assuming that he has fairly stated their performances, we see but one conclusion to draw—viz., that "central batteries are the most efficient (for they may be made effective end-on as well as broadside) and they are least liable to injury from the enemy's fire (since one central battery has far less exposed surface than two or more distributed). Also, such ships are more steady and more easily fought, being always clear and ready for action. The old "hurry-scurry" of getting everything heavy amidships on sighting an enemy could no longer exist, as it would be all done beforehand, and in the case of forecastle batteries could not be done at all. In nearly every way, then, we see but good in Captain Symonds' suggestions.

Mr. "Rob Roy" Macgregor presented himself to the meeting, and gave a *viva voce* description of certain improvements which it had occurred to him to make in the compass. These were the result of experience acquired during a voyage of several months in a yawl manned by himself, and christened "Rob Roy" out of respect to his faithful canoe, the cruises of which are so well known to and appreciated by an adventure-loving public. One moiety of the profits arising from the sale of Mr. Macgregor's accounts of his canoe voyages was, by his kindness and liberality, handed over to the Lifeboat Institution, who, as a slight acknowledgment of benefits received, presented the author with a "liquid boat compass," a kind with which all their lifeboats are furnished. This compass Mr. Macgregor used during the summer and autumn of last year on board his yawl, and had ample opportunities to find out its defects, and, being alone, ample leisure to ruminate over them. Apparently, those opportunities were not thrown away. Among other things, the size of the lamp and of the wick, the position of the wick, the introduction of air into the lamp, the colour of the card and its design, all received Mr. Macgregor's attention. The captain of the Canoe Club, who at one stormy period last August, was forced to keep his eyes open and fixed on his compass for more than fifty consecutive hours, is, as the noble chairman, the Earl of Hardwicke, an old sailor who is proud of his profession, justly remarked, "of all men the one most competent to appreciate the defects in the present compass, and most entitled to a hearing when he suggests improvements to remedy those defects."

Next in order comes a valuable paper by the Chief Constructor of the Navy, which, with other matters, we reserve for a concluding notice in our next number.

GENERATING STEAM BY GAS.

WITHOUT doubt gas is one of the greatest blessings modern times has produced, and fully as its value is appreciated, we believe its usefulness is not yet perfectly realized. But, by degrees, we are beginning to understand that it is not only a mere light-giving medium—though that itself were an inestimable boon—but that we can utilize it for the purposes of cooking, of driving engines, and of heating steam boilers. It is in this latter capacity we now have to notice it, and as applied to this useful and economic purpose by Mr. Arthur Jackson. It has often occurred to us how very greatly the carrying out of some provisions of the Street Traffic Regulation Act might be facilitated if those warehouses abutting upon our narrow public thoroughfares had their crane work effected more expeditiously. Not only would the thoroughfares be less liable to stoppages from loading and unloading goods, light as well as heavy, but the proprietors themselves would benefit by a saving of labour. Now, there are very few places where steam power can be applied, in its ordinary form of production, if even it could be tolerated. Then, again, the insurance companies, with their heavy

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risk-premiums, meet the proprietor and fetter his actions. There is also the consideration of first cost and expense of maintenance ready for use while not engaged in actual work. But if there be the means of affording the warehouseman the full benefit of steam power, without incurring any of the foregoing objections, then we hold that a great step in advance has been gained. And this, in fact, is just what we meet with in Mr. Jackson's steam generator, which is heated by gas. It occupies but little space, and, placed in a corner of the top loft of the highest warehouse, it commands its work and is out of the way. Its first cost is not great, whilst its working expenses are very trifling. The insurance companies pass it without additional premium on their fire policies, and steam may always be kept with a mere jet of gas on—a very valuable feature considering the intermittent work hoists and cranes have to perform.

It is now more than a year since we noticed the first practical adoption of this system of steam generation by a large warehouse firm in London. Since that time, several others have followed the example, the latest being Messrs. Ledger, of Lyons Wharf, Upper Thames-street, upon whose premises an apparatus has just been erected, which we recently inspected. We found a vertical tubular boiler of 3-horse power supplying steam at from 50lb. to 60lb. pressure to drive a set of sack tackle for working four chains for unloading barges laden chiefly with grain. The boiler and engine are placed on the upper floor of the warehouse, and present a very compact and neat appearance. As a guarantee for the character and finish of the work, we may observe that the manufacturer is Mr. Middleton, of the Loman-street Works, Southwark. The gas is led beneath the boiler to a chamber resting on a stone slab. Vertical burners fitted with regulating cocks and air valves reach from the chamber nearly to the under side of the boiler, and this completes the simple arrangement. There are twenty-three burners in the present instance, and the consumption of gas is stated to be 100ft. per horse-power per hour in full work. Wherever these gas-heated boilers are at work, ample testimony is borne to their efficiency and economy. These are the two great points which proclaim the success of any system or invention, and we are glad to find them developed in Mr. Jackson's apparatus. With such a means of generating steam within easy reach, our wharfingers and warehousemen will certainly be consulting their own interests by adopting them.

NOTES ON OUR NAVY.

NOTES of mine, on the above subject, have appeared at various times in the MECHANICS' MAGAZINE, written in good faith and with a thorough knowledge of the subjects treated on. I now feel assured that my suggestions will in due time be carried out, as I can already perceive that many of the best officers in the service are favourable to them. The death knell of converted ironclads has been rung, and never again, except in some dangerous hour, will men recommend such costly experiments to be tried on wooden two-deckers. Not long since there were severe comments on the Admiralty for selling a number of them. I have no hesitation in asserting that the Board acted wisely by so doing, and saved the country an annual expense, which under present circumstances could be ill afforded. It is too much the fashion to abuse men in office for decisions which step out of the beaten track, for any one to wonder at such comments. In times like the present the naval rulers of England have quite enough work to do in trying to keep pace with the many ambitious powers which have sprung up around us, without keeping a lot of obsolete ships on hand to rot at their moorings, or fill up our harbours. Never since England was a great nation did she stand in such a critical position as she does at present. In former times she was enabled to stand defiantly by and regulate the peace of the world; that day has gone for ever, and we must now be content to keep our shores from invasion and our flag from insult. For this we require the best ships and seamen which can be had, and where are they? I look around and see them not, but in lieu I see a fleet of various dimensions armed with guns of the largest calibre, which cannot be worked in ordinary bad weather by many. Why are we so placed? Could not one ship of the "Royal Oak" class have been well tried before such a large number were taken in hand? Our seas are famed for their storms, and men-of-war which cannot keep them without inconvenience at all seasons should not be relied on by a people whose existence depends on their fleet.

There are those amongst us who have seen the "Lord Clyde" rolling her armour belting clean out of the water after a moderate gale. What an opportunity would be given to some daring seaman, who, in the event of a war, might come within range at such a time. Neither can I speak more favourably of many others. A paragraph recently appeared in the "United Service Gazette," stating that the officers of H.M.S. "Bellerophon" had refused to be responsible if she were manœuvered under sail only. Now in action it is an admitted fact that machinery may be disabled from many causes. A chance missile may damage the stern post and render the propeller useless; concussion of a heavy shot may break a rod or a pipe in the engine room, and then this much-vaunted ship would be helpless, if the published report be true. The ships of all nations are subject to such disasters, and the chances on that score would be equal, some one may say. True, yet Englishmen have hitherto believed themselves better able to handle ships under sail than the seamen of any other nation on earth, and the chances from such disasters should be wholly in their favour. There are other ships which can with difficulty be wore at all, and no man dreams of bringing one into port under canvas only. Is this, Sir, a correct position for the once great mistress of the seas to be placed in with navies springing up around her on every hand? The answer is obvious, and all true lovers of their country must look with anxiety on the future. The time is not far distant when England will be compelled to call in the distant outposts and concentrate her defences around her own shores. At the present day the position of the armament of the great majority of the colonies is unsatisfactory. In many I perceive huge twelve-ton guns lying about dismounted, like gigantic boulders in an ice-worn country, when the floods have subsided, and carriages rusting away without any shelter from the weather, and armour plating for forts without forts to put it on. At Gibraltar and Malta the shields will not resist shot, nor the greater number of the guns penetrate. Batteries, which were once impregnable, are now useless, so much has the whole system of warfare changed; and if we are determined to hold these places, we have much to do before they will reach the proud position they once held, and be able to bid defiance to the world in arms.

There cannot be a doubt that for all purposes of warfare a large ship, if properly built and rigged, is greatly superior to any number of small ones, carrying the same amount of guns between them, which can be brought against her; she carries her armament higher above the water-line, is swifter, better able to use the stem, and, what is of no little consequence in such matters, inspires he crew with confidence in her seagoing, qualities and powers of offence and defence. In a former paper I have given my ideas of the formidable nature of a vessel which could charge an enemy without the fear of foundering from the shock; there could be no divided opinion concerning the fate of her antagonist. But here the skill and daring of the seamen would be of equal importance to the science of the shipbuilder; any mismanagement of the former would render abortive the highest order of talent which the latter might possess, Second in importance to a ram are upper deck guns. I have no faith in the aim of the captains of guns through a narrow main deck port in the smoothest water; when smoke begins to fill the between decks or obscure the motions of an enemy, and in bad weather it is simply a waste of ammunition to attempt to fire. Again, main deck ports will occasionally be shot away, and under such circumstances the safety of the ship would be risked, because, to avoid an enemy, she might have to run in the trough of the sea at all risks, and Mr. Reed has probably never seen a main deck port stove in on such an occasion, or the alarm it creates. With all the admiration I have for his talents, I believe he could learn a few trifles by consulting practical men, for I feel no confidence in a ship which is not perfectly manageable under sail as well as steam.

Though perhaps out of place here, I cannot help commenting on a subject which appears hitherto to have escaped the notice of statesmen and the Admiralty. Russia makes no secret of her intentions to become a first-class naval power. Already she has secured a port which will make the North Sea accessible to her at all times. When completed it will be a standing menace to our shores incomparably more than Cherbourg, as we have not an arsenal or dockyard throughout the whole extent of the eastern shores of Scotland and England, nor a port where a disabled ship could run for safety. In the days of our grandfathers, Yarmouth Roads formed a sufficient shelter on most occasions for the fleet, but then ships required neither constant supplies of coal or repairs to elaborate machinery; neither could an enemy quit his port if the wind were adverse. Again, we have only to turn to the list of wrecks of the English Navy to perceive the fearful loss of life and property which this service entailed. The shores of Jutland and Holland were strewed with the corpses of English seamen and the shattered hulls of English ships, and at this day the traveller is shown the graves of his drowned countrymen on that inhospitable coast. Since that time science has done much to mitigate such disasters, but science could not keep a fleet cruizing in the North Sea without a better provision for a disabled ship than we have at present, or prevent a determined enemy from coming out on a dark, stormy night. I have cruized in that sea in peaceable times, and often have felt that it would be impossible to do it, and, with our present ironclads, folly to attempt it during the storms of winter. I have already given my views of the class of ships we ought to have, and in some future paper I shall enter more into details. Time will show whether I am only an alarmist.

X.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

USE OF BARYTA IN THE PREPARATION OF WOOD VINEGAR—A NEW AND EASY METHOD OF FUSING REFRACTORY MINERALS—VARNISH FOR IRONWORK.

SOME months ago, we called attention to a suggestion useful to the makers of wood vinegar, and that was the use of baryta in place of lime. It was said that acetate of baryta stood the torrefaction necessary to carbonize the empyreumatic matters very much better than acetate of lime, and the yield of acetic acid was consequently increased. We read however, that the torrefaction may be altogether dispensed with. When

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a solution of acetate of baryta is evaporated to dryness with constant stirring, a very dense granular powder of a brownish-black colour is obtained. By washing this with alcohol, the empyreumatic matters which give the colour are dissolved away, and a nice white salt is left. The powder is so dense that a very small quantity of alcohol suffices for the washing. Wood spirit can also be used, and, of course, either can be recovered by distillation.

A process is given in the last number of "Silliman's Journal" which will rejoice the hearts of all analysts who have to examine very refractory minerals. Chrome iron ore, rutile, tinstone, and several other minerals, have teazed the chemist by the difficulty of getting them into solution. This difficulty, however, no longer exists. By the use of fluoride of sodium and bisulphate of potash either one of the minerals we have named can be completely fused in from three to five minutes, and, with the exception of tinstone, over an ordinary Bunsen's jet. Tinstone requires the addition of a blast, but with the help of this is fused in as short a time as the rest. In carrying out the process, one part of mineral is mixed in a platinum crucible with three parts of fluoride of sodium, and on the top of the mixture is placed twelve parts of bisulphate of potash, which may be in powder or small lumps. When the heat is applied, the mixture soon begins to boil, but as quickly settles in tranquil fusion. In quantitative experiments the crucible must be covered to prevent loss. It is not necessary to continue the heat for longer than five minutes. In most cases, the fused mass, when cold, will be found to be completely soluble in water; but in some instances a basic salt is found, which is soluble in hydrochloric acid. A second fusion, however, after the addition of a little strong sulphuric acid, will leave a mass completely soluble in cold water. We give a few special examples. Chrome iron ore fuses very easily, and need not be employed in very fine powder. The fusion is complete in three minutes from the first application of the heat of a Bunsen's burner. The cold mass is, for the most part, soluble in water, but entirely in hydrochloric acid. After a second fusion it is completely soluble in water. Hæmatite and hard specular ore are completely resolved. The mass is perfectly soluble in hydrochloric acid, and after a second fusion in water. In these cases, the iron being in the state of sulphate is advantageously placed for determination by permanganate. Tinstone, as we have said, requires the assistance of a blast. It gives a white mass which is almost entirely soluble in water. A small amount of stannic acid generally remains undissolved. A second fusion, with a little sulphuric acid, gives a mass quite soluble in water. If, then, the solution be rendered nearly neutral, leaving a slight excess of sulphuric acid, and any iron reduced by sulphuretted hydrogen or hyposulphite of soda, the solution, when boiled, will deposit all the tin as stannic acid. Tungstic, niobic, and tantalic acid, if present, will go down at the same time. Rutile and omery fuse very easily with the fluoride and bisulphate, and the mass is completely soluble in cold water. The same method may be employed with zircon and wolfram, but in the latter case is not so necessary, seeing that the mineral is soluble in nitric acid. The great recommendation of this method of fusion is the ease and speed with which it is effected. It has hitherto been necessary to apply the heat for an hour or two, and then, as the books usually say, "a little of the mineral will be left undissolved," which must be separated by filtration, and another fusion made with the same difficulty. In most cases the author tells us that ordinary cryolite may be used for fluoride of sodium, but it has the disadvantage of introducing alumina into the solution. Fluoride of sodium can, however, be prepared with even more ease than stated by the author.

Dr. Lunge gives, in "Dingler's Journal," a method of making an excellent black varnish for ironwork. He distils gas tar until nearly all the volatile products are got rid of. He then stops the distillation, and dissolves the residual pitch either in the heavier oils, or, if a very quickly drying varnish is required, in the light oils or naphtha. This varnish is, of course, the original tar minus the ammonia, water, carbolic acid, and other things which give it its disagreeable odour, and make it so long in drying.

INSTITUTION OF CIVIL ENGINEERS.

AT a meeting of the Institution of Civil Engineers, held April 7, Mr C. H. Gregory, President, in the chair, the paper read was on the experimental determination of the strains on the suspension ties of a bow-string girder, by Mr. W. Airy, Assoc. Inst. C.E.

Although in this communication the case of a bow-string girder, as ordinarily constructed, only was considered, yet the author believed that the principle on which the strains had been ascertained was equally applicable to all mechanical structures with complex bracing, as, for instance, station roofs, where the labour and uncertainty of a theoretical calculation rendered an experimental investigation exceedingly desirable. The model on which the experiments were made was composed of a bow of steel, and had a span of 6ft. with a rise of 1ft.; the string being constructed of two slips of oak, and the suspension ties being of steel wire, gauge No. 6 (96ft. to the oz.). The process by which the tensions were ascertained was the following: the ties, on being sounded, gave a good resonant musical note, and advantage was taken of this to compare the note of any string with that of a free string suspended in a frame, and cut off by a sliding bridge to the length of the string under comparison. The free string supported a small scale-pan, and this scale-pan was loaded with weights till the note of the free string and that of the string under comparison exactly coincided. This was determined by ear with the greatest accuracy, the effect of half an ounce in eighty ounces being clearly perceptible. The tension of the string on the girder was thus measured by the weight in the scale-pan of the free string; and this was done for every string in every case.

The determination of the thrusts was arrived at by a differential process, thus:—A uniformly distributed weight was applied on the girder, and the tension of every string was taken; then a travelling weight was introduced in addition, and hung at any one point, and the tension of every string was again taken: the difference of the tensions in the two cases of each string being regarded as the thrust, or tension, of that string produced by the travelling load. The reduced results of the experiments comprising the effect of every possible arrangement of loads that could come on a girder were given in diagrams. It was verified by experiment: 1st, that the tension, or thrust, of every string was proportional to the weight causing it; and 2nd., that when several weights were applied at the same time, the effect on every string was that due to the sum of the effects which would be produced by each of the weights separately.

The rules by which the strength of ties should be regulated, as deduced from the experiments, were, for an evenly distributed stationary load, that all the bars were in tension, that the end uprights were most strained and the middle ones least, and that, with respect to the diagonals, those were most strained which radiated outwards from the points where they met the string—the strain on each of which might be taken at one-half the load due to a bay—those that radiated inwards from the points where they met the string being strained to the extent of one-fourth the load due to a bay. In the case of a single movable load, the uprights were liable to a tension of from 10-34th to 1-6th of the weight, as the load advanced from either end towards the middle, and the greatest tension to which the diagonals were liable was one-fourth, and the greatest thrust two-thirteenths of the weight.

DR. LIVINGSTONE.

WE have much pleasure in placing before our readers the following extracts from a letter which was received last Monday, in Edinburgh, from Dr. Livingstone, by a friend of the celebrated traveller:—"Country of the Chipeta, Nov. 10, 1866.—It has been quite impossible to send a letter coastwise ever since we left the Rovuma. The Arab slave-traders take to their heels as soon as they hear that the English are on the road. I am a perfect bugbear to them. Eight parties thus skedaddled, and last of all my Johanna men, frightened out of their wits by stories told them by a member of a ninth party who had been plundered of his slaves, walked off and left me to face the terrible Mazitu with nine Nassick boys. The fear which the English name has struck into the souls of the slave-traders has thus been an inconvenience. I could not go round the north end of the lake for fear that my Johanna men, at sight of danger, would do there what they actually did at the southern end, and the owners of two dhows now on the lake kept them out of sight, lest I should burn them as slavers, and I could not cross in the middle. Rounding the southern end, we got up Kirk's range, and among Manganja not yet made slave-sellers. This was a great treat, for, like all who have not been contaminated by that blight, they were very kind, and, having been worried enough by unwilling Sepoys and cowardly Johanna men, I followed my bent by easy marches among friendly generous people, to whom I tried to impart some new ideas in return for their hospitality. The country is elevated, and the climate cool. One of the wonders told of us in successive villages was that we slept without fires. The boys having blankets did not need fire, while the inhabitants, being scantily clad, have their huts plastered inside and out, and even the roofs, to make themselves comfortable. Our progress since has been slow from other and less agreeable causes. Some parts have been denuded of food by marauding Mazitu or Zulus; we have been fain to avoid these, and gone zigzag. Once we nearly walked into the hands of a party, and several times we have been detained by rumours of the enemy in front. January, 1867.—I mention several causes of delay. I must add the rainy season is more potent than all, except hunger. In passing through the Babisa country we found that food was not to be had. The Babisa are great slave-traders, and have, in consequence, little industry. This seems to be the chief cause of their having no food to spare. The rains, too, are more copious than I ever saw them anywhere in Africa; but we shall get on in time. February 1.—I am in Bemba or Lobemba, and at the chief man's place, which has three stockades around it, and a deep dry ditch round the inner one. He seems a fine fellow, and gave us a cow to slaughter on our arrival yesterday. We are going to hold a Christmas feast off it to-morrow, as I promised the boys a blow-out when we come to a place of plenty. We have had precious hard lines; and I would not complain if it had not been gnawing hunger for many a day, and our bones sticking through as if they would burst the skin. When we were in a part where game abounded I filled the pot with a first-rate rifle given me by Captain Fraser; but elsewhere we had but very short rations of a species of millet called 'macre,' which passes the stomach almost unchanged. The sorest grief of all was the loss of the medicine box which your friend at Apothecaries' Hall so kindly fitted up. All other things I divided among the bundles, so that if one or two were lost we should not be rendered destitute of such articles; but this I gave to a steady boy, and trusted him. He exchanged for a march with two volunteers, who behaved remarkably well, till at last hungry marches through dripping forests, cold hungry nights, and fatiguing days overcame their virtue, and they made off with 'Steady's' load—all his clothes, our plates, dishes, much of our powder, and two guns, and it was impossible to trace them after the first drenching shower, which fell immediately after they left us. The forests are so dense and leafy that one cannot see fifty yards on any side. This loss, with all our medicine, fell on my heart like a sentence of death by fever, as was the case with poor Bishop Mackenzie; but I shall try native remedies, trusting Him who has led me hitherto, to help me still. We have been mostly on elevated land, between 3,000ft. and 5,000ft. above the sea. I think we are now on the water shed for which I was to seek. We are 4,500ft. above the sea level, and will begin to descend when we go. This may be put down as 10deg. 10min. south lat., and long. 31deg. 50min. 2sec. We found a party of black half-caste Arab slaves here, and one promises to take letters to Zanzibar, but they give me only half a day to write. I shall send what I can, and hope they will be as good as their word. We have not had a single difficulty with the people, but we have been very slow. Eight miles a day is a good march for us, loaded as the boys are; and we have often been obliged to go zigzag, as I mentioned. Blessings on you all. Love to Mrs. ———. From yours, ever affectionately, DAVID LIVINGSTONE.

THE inauguration of a statue of Bernard Palissy is to take place at Saintes, where the famous potter was born, on the 3rd of May. The fête to be given on the occasion will recall one of the most interesting events in the history of the town, namely, the entry of Charles IX. and Catherine de Medicis, and their visit to Palissy, whom they took with them to Paris, where he was installed in the old Louvre, and executed some remarkable works; and where the remains of his kiln and a number of his moulds were discovered last year.

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ELECTRICAL TESTS OF RECENT SUBMARINE TELEGRAPH CABLES.

THE following tabulated statement of the Electrical Tests of various recent Submarine Telegraph Cables, which has been compiled and forwarded to us by Mr. Latimer Clark, C.E., will prove of practical interest to our telegraphic readers. We should premise that the Mil is the 1-1000th. part of an inch. The Megohm = one million ohms. The Farad is the standard unit quantity of electricity as determined by the Committee on Standards of Electrical Resistance appointed by the British Association; it is that quantity of electricity which with the unit electromotive force passes through a resistance of one Megohm in one second. The unit of electromotive force does not differ greatly from that of a Daniell's cell.

The inductive capacity of a strand is assumed as 5 per cent. less than that of a solid wire of the same diameter, and has been so allowed for in calculating the relative capacities. The following empirical data may be found sometimes useful for calculating the approximate weight of cores. 54 circular mils in sectional area of copper, 69 circ. mils of copper strand, 63 circ. mils of iron, 481 circ. mils of gutta percha, or 401 circ. mils of Hooper's material—weigh one pound per knot.

Hence $\frac{d^2}{54}$ gives the weight per knot of any solid copper conductor, and $\frac{d^2}{69}$ of any copper strand, and similarly $\frac{D^2 - d^2}{481}$ gives the weight of gutta-percha in any core. $\frac{d^2 n}{6789}$ gives the weight of iron in cwts. per knot (including lay) for any cable of n wires.

DESCRIPTION OF CABLE.	Length Laid.	Diameter.		Logarithm of $\frac{D}{d}$	Weight per Knot.				Resistance of Conductor, at 24deg. Cent.		Resistance of Dielectric, at 24deg. Cent.		Electrostatic Capacity.		Approximate Resistance per Knot when Laid. Irrespective of Temperature and Pressure.	
		Copper. d.	Core D.		Copper.	Dielectric.	Iron Wires.	Completed Cable.	Resistance per Knot.	Specific Conductivity. Pure Copper =100.	Resistance per Knot.	Relative Specific Resistances. Persian Gulf=1	Electrostatic Capacity per Knot.	Relative Specific Inductive Capacity. Persian Gulf=1	Resistance of Dielectric.	Resistance of Conductor.
	Knots.	Mils.	Mils.		lbs.	lbs.	tons.	tons.	Ohms.		Megohms.		Farads.		Megohms.	Ohms.
1. MALTA AND ALEXANDRIA CABLE. Conductor a 7 wire strand. 18 Iron Wires 120 mils diam. (Laid 1861)	1330	153	463	0·48089	400	400	1·68	2·13	3·49	85·39	115	0·679	—	—	Malta Tripoli 242 Tripoli Benghazi 192 Benghazi Alexandria 151	3·59 3·56 3·54
2. PERSIAN GULF CABLE. Segmental Conductor. 12 Iron Wires 192 mils diam. Exterior Covering of Asphalte Compound. (Laid in 1864)	1148	110	380	0·53839	225	275	3·06	3·73	6·25	84·79	190	1·000	0·3486	1·000	Fao-Bushire 495 Bushire Mussendom 326 Mussendom Gwader 342 Gwader Kurrachee 239	6·46 6·21 6·40 6·30
3. HOOPER'S CABLE for River Crossing in India. Conductor a 7 wire strand. 12 Iron Wires 200 mils diam. (1865)	46	110	380	0·53839	180	330	3·3	3·8	6·98	94·9	8064	42·420	0·2719	0·812	—	—
4. ATLANTIC CABLE. Conductor a 7 wire strand. 10 Steel Wires 95 mils diam. Each wire covered with tarred Manilla hemp. (Laid 1865)	1896	147	467	0·50200	300	400	0·632	1·75	4·27	93·08	349	1·968	0·3535	0.995	2945	4·01
5. PERSIAN GULF CABLE. (Additional length.) Solid Conductor. 12 Iron Wires similar to No. 2. Exterior Covering of Asphalte Compound. (1866)	160	110	380	0·53839	225	275	3·06	3·73	6·01	88·17	395	2·079	0·3312	0·950	—	—
6. CEYLON CABLE. (Hooper's Core.) Conductor a 7 wire strand. 12 Iron Wires 200 mils diam. Exterior Covering of Asphalte Compound. (Laid 1866)	35	110	380	0·53839	180	330	3·3	3·8	7·52	88·09	7949	41·840	0·2775	0·829	7000	—
7. CORE FOR INDIA. (Hooper's Core). Similar to No. 6. No Iron covering. (1866)	40	110	380	0·53839	180	330	—	—	7·59	87·27	8526	44·870	0·2782	0·831	—	—
8. ATLANTIC CABLE. Conductor a 7 wire strand. 10 Steel Wires similar to No. 4, each covered with white Manilla hemp. (Laid 1866)	1852	147	467	0·50200	300	400	0·632	1·50	4·20	94·63	342	1·932	0·3535	0·995	2437	3·89
9. ENGLAND AND HANOVER CABLE. Containing 4 insulated wires. Conductors a 7 wire strand. 12 Iron Wires 305 mils diam. Exterior Covering of Asphalte Compound. (Laid 1866)	224	87	280	0·50764	107	150	8·003	10·94	12·07	92·32	239	1·333	0·3447	0·989	1010	11·71
10. PLACENTIA BAY AND SYDNEY CABLE. Conductor a 7 wire strand. 12 Iron Wires 148 mils diam. (1867)	112·1 188·7	102	348	0·53298	150	230	2·15	2·5	8·958	88·73	455	2·421	0·3566	1·050	Placentia and St. Pierre 4498 St. Pierre and Sydney 4257	8·32 8·34
11. CUBA AND FLORIDA CABLES—Havanah to Key West ... Key West to Punta Rassa ... Conductor a 7 wire strand 12 Iron Wires 148 mils diam. (1867)	125·4 119·9	87	290	0·51229	107	166	2·1	2·5	12·38	90·01	464	2·568	0.3507	1·005	1268 175	11·83 12·37
12. NEW ZEALAND CABLE—Lyall Bay to Disaster Point. Containing 4 insulated Wires. Conductors a 7 wire strand. 10 Iron Wires 300 mils diam. Exterior Covering of Asphalte Compound. (Laid 1866)	42	87	289	0·52138	107	166	7·45	9·1	12·46	89·43	317	1·72	0·3297	0·962	—	—
13. SOUTH FORELAND AND LA PANNE CABLE. Containing 4 insulated Wires. Conductors a 7 wire copper strand 10 Iron Wires 331 mils diam. Exterior Covering of Asphalte Compound. (Laid 1867)	47	87	256	0·46872	107	120	7·7	9·7	12·48	89·29	217	1·31	0·3700	0·970	1183	11·83

MUZZLE PIVOTING GUN CARRIAGE.

LAST Monday evening, Captain T. B. Heathorn read a very interesting paper on the above subject at the Royal United Service Institution. After noticing the advantages of the muzzle-pivoting system, he described his own invention. Early in 1865 he had been impressed by the fact that the facilities for working heavy guns did not keep pace with either their size or the anticipation of the results to be achieved by them, and he took to the study of the requirements as a new field of professional interest. He then constructed a carriage on the following resolutions:—To use a lever, fulcrum, on incline-plane principle to lift the weight of the gun, and to create a pivoting motion on an optional point; to take the shock always at a right angle to the force of the recoil, the strongest part of the gun meeting the strongest part of the carriage; as much as possible to avoid cog-wheel motion; to make the muzzle-pivoting gear wholly independent of the application of power, so that the derangement of one might not interfere with the action of the other; so to construct the carriage that for constant discharges at high angles it could serve in a mortar bed, which is effected by scotching up the trunnions in the slot of the carriage readily and efficiently with a lot of hand-spikes, timber, or simply adjusted quoins, and, if possible, to make the carriage serve both purposes of muzzle and trunnion pivoting—the latter in case of derangement to the muzzle-pivoting gear. In March, 1866, he had forwarded his invention to the War Office, but it was then, as now, in a general sort of way rejected and disapproved as inapplicable to the service. The details of the carriage were then given at length, after which the author made pointed statements of the injustice of the official treatment he had experienced. A Heathorn carriage was ordered by the Admiralty for experiments in the spring of last year, but was, however, never constructed, for, later, he was informed that a somewhat similar plan was in course of construction in the Arsenal for experimental purposes, and that no further steps concerning his carriage could be taken until the results of this trial were made known. He considered his carriage had suffered by the fact that he had first been instructed to omit all details of accessories, and that afterwards this omission was made an objection to its trial. In the discussion, Captain Mitchell, Sir H. Codrington, and Mr. Mallet took part. The chairman, Sir John Boileau, quite agreed that muzzle-pivoting must become the recognized system. At present, either in guns or forts, nothing can be said to be settled, though we may have the germs of the future weapons and defences. For naval purposes the muzzle-pivoting system is excellent, a small aperture being the great feature, and outbalancing any disadvantages. The officers who bring forward new systems deserve the best thanks of the institution.

The Rosedale and Ferryhill Iron Company, we, the "Newcastle Daily Journal," are glad to learn, have struck the Harvey seam, upwards of 4ft. thick, at their Jane Pit winning, at Ferryhill. As the sinking is close to the blast furnaces, this fine bed of coal will be an immense gain to the company, who contemplate raising upwards of 2,000 tons of coal per day, and erecting several hundred coke ovens to convert the small coal into coke, which can be delivered to the furnaces without the usual heavy railway carriage that swells so largely the working expenses of the manufacturer, and not unfrequently operates as a barrier to the development of large and costly undertakings.

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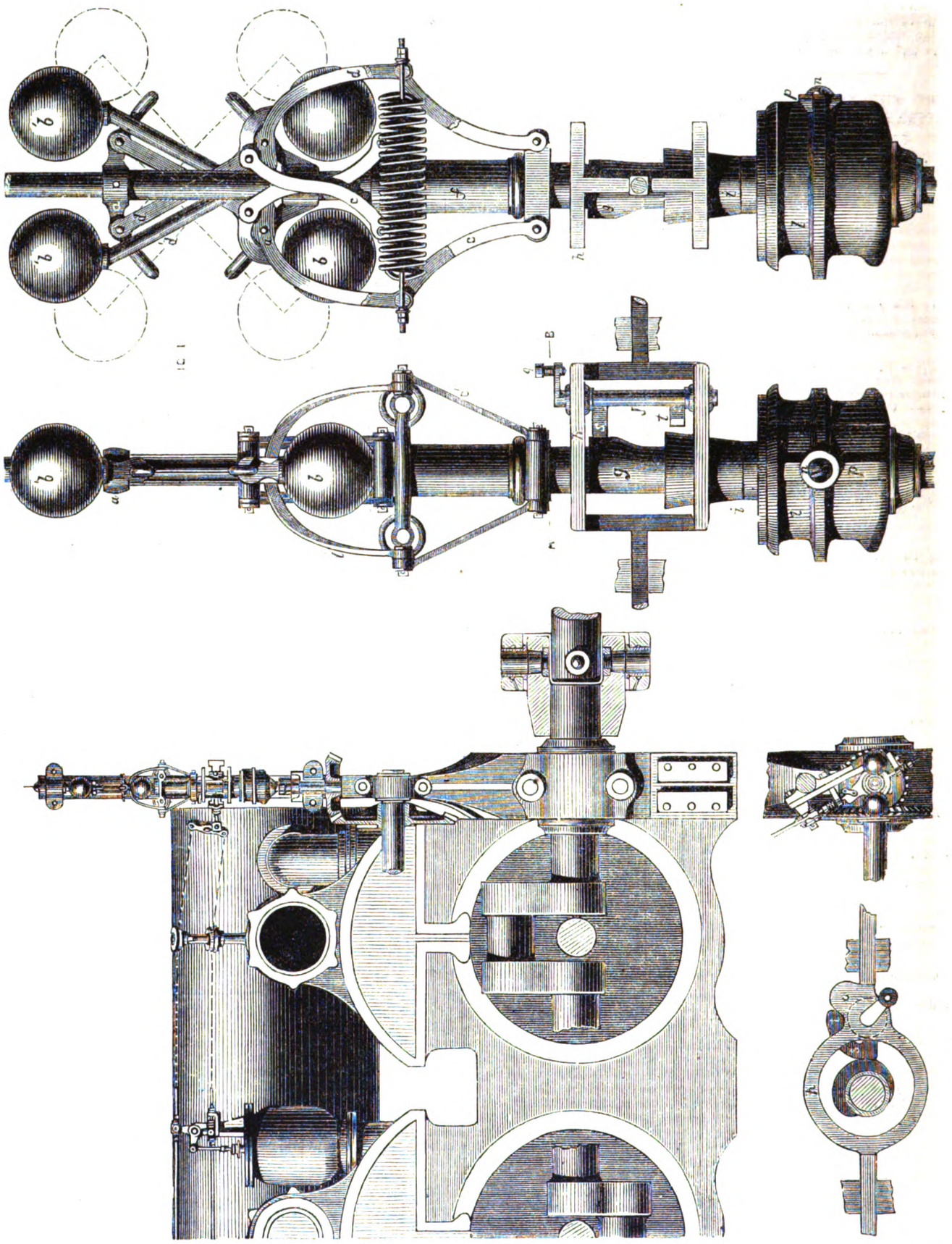
FOUR BALL MARINE GOVERNOR.

BY MESSRS. FARCOT AND SONS.



FOUR BALL MARINE GOVERNOR.

THE governor, which we illustrate in the accompanying engraving, and which was designed by Messrs. Farcot and Sons, engineers, of St. Ouen, is fitted on board the French Government steamer "Hamelin." It consists of four balls, *b* *b*^{1}, &c., which are connected by means of the arms *d* *d*, *c* *c*, with the sliding collar *f*. The upper balls are made somewhat heavier than the lower pair, in order that the extra weight may act as a counterpoise to the weight of the attachments. The centrifugal force is counteracted by a spiral spring fitted with accurate adjustments. The collar is fitted with two cams *g* and *i*. The shape of the cam *g* is shown in the sectional plan, and the point of the cut-off of the steam depends upon the action of this cam upon the tappet *s*, from which the motion is transmitted to the valve gear through the frame *h*, and the flexible cord shown by dotted lines in the front elevation of the cylinders. The throttle valve is worked by the cam *i*, which acts on the tappet *t*, also attached to the spindle *j*. The amount of opening of the throttle valve depends upon the

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diameter of that portion of the cam c which acts against the tappet. An air cylinder l is adapted to the base of the governor, in which works a piston is attached to the sliding collar f. This piston is for the purpose of preventing the too rapid revolution of the balls, and the set screw n, inserted in the passage p, serves to regulate the discharge of the air from one side of the piston to the other, and by this means the space, and consequent position, of the ball is regulated.

ON THE THEORETICAL LIMIT OF THE EFFICIENCY OF PROPELLERS.*

By W. J. MACQUORN RANKINE, C.E., LL.D.

1. THE following statement of a certain theoretical limit towards which the efficiency of propellers may be made to approximate by mechanical improvements, and of certain causes which make the actual efficiency fall short of that limit, although it involves no new principle, may be useful in the present state of the question of propulsion.

To avoid complexity, let the water be still when the action of the propelling apparatus begins; so that its velocity relatively to the vessel (which may be called the velocity of feed of the propelling apparatus), is simply equal and opposite to the speed of the vessel. Let that velocity be denoted by v.

2. Let s be the true slip, or acceleration, or additional velocity, impressed on the water by the propelling apparatus; so that $v + s$ is what may be called the velocity of discharge from the propelling apparatus, relatively to the vessel.

3. If W is the weight of the mass of water acted upon in each second, and g the acceleration produced by gravity in one second, the reaction of the water, equal and opposite to the resistance of the ship, is well known to be given by the following formula,

$$R = \frac{W s}{g}; \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

and the effective power, or useful work per second, done in driving the ship, by the formula,

$$R v = \frac{W v s}{g} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

4. When the apparatus first takes up a supply of water, then carries it for a time along with the vessel, and then discharges it, the reaction R may be the resultant of a forward reaction $-\frac{W}{g}(v + s)$ exerted by the water when discharged, and a backward reaction $-\frac{W v}{g}$, exerted by the water when received; but in this, as in other cases, the resultant reaction is $\frac{W s}{g}$.

5. In order that the loss of work may be the least possible, the propelling instrument should be so contrived as to act on each particle of water with a velocity at first simply equal to the velocity of feed v, and gradually increasing at an uniform rate up to the velocity of discharge $v + s$. If this condition were fulfilled, the mean velocity with which the propelling apparatus would have to work against the reaction R would be $v + \frac{s}{2}$; and the total work per second would be

$$R\left(v + \frac{s}{2}\right) = \frac{W v s}{g} + \frac{W s^2}{2g}; \quad . \quad . \quad . \quad . \quad (3)$$

in which equation, the first term is the useful work per second, as already given in equation 2, and the second term is the lost work, reduced to a minimum: for it is easy to see that this lost work is simply the actual energy of the discharged water, moving astern with the velocity s relatively to still water; and that quantity of energy must necessarily be lost under all circumstances.

6. The corresponding value of the efficiency, or ratio of the useful to the total work, is

$$\frac{v}{v + \frac{s}{2}}; \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

and this is the theoretical limit to the efficiency of a propeller.

7. It is certain that no actual propelling instrument has ever attained the limit of efficiency stated above. It is probable that the nearest approach to the theoretical limit of efficiency is made by the oar; for the skilful rower pulls with a nearly uniform force, and thus produces a gradual acceleration of the water laid hold of by the blade.

In the following articles are described some causes of additional loss of work, irrespective of friction. Those causes may be briefly enumerated thus:—Suddenness of change from the velocity of feed to the velocity of discharge; transverse motions impressed on the water; and waste of the energy of the feed water; and the effect of each of them is to waste work in the production of eddies.

8. Suddenness of the change from the velocity of feed to the velocity of discharge operates to the full extent in every case in which the propeller, instead of beginning its action with the velocity of feed v, and gradually increasing its speed to the velocity of discharge $v + s$, acts throughout with the velocity of discharge $v + s$. Thus the total work per second becomes

$$R(v + s) = \frac{W v s}{g} + \frac{W s^2}{g}; \quad . \quad . \quad . \quad . \quad . \quad (5)$$

so that the lost work, instead of being simply equal to the actual energy of the water discharged per second, is increased to double that quantity of energy; and thus besides the unadvoidable loss of work, there is a waste, or unnecessary loss of work $\frac{W s^2}{2g}$ per second, expressed by $\frac{W s^2}{2g}$.

The corresponding value of the efficiency is

$$\frac{v}{v + s} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

The object of such inventions as Woodcroft's gaining pitch screw, and Mangin's screw, is to diminish waste of the kind that has now been described; and in Ruthven's form of centrifugal pump the same principle appears to be kept in view. The same is also the object of making paddles feather so as to enter the water edgewise. It is probable that the object is partly attained by all those inventions, but by none of them wholly; and such being the case, the loss of work may be expressed by $\frac{c W s^2}{2g}$; c being a multiplier, not exceeding unity, depending on the mode of action of the particular propeller employed. It is probable that in a well-designed centrifugal pump, c may be very small; while for ordinary paddles and screws it is $= 1$.

9. Transverse motions are impressed on the discharged water by all forms of the screw and paddle.

Let u denote the transverse component (whether vertical, horizontal, or inclined) of the velocity of the discharged water. Then if that motion is impressed gradually, the work wasted per second in producing it is $\frac{W u^2}{2g}$, and if more or less suddenly $(1 + c^1)\frac{W u^2}{g}$; c^1 being a multiplier n t exceeding unity; and the latter is the more common case. The jet propeller is free from this cause of waste of work.

10. Waste of the energy of the feed water may occur in those cases in which the water acted upon by the propelling apparatus is received into the vessel and carried along with her before being discharged; that is to say, in certain forms of jet propeller. The feed water has, relatively to the ship, the velocity v; and in order that the energy due to that relative velocity may not be wasted, it is necessary either that each particle of water should begin to be acted upon by the propelling apparatus without losing any part of that relative velocity (as in the case of the screw and the paddle) or that any loss of velocity should be compensated by a corresponding increase of pressure, to cooperate with the propelling apparatus in producing the velocity of discharge $v + s$. For example, if the feed water is taken into a space in which it is sensibly at rest relatively to the ship, it should produce by its impulse on the water previously in that space the whole head of pressure due to its relative velocity $\frac{v^2}{2g}$, otherwise energy will be wasted, in producing eddies in the confined water, to an amount per second which may be expressed by $\frac{f W v^2}{2g}$; f being a multiplier whose value may range from an insensibly small fraction to unity, according to the degree of suddenness with which the velocity of feed is checked.

11. The multiplier f may even take values greater than unity, if the feed water is "throttled:" that is, if it is drawn through openings so narrow that the velocity becomes for a time greater than v, and then falls suddenly by the water entering a large receiver.

12. The following is a summary of the results arrived at in the preceding articles:—

		Ratio to the useful work.
A. Useful work per second	$R v = \frac{W v s}{g}$	1
B. Work unavoidably lost, being the energy of the discharged water	$\frac{R s}{2} = \frac{W s^2}{2g}$	$\frac{s}{2v}$
C. Additional work wasted, through suddenness of action of the propeller on the water	$\frac{c R s}{2} = \frac{c W s^2}{2g}$	$\frac{cs}{2v}$
D. Work wasted through transverse motion of the water if produced gradually	$\frac{W u^2}{2g}$	$\frac{u^2}{2vs}$
E. Additional work wasted if transverse motion is produced suddenly	$\frac{c^1 W u^2}{2g}$	$\frac{c^1 u}{2vs}$
F. Work wasted, through loss of energy of feed water	$\frac{f W v^2}{2g}$	$\frac{fv}{2}$

13. The following particular case may be specially mentioned. Suppose that the velocity of discharge is impressed gradually (so that $c = 0$), that there is no transverse motion of the discharged water (so that $u = 0$), and that all the energy due to the velocity of feed is lost (so that $f = 1$). Then the total work per second is—

$$R v\left(1 + \frac{s}{2v} + \frac{v}{2s}\right) = \frac{W(v+s)^2}{2g} \quad . \quad . \quad . \quad (7)$$

being the actual energy corresponding to the velocity of discharge; and the corresponding efficiency is—

$$\frac{2vs}{(v+s)^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

In this case the lost work becomes a minimum, and the efficiency a maximum when $s = v$; and such is very nearly the case in the "Nautilus" and the "Waterwitch."

14. In the following example the data assumed are—

$W = 5$ tons, or 11,200lb. per second;

$v = 15$ft. per second; $s = 15$ft. per second;

so that $v + s = 30$ft. per second; and R = 5,217lb.; the velocity is supposed to be impressed gradually; and $u = 0$. Then—

	Ratio to useful work.	Foot-pounds per second.	H.P.
A. Useful work	1	78,255	142
B. Necessary loss of work	½	39,127½	71
F. Additional loss if energy of feed water is wholly wasted	½	39,127½	71
Total work, including the above losses, but exclusive of friction (the efficiency being 0·5)	2	156,510	284
C. Additional loss if the velocity s is impressed suddenly	½	39,127½	71
Total work with that addition, but still exclusive of friction (the efficiency being 0·4)	2½	195,637½	355

15. As another example, let—

$W = 10$ tons, or 22,400lb. per second;

$v = 15$ft. per second; $s = 7\frac{1}{2}$ft. per second;

(so that $v + s = 22\frac{1}{2}$ft. per second, and R = 5,217lb., as before); let $u = 0$; and let the velocity s be impressed suddenly. Then—

	Ratio to useful work.	Foot-pounds per second.	H.P.
A. Useful work	1	78,255	142
B. Necessary loss of work	¼	19,563¾	35¾
C. Additional loss through suddenness of action	¼	19,563¾	35¾
Total work, exclusive of friction (the efficiency being 0·67)	1½	117,382½	213¾

W. J. M. R.

Glasgow University, December 26, 1866.

* From the "Engineer."

The following is a return of the quantity of coal exported from the port of Grimsby, March, 1868:—To Belgium, 1,092 tons; Canada, 974 tons; Denmark, 354 tons; Egypt, 1,206 tons; France, 5,082 tons; Hanse Towns, 805 tons; Holland, 425 tons; Italy, 648 tons; Norway, 377 tons; Spain, 1,267 tons; Sweden, 749 tons; Sardinia, 793 tons; Wallachia and Moldavia, 173 tons—foreign, 15,945 tons; coastw is, 3,452 tons—total, 17,397 tons Corresponding period, 1867:—Foreign, 14,621 tons; coastwise, 3,091 tons—total, 17,112 tons. Increase this year, 285 tons.

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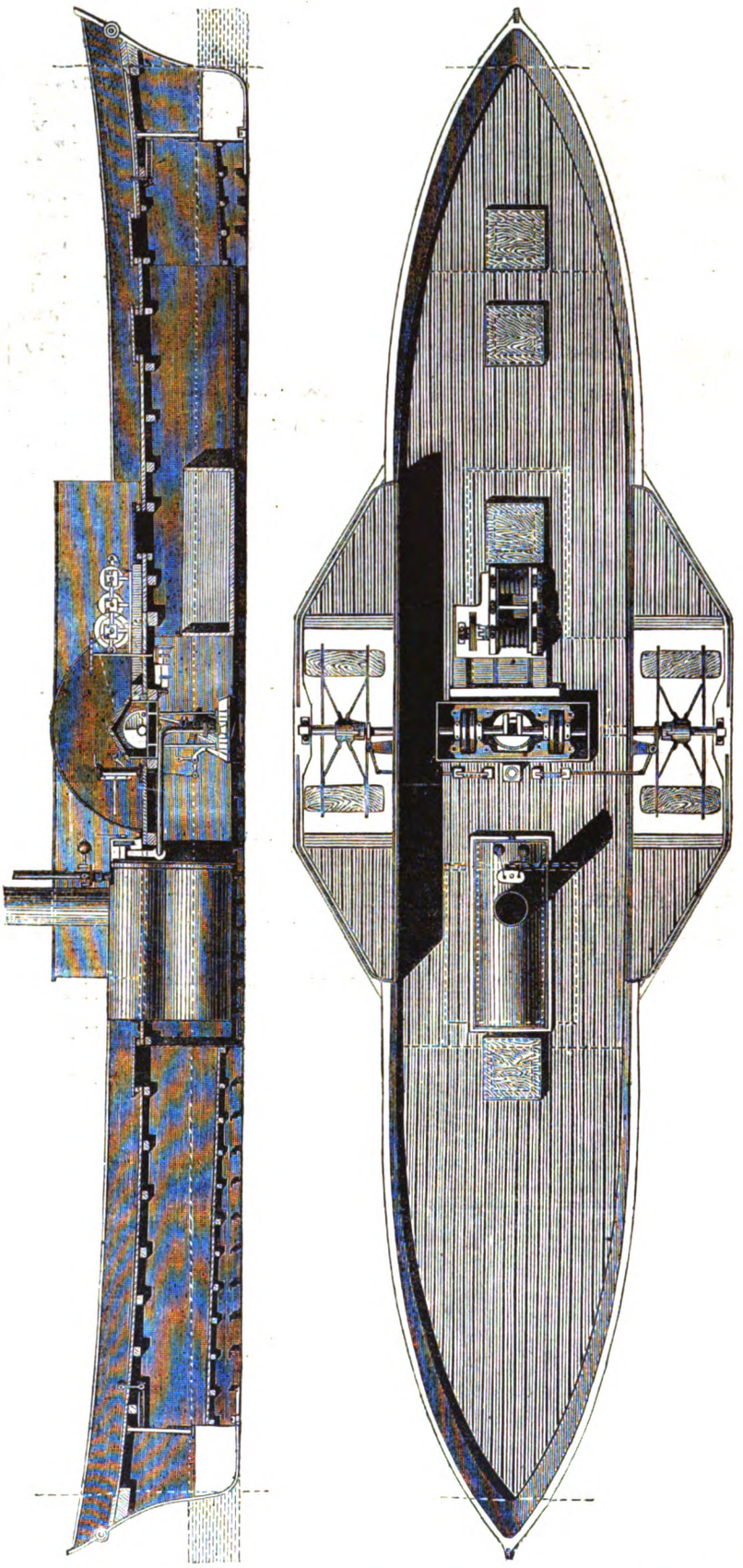
CHAIN TUG BOAT ON THE PAJANE GULF, FINLAND.

BY MESSRS. WILLIAM CRIGHTON AND CO.



CHAIN TUG BOAT.

THE accompanying engravings show a longitudinal sectional elevation and a plan of a chain tug boat built by Messrs. William Crighton and Co., of Abo, Finland. The steamer was built for warping rafts of timber from the upper end of an inland sea called Pajane, to the saw mills at the lower end, which are situated near the coast. The upper end of this sea is in communication with the rivers, which, in spring, float the timber from parts still further north to the Pajane. The distance is about seventy English miles, and this steamer, with about 1,000 fathoms of ¾in. chain, warps a raft of timber consisting of between 6,000 and 7,000 trees this distance in from five to six days, depending upon the weather. There is little or no current, but the sea being in some places twelve to fifteen miles broad, the steamer has often to contend with contrary winds. Before she came into use, the transporting of the raft from the one end of the sea to the other often occupied a whole season with horses. A steamer of 80-horse power, some years ago, tried to tow the raft without being able to make the least impression on it.

It is here necessary to explain that the raft is not made in the ordinary way, but why is not so easy to explain; in the meantime, we may state that the sawmill owners, after repeated attempts to get the peasants to form their rafts like other people, were obliged to give it up. The proper name, instead of raft, would be to call it a floating field of timber, and its formation is thus attained:—An enclosure is formed around the mouth of the river, down which the trees are, in the first instance, floated; this enclosure consists of floating trees with their ends lashed together, so wide as to contain 6,000 or 7,000 trees. The ends of the enclosure are secured to the land, and are released so soon as it is full. The ends are then brought together until the whole forms an immense loop, and, in this state, without reference as to how the trees are lying, they are warped or towed to their destination by the steamer.

The stems of the boat are forged with an opening just above the deck, for receiving an ordinary block sheave, the chain is led through this opening, and has an anchor at its end with large flukes and large timber stock, which description of anchor is found to hold best in the generally very soft bottom of the Pajane. The steamer has 1,000 fathoms of chain on board, she anchors at about that distance from the raft, practice enabling the men to take the distance by the eye. The windlass upon deck having six turns of chain on the barrels, is then disconnected from the engines, and the engines connected to the paddles, and the boat being supplied with a rudder at both ends, goes back towards the raft, and having become attached to it, disconnects her engines from the paddles, and the engines being thrown into gear with the windlass, the warping commences, and goes on thus until the raft reaches its destination, and so quickly is each operation or warping executed through a little practice, that it is not found necessary to anchor the raft whilst the steamer is taking a fresh hold.

The windlass is furnished with a brake, so that the paying out of the chain can be regulated by the speed of the boat. All the disengaging handles, starting and steering gear, are close to one another on deck. The engines are oscillating, fitted with the link motion, and the boat being quite alike at both ends, goes either way. Instead of ordinary cranks, the shafts have cast-iron discs fitted to them, which act as fly-wheels when the engines are disconnected from the paddles, and the windlass is driven from one of these discs by means of a pitch chain. The boat is built of Swedish iron, 90ft. long, 15ft. 6in. beam, 5ft. 6in. depth of hold; draught, 3ft., with 1,000 fathoms of chain on board. Fitted with a pair of condensing engines with 20in. cylinders, and 21in. stroke. It has been tried to attach the chain to the raft, and advance with the steamer as far as the length of the chain would permit, but this is not found to answer as well. The whole cost of this boat, with about 1,000 fathoms of ¾in. chain, as she now stands on the Pajane, was £2,600.

LIGHTING THE EUSTON-SQUARE STATION.

THE principal hall at the Euston-square station is now lighted on a new principle, which appears to be working very successfully. It may be remembered that under the old system the hall was lighted by ordinary burners, consuming 280ft. of gas per hour. The light was dismal in the extreme, and the beauty of the building was quite obscure. Under the new system (Kidd's patent), which has been applied by Messrs. Sim, Barff and Co., of 92, Cannon-street, the hall is lighted by the use of two bell-shaped vessels, containing dead oil. The consumption of gas is reported to be 100ft. per hour, and a very small quantity of oil is evaporated. The result is a light by which the smallest print can be easily read in any part of the hall. The booking office is also lighted on this principle.

THE foundation stone of the bridge to cross the Mississippi River at St. Louis, was laid on the 25th ult., in presence of a large number of citizens.

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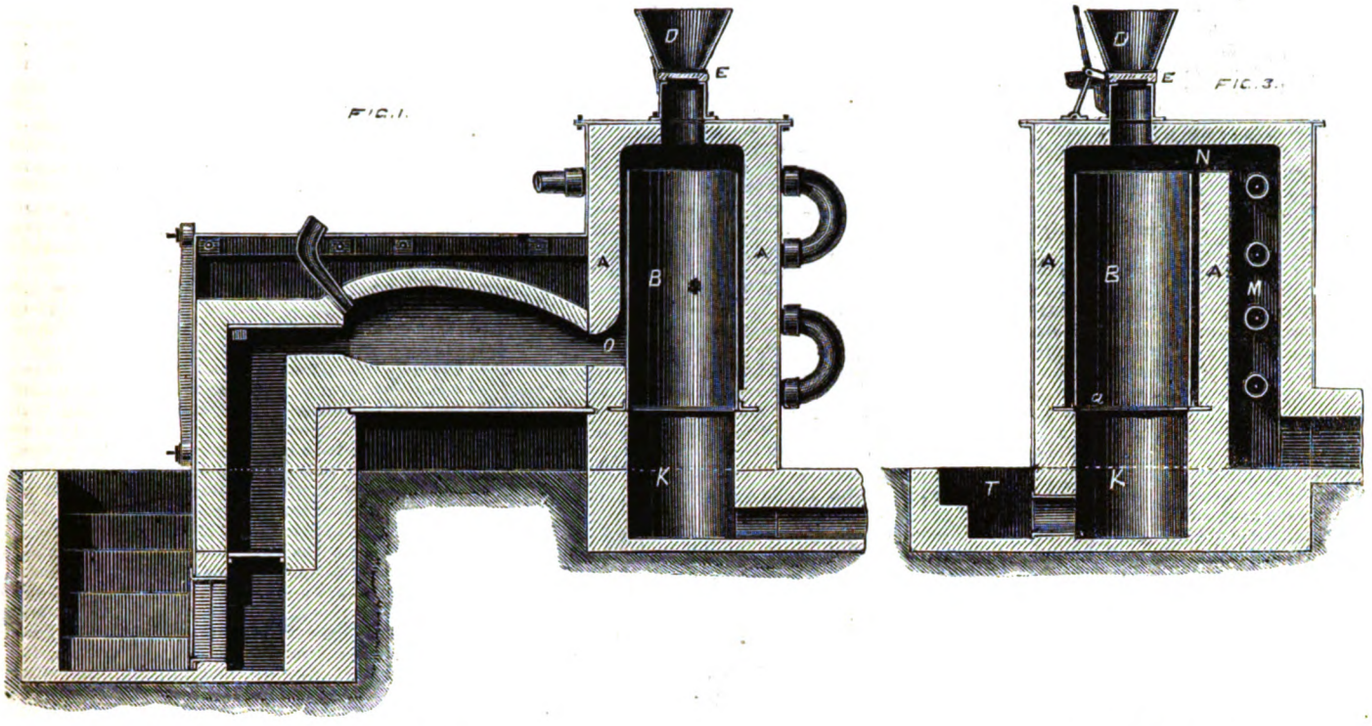
APPARATUS FOR PRODUCING COMBUSTIBLE GASES.

BY M. LEBEDEFF.

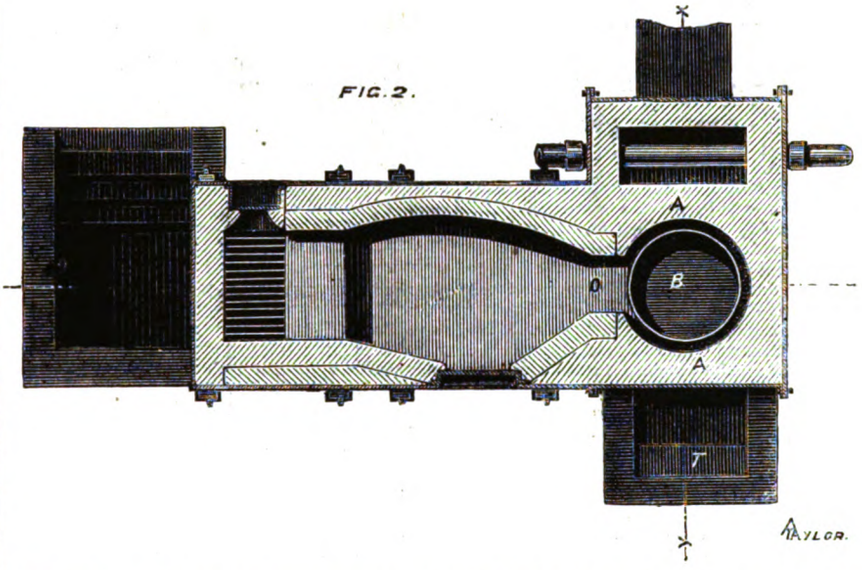


CONVERTING GASEOUS PRODUCTS INTO COMBUSTIBLE GASES.

THE invention illustrated in the above engraving has for its object the utilization in a very advantageous manner the waste heat of furnaces and fireplaces. It is the patented invention of M. Nicolas Lebedeff, a mining engineer, of St. Petersburg. It consists mainly in employing the waste heat to effect the regeneration of the gaseous products of combustion from the furnace or fireplace, that is, to convert the gases, which consist mainly of carbonic acid and vapour of water, into combustible gases, such as carbonic oxide and hydrogen. For this purpose the products of combustion are made to pass from the furnace partly through a cylinder of refractory material filled with carbonaceous matter, and partly through a space surrounding the cylinder, so as to heat the carbonaceous matter it contains. By this means that portion of the gases which passes through the cylinder is converted into combustible gas, which may be used for heating purposes either in the same furnace or elsewhere. The other portion of the gases, after imparting a portion of their heat to the contents of the cylinder, is conducted into a chamber where they are employed to heat the air required for the furnace.

Fig. 1 in the accompanying engraving shows a longitudinal section through a furnace and regenerator constructed according to M. Lebedeff's invention. Fig. 2 shows a sectional plan of the same, and fig. 3 shows a sectional elevation of the regenerator on line X X, fig. 2. The gases issuing from the furnace enter the regenerator A through the opening O, and in passing through the annular space surrounding the cylinder B they impart to the latter the requisite amount of heat for the regeneration of the gases passing through it. Arrived at the top of the cylinder the gases divide into two portions, of which one passes through the space N into the apparatus M for heating the air required for combustion in the furnace. The other portion passes down through the cylinder B, and in doing so is converted into combustible gases, which on issuing from the bottom of the cylinder are conducted through the passage K where required. The cylinder B is charged with carbonaceous matter through the hopper D provided with a sliding bottom E. The cylinder at the lower end is provided with a grating, and the attendant has access to the space below by means of the steps T for the purpose of removing the ashes of the burnt carbonaceous matter.

In constructing this apparatus the following points have to be attended to, firstly, the regenerator must be kept as close as possible to the furnace, of which the waste heat is to be utilized; secondly, the chimneys for producing the requisite draft must be provided with regulating dampers; thirdly, the gas passages must be impermeable to the external air, as otherwise explosions might take place. According to M. Lebedeff, this apparatus offers the following advantages:—Firstly, an economy in fuel to the extent



of fifty per cent., as for each equivalent of carbonic oxide only one-half of the carbon comes from the fuel, the other half being derived from the gases issuing from the furnace. Secondly, an increase of temperature on account of the decomposition of the aqueous particles contained in the fuel. Thirdly, all kinds of fuel of inferior quality may be employed. Fourthly, the apparatus is of very simple construction, thus permitting of its being applied at a very low cost to all kinds of furnaces, ovens, or kilns. In addition to the above the waste heat of a furnace may by this means be utilized at any distance away from it, and there is no necessity for this purpose to put, for instance, a boiler over the furnace.

THE SOCIETY OF ARTS' ALBERT MEDAL.

THE time draws near when the council of the Society of Arts will award the Albert Medal of the Society, and doubtless there are not a few expectant recipients. It is just possible, however, that the medal will be bestowed where least expected. But in order that every one who can show any title to it may have his claims fairly considered, the council invite members of the Society to forward to the secretary, at the Society's house, the names of such men of high distinction as they may think worthy of this honour. And its award is an honour, for it was instituted to reward distinguished merit in promoting arts, manufactures, or commerce. In the year 1864, this medal was awarded to Sir Rowland Hill, for his great services to arts, manufactures, and commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilized world. In 1865 it was awarded to the Emperor of the French, for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of arts, manufactures, and commerce, the proofs of which are afforded by his judicious patronage of art, his enlightened commercial policy, and especially by the abolition of transports in favour of British subjects. The following year saw it inscribed with the name of one of England's greatest philosophers—Professor Faraday, to whom it was awarded for discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted arts, manufactures, and commerce. Last year it was given in duplicate to Mr. W. Fothergill Cooke and Professor Wheatstone, in recognition of their joint labours in establishing the first electric telegraph. Whose shall be the next name on the roll of honour?

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ON THE PORT-GLASGOW WATER-WORKS.*

By MR. JAMES M. GALE, C.E.

IN the autumn of 1864, when these works were designed, Port-Glasgow contained a population of about 9,000, but from the increasing commerce of the River Clyde, and the development of ship-building and engineering works of all kinds in the towns on its banks, it was thought proper to provide an immediate supply of water for 12,000 people, and to establish the works in a district capable of furnishing a supply for 20,000 inhabitants. The daily supply per head it was considered expedient to provide for was 30 gallons, making a total daily supply for present purposes of 360,000 gallons a day; while the whole works were arranged so that the supply could be ultimately increased to 600,000 gallons a day.

Geologically the country to the south of Port-Glasgow is trap, which rises into a ridge, at one point 995ft. high, extending from Greenock to near Bishopton, a distance of about nine miles. This ridge separates the valley of the Gryfe from that of the Clyde, and is distant from one to two miles from the south bank of the Clyde. The streams flowing from the northern slopes of the ridge are short and rapid, and no site for a good storage reservoir existed on them, except one which had been appropriated by one of the large manufactories of Port-Glasgow, and which drained a considerable area of deep peat, and discharged water stained to an objectionable extent. A depression in the ridge about one and a-half mile south from the banks of the Clyde and three miles south-east of Port-Glasgow presented the only other position where a reservoir of sufficient size could be constructed, unless the Gryfe itself had been selected, while it possessed the additional recommendation that the ground draining into it was entirely without peat; and as the whole area consists of trap, the water flowing from it is extremely soft and brilliant, and admirably suited for all domestic purposes. The quantity of water which can be collected in this locality is more than sufficient to supply even a greater population than the 20,000 it was thought proper to look forward to, and it was accordingly selected as the source of supply.

The reservoir which has been constructed, being in a depression in the ridge above referred to, intercepts the drainage from an area of 162½ acres, which formerly flowed to the Gryfe, and a very short diversion cut brings the water into the reservoir from 62½ acres, which formerly flowed into the Finlayston Burn, a stream which discharges into the Clyde at Finlayston House—making the total drainage area to the reservoir 225 acres. No rain gauges have been kept in the district nearer than those in connection with the Shaws Water-works, but as these works are only about seven miles to the west, the results obtained there have been taken as affording sufficiently reliable data; and the amount of rainfall which can be collected has been assumed at 36in. for a dry year. An available fall of only 30in. over the area draining into the reservoir would give considerably more water than is wanted for 12,000 people, while another reservoir constructed on the Finlayston Burn at a point somewhat lower down the stream would intercept the drainage from about 250 acres of additional land, and together with the works which have been constructed, would be capable of supplying more than 20,000 people.

The delays and discussions which so frequently accompany or precede the construction of water-works were not experienced in the case of Port-Glasgow. The writer of this paper received orders from the Town Council to examine the country and report on the best source available for the town in September, 1864. The recommendations in the report were immediately adopted, and Parliamentary plans for the works were lodged in the same year, and the Act received the Royal Assent in July, 1865. The works were commenced in April, 1866, and were completed and formally opened on October 15, 1867. Throughout the whole time the greatest unanimity prevailed among the community of Port-Glasgow; and the land-owners whose land and streams were affected by the works not only did not oppose, but gave all the assistance in their power in carrying out the work.

The reservoir is partly formed upon the site of what must at one time have been a small natural lake, which had got nearly filled up by the washings from the adjoining slopes, and had formed a flat marshy basin, the low ground being of little value, but the whole site forming an admirable place for a reservoir. Two embankments were required—one at the south of Gryfe end of the reservoir, and another at the north of Finlayston Burn end, and the depth of water impounded above the level of the marsh is 15ft. The embankment at the south end is the most extensive. It is 275yds. long, and 35ft. high from the bottom of the puddle trench to the top of the embankment. The north embankment is only 77yds. long, and 16ft. high. Both embankments have inside slopes of three to one, and outside slopes of two to one; are 12ft. broad at top, are carried about 4ft. above top water level, and have puddle walls 8ft. thick at top, with a batter of one inch to the foot on each side. The byewash is 10ft. wide, is placed at the east end of the south embankment, and discharges into the stream flowing to the Gryfe. A cast-iron pipe, 10in. diameter, is placed through this embankment for discharging the compensation water to be given out of the Gryfe, and a weir is constructed behind the embankment for gauging the flow.

The reservoir contains 9,000,000 cubic feet, or 56,500,000 gallons, has a water surface of about 21¾ acres, and when full is 319·67ft. above the mean level of the sea. The compensation water to the Finlayston Burn has been fixed at four gallons a minute, but that for the stream flowing to the Gryfe has not yet been determined. After making ample allowances the reservoir contains 130 days' supply for 12,000 people at 30 gallons a head a day.

The water for the supply of the town is drawn from the reservoir by a 10in. cast-iron pipe through the north embankment, which communicates with a cast-iron stand-pipe inside the reservoir, 3ft. 6in. inside diameter, furnished with valves, by means of which the water can be drawn from the reservoir at three different levels. The valves are worked from the top of the stand-pipes, which communicates with the embankment by a wrought-iron foot bridge, and the openings into the stand-pipes are so arranged that the valves can be taken out and repaired or renewed, without interrupting the supply to the town.

The water is gauged as it flows from the reservoir over a weir at the outside tail of the embankment, and is conveyed by a fire-clay pipe conduit, 9in. diameter, for a distance of 495yds., and for a further distance of 2,005yds., by a 15in. fire-clay pipe conduit to the filters at Parkhill. The 9in. part of the conduit has a considerable fall, and is capable of conveying the 360,000 gallons a day, for which the works have been constructed. The 15in. part has a fall of 1 in 350, and is large enough to convey 600,000 gallons a day. It commences near the point where the next reservoir will be constructed when Port-Glasgow comes to require more water than the present works will give. The pipes forming the conduit were jointed with cement and concrete, with great care, so as to exclude all surface water.

The works at Parkhill consist of a gauge-well for gauging the flow of water as it is received from the conduit; a filter; a clear water-tank; a valve-well, with valves for regulating the flow from the tank; and a box for washing the filtering sand. The filter has an area of 270 square yards, and a depth of 4ft. of filtering materials, which are disposed in the following order:—

	Feet.	Inches.
Broken whinstone metal, 3in. ring	1	0
Do. 2in. ring	0	7
Gravel	0	3½
Perforated glazed fire-clay tiles 10in. square, 64 holes in each tile	0	1½
Sand from Brodick	2	0
	4	0

The tank is circular, 55ft. diameter; 13½ft. deep, 13ft. of which can be drawn off by the town main, contains 193,000 gallons, and when full is 271ft. above Ordnance datum. The walls are of ashlar, 18in. thick at the bottom, and 15in. at the top, and the whole is puddled so as to be perfectly water-tight. A frame, carrying copper-wirecloth strainers, is fixed to the inside end of the supply-pipe, to exclude all minute particles which may accidentally find their way into the clear water basin. The valve-well is circular, 7ft. inside diameter, with cast-iron pipes communicating with both the gauge-well and the filter, arranged in such a manner that water can be uninterruptedly supplied to the town, while either the filter or clear-water tank is under repair or being cleaned out. The apparatus for washing the filtering sand is similar to that first erected by the writer at the Gorbals Waterworks in 1854, and successfully worked ever since with little or no repair. It consists, in this case, of a wooden box, of capacity sufficient to contain 1½ cubic yard of sand, with a false bottom of perforated cast-iron plates, upon which the sand rests. Water, under a head of a few feet, is introduced between the true bottom of the box and the perforated plates, which causes an action in the sand resembling boiling. The attrition of the particles of the sand rubs the whole perfectly clean in about 15 minutes, with the assistance of very little manual labour, and with not a great expenditure of water. The cost of this operation, with similar apparatus, at the Gorbals works, amounts to 6d. per cubic yard of sand. All these works at Parkhill, with the exception of the filter, are designed for a supply of 360,000 gallons a day only, and ground has been purchased on which to erect an additional filter.

The main-pipe, from the clear-water basin to the town, is 9in. diameter, and 2¼ miles long, to the Court-houses, near the harbour. It is carried principally along the old road from Port-Glasgow to Glasgow, which is at a considerably higher level than the new road, the line of which should be taken for a second main when it is required. All the cast-iron pipes have turned and bored joints, and were driven home with a little fine cement to make the joint. Air-cocks are placed on all the summits on the line of main, and scour-cocks in all the hollows. The distributing-pipes ramify the streets of the town in the usual way. They are not interlaced in any way, but are each furnished with a valve where they leave the main, and a cleansing-cock at the further end. The fire-cocks, of which there have been 150 placed throughout the town, are of the kind known as Bateman and Moore's ball valves, and have cost about 27s. each complete. They are found to work well, and to require little repair, and they have the additional recommendation that they act as air-cocks. The full pressure, due to the elevation of the tank, is constantly on the distributing-pipes, and, in the event of fire, there should be a good supply of water.

There was nothing new introduced in the service-pipes and water-fittings, except it be the attachment of the service-pipes to the cast-iron distributing-pipes. Instead of the usual detached cock and ferrule, a cock was used with a ferrule attached at an angle of 45deg., the attachment to the pipe being made at an angle of 45deg. off the perpendicular. These cocks had been previously introduced by the writer in the towns of Dumbarton and Hamilton, where they have been quite successful, and cost less than the ordinary arrangement.

The cost of the whole works has been as follows:—

Reservoir	£1,339
Conduit, filter, and clear-water tank .	2,230
Pipe laying	1,018
Cast-iron pipes and special castings . .	3,620
Valves, fire-cocks, &c.	251
Land and expenses connected therewith	2,347
	£13,805

The contractor for the reservoir, conduit, filter, tank, and pipe-laying was Mr. John Murray, Glasgow; for the cast-iron pipes, Messrs. Robert Maclaren & Co., Glasgow; for the valves and fire-cocks, Messrs. Guest & Chrimes, Rotherham; and for the special castings, Messrs. Alston & Gourlay, Glasgow. The resident engineer was Mr. James Wilson, and the inspector of works, Mr. John Wilson. The whole of these gentlemen executed their work and discharged their duties to the entire satisfaction of the writer.

*Read before the Institution of Engineers in Scotland March 11, 1868.

GAS ENGINEERING.

NO greater proof is required of the incompleteness of knowledge upon any given subject than that afforded by the frequent publication of information thereon. For assuredly if everything were known, then should we require no teachers. In gas engineering we specially have to notice the occasional appearance of books, which, while purporting to serve a business purpose, are really the media of valuable information upon the subject of which they treat. Each one, too, goes beyond its predecessors in imparting practical knowledge, and thus bears testimony to the truth of our observation that generally the knowledge upon given subjects is incomplete. Some of these books give information by description, others by illustration. Of the latter class is one which has just been issued by Messrs Christie and Co., the gas engineers and contractors, of Bankside, Southwark, of which firm Mr. Alfred Williams (well known to our readers as the Honorary Secretary of the Society of Engineers

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is the active and acting partner. To Mr. Williams, in fact, is due the production of the book before us, which of course does not pretend to be more than an illustrated price list, but in outward appearance it is a respectable-looking volume. On opening it we find it to consist of a series of twenty folding sheets of lithograph drawings, illustrative of every apparatus and implement used in the manufacture of gas. These plates are interspersed with brief descriptive matter, including dimensions and other information of value to managers of gas works. We first have some light iron roofs for the various buildings on a gas works, after which follow retorts, showing their settings and their details, together with all the necessary fittings. We then come to the condensers, of which there are two kinds illustrated—the ordinary and the annular—the latter being a great improvement upon the former.

Next in order is the exhauster, which is shown with the boiler engine and connections, as carried out in practice. Then come in succession the scrubbers, a series of purifiers with their well-arranged connections, station meters, gasholder tanks, and gasholders. The scrubbers employed by Messrs. Christie are specially noteworthy, being a great improvement upon those of ordinary construction. They are filled with drain tiles, which entirely prevents any addition of pressure by the use of the scrubber, and affords easy escapement for the tar. An interesting plate is that showing the various photometrical apparatus, and where we have the systems of Dr. Letheby, Mr. F. J. Evans, and Mr. Wright graphically illustrated. Following these are illustrations of meters, and of the numerous implements and tools used in gas works. We thus have a collection of drawings of machinery and apparatus embodying all the most recent improvements in practice, and which have been suggested by the long experience of Messrs. Christie and Co. as gas engineers. The execution of the drawings has been entrusted to Messrs. Spon, of Charing Cross—who, in fact, have brought out the book—and this is a guarantee that they are well done. We cannot conclude without specially noticing some well-designed gas stoves for cooking and heating; they are fitted with atmospheric burners, and work at a great economy as against coal stoves. The cooking stoves are well arranged, and are a special boon for domestic use in summer, as they are cool, cleanly, and ready for use at a moment's notice. *Apropos* of this stove we would suggest that our gas companies follow the excellent example set by one company of letting out these stoves on hire, charging a small rental upon them. This the Maidstone Gas Company does, and makes a good round sum annually, whilst the public are well pleased with the saving they effect by such an arrangement and the convenience they possess in such a stove. Having examined one of these stoves at Messrs. Christie's wharf we can strongly commend them to the public.

THE ROYAL AGRICULTURAL SOCIETY.

THE meeting of the Royal Agricultural Society, to be held in Leicester in July, promises to be an unusually brilliant affair. Already tradesmen are busy with their decorations, and "town improvements" are being advanced as rapidly as possible. The show-ground will be situate on the racecourse, which comprises 55 acres, of which 45 acres have been placed at the disposal of the Royal Agricultural Society and the Royal Horticultural Society, who will also hold their annual country exhibition at the same time. This large area, of which about 30 acres have been expressly levelled, is being rapidly enclosed with a hoarding by Mr. T. Penny, of Taunton, Somersetshire, who, it will be remembered, gave so much satisfaction in the erection of the fittings of the last show at Bury St. Edmunds. Already many of the offices are nearly completed. The Midland Railway Company have undertaken to construct a siding (of rather steep gradient), at their own expense, from the main line (south of Leicester) to the show-ground, and this, from the progress which has been made, promises soon to be workable. The space allotted for the show will be the largest yet put at the disposal of the Society, and will consist of one unbroken space, disposed of as follows:—Sheds for implements, 7,500ft. run; live stock, 6,020ft. run; seeds and models, 1,000ft. run; fodder sheds, 180ft run; machinery in motion, 1,390ft. run, in addition to horse-boxes and stalls to accommodate 387; offices, exercising grounds, &c. The show, being so centrally situated, is expected to attract a large influx of persons, and already accommodation is eagerly sought after.

NEW METHOD OF REEFING TOPSAILS.

BY CAPTAIN WEBB, R.N.

FIG. 1.

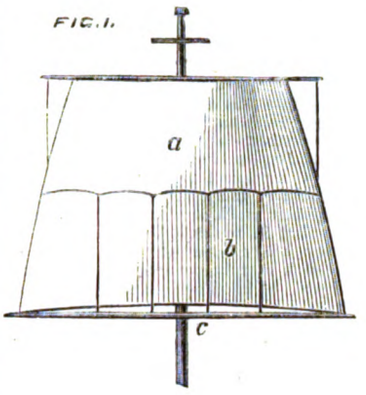


FIG. 3.

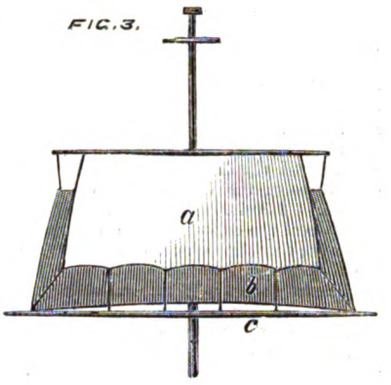


FIG. 2.

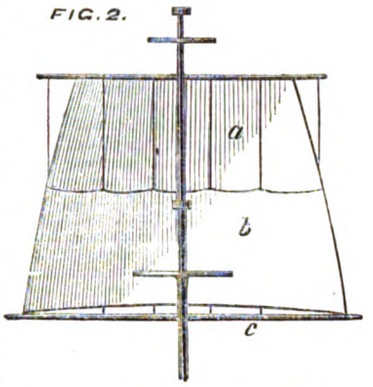
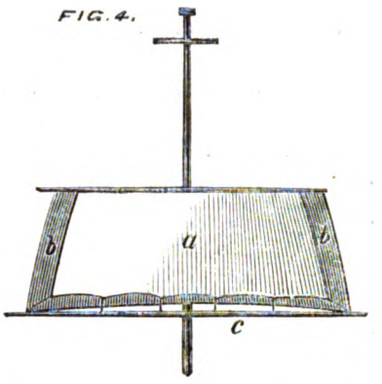


FIG. 4.



THE BRITISH ARMY.

THE strength of the army at home and abroad in 1866 was 201,641 officers and men. At home there were, on an average, in cavalry, infantry, artillery, and engineers, 4,470 officers and 79,654 men, of whom 3,021 officers and 53,456 men were in England and the Channel Islands. The residue of the home strength, 27,647 officers and men, were in Scotland and Ireland. The large proportion of 24,238 were stationed in the latter country. The proportions of military force in each of the three kingdoms to 10,000 civil population were—England and Channel Islands 26, Scotland 11, and Ireland 43. In the United Kingdom, in 1866, 49 officers, and 1,007 men died. The mortality of officers was 1·096 per cent.; that of the men was 1·264. Abroad there were 6,252 officers and 111,265 men. The number of soldiers was less by about 15,000 than the number abroad in 1864, and less by about 7,000 than the number in 1865. Seventy-nine officers and 1,723 men died abroad in 1866. The mortality was remarkably low, that of officers being 1·264 per cent. against 1·576 in 1865. The mortality of men was 1·549 against 2·102 in 1865. Of the 4,470 officers and the 79,654 non-commissioned officers and men at home in 1866, respectively, 776 and 12,165 were cavalry; 2,766 and 51,179 were infantry; 617 and 13,788 were artillery; and 311 and 2,522 were engineers. Of the 6,252 officers and the 111,265 non-commissioned officers and men abroad in 1866, respectively, 413 and 6,283 were cavalry, 4,192 and 85,882 were infantry, 1,216 and 17,347 were artillery, and 431 and 1,753 were engineers.

REEFING TOPSAILS.

SHIPS frequently have their sails blown away through the inability of the crew to reef with sufficient speed; and, when shorthanded, and sailing under close reefed topsails, advantage is not taken of a short lull of the wind to extend the sails, for fear of another increase of wind endangering the sails. This is all entirely obviated by an invention, recently patented by Captain Webb, R.N., of 4, Woolwich Common, and which has for its object the reefing of topsails from the deck in a speedy, simple, safe, and efficient manner, thereby obviating the necessity of going aloft, and rendering a small crew capable of working a ship in heavy weather. By this invention the topsails can be hoisted and increased in surface, or lowered and reefed with such celerity that no loss of speed need take place when the force of the wind becomes lessened, and the operation of reefing is thereby rendered a far less formidable affair. The alteration can readily be made from common to the patent topsails. The sails can be arranged and bent to the ordinary yards, at a small cost, and without any inconvenience.

The annexed engraving will enable our readers to understand the *modus operandi*, with the aid of the following description. The topsail is divided horizontally into two parts or halves, so that the topsail is composed of an upper and lower topsail. Fig. 1 represents a foreside view of the topsail, as ordinarily set, without reefing, and fig. 2 an afterside view of the same. *a* is the upper topsail, which is attached to the topsail yard in the usual manner. *b* is the lower topsail, the clews of which are attached to the yard *c* with sheets in the usual manner. The head of the lower topsail is fitted with reef tackles and head ropes to draw it taut; the reef tackles being fitted in the usual manner, and the head ropes leading through blocks on either quarter of the topsail yard, and leading from thence to the cleats on deck. The foot of the upper topsail is fitted with sheets and down hauls, the sheets leading through blocks on the clews of the lower topsail and through sheaves on the foreside of the lower yard *c*, and the down hauls leading through fair leaders on the foreside of the quarters of the lower yards, and thence to the cleats on deck. By means of these ropes the topsail is kept taut and fair when set.

When it is necessary to reef, the topsail yard is lowered to the required position, and the several sheets and ropes are hauled taut from the deck, by which operation the effective surface of the topsail is reduced, the upper topsail and lower topsail sliding over each other. Fig. 3 is a foreside view of the topsail so reduced as to be equivalent to a double reefed topsail. When it is necessary to close reef the topsail, the topsail yard is lowered down close to the head of the lower topsail, and the foot of the upper topsail is lowered down close to the lower yard, so that one sail is behind the other, the canvas being consequently doubled, and thereby greatly increasing its strength. Fig 4 is a foreside view of the topsail in the position lastly described. It appears to us that this invention meets the difficulty of reefing in the most simple and economical manner, while at the same time the efficiency of the sail is not in the least impaired.

VARIABLE CUT-OFF STEAM ENGINE.

WE last week gave a summary of a paper read by Mr. Horace McMurtrie, at a meeting of the Massachusetts Institute of Technology, which was reported in an American journal. Mr. McMurtrie has since written to that journal—the "Railway Times"—to make several corrections, which, in justice to the author, we here append. He says:—

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"In the first place, you report me as stating:—'In relation to economy of fuel, that this engine consumed but 2lb. of coal per hour per horse power.' Although I claim an economy equal to any yet effected by any engine, I did not make such an assertion. Upon this subject I remarked that 'with boilers properly proportioned and set, and with a condensing engine of this make, I had no doubt this result could be obtained'—which is a very different statement. The present consumption of fuel with a non-condensing engine is about 2½lb. to 3lb. The socond error is respecting the reply made to Mr. E. B. Bigelow's questions, which were, that I should state the 'difference in principal between the Corliss engine and the one exhibited.' I am reported as replying that 'the principle of the cut-off was the same in both,' but that 'the eccentric used to regulate the cut-off in the Corliss engine was dispensed with,' etc.! This is all wrong, and the latter part of it an absurdity. My reply to Mr. Bigelow was, that 'the general principle of all variable cut-offs was the same, viz., that the variation in the load, through the agency of the governor, varied the grade of expansion; but that in the Wright engine, the valve gear, being operated entirely by the governor, the eccentric and its appendages used in the Corliss engine' were dispensed with."

TURRET SHIPS FOR COAST AND HARBOUR DEFENCE.

ABOUT eighteen months ago, the Dutch Government, after a long discussion as to the description of vessels which would most efficiently provide for the defence of their own harbours and coast, decided to construct a fleet of armour-clad vessels, some to be of a light draft of water for the navigation of their shallow inland waters, canals, and harbours, others with great speed and good sea-going qualities, to render them available, when necessary, for the defence of any portion of their sea-board. The construction of several of these vessels was entrusted to Messrs. Laird Brothers, Birkenhead. One of these, the "De Steir," was successfully launched at Messrs. Laird Brothers' works, at Birkenhead, on Thursday last, in the presence of Mr. Jansen, under whose superintendence the vessels are being built; Captain Hugenholtz, Commander of the "Prins Hendrik" during her recent cruise; Mr. May, Dutch Consul at Liverpool; M. Von Santen, Mr. John Laird, M.P., and a number of ladies and gentlemen, who took great interest in the proceedings, and in the christening of the vessel, which was gracefully performed by Miss Agnes Laird. "De Steir" is a twin screw iron-clad steam-ram, carrying one turret on Captain C. P. Coles' principle, armed with two 300-pounder 12½-ton rifled guns. After being launched the ram was taken into one of Messrs. Laird's adjoining docks, and as this vessel is of the same class as the Peruvian turret vessel "Huascar," built by Messrs. Laird Brothers, and referred to in the "Times" in an article pointing out the valuable qualities of this description of iron-clad turret-ships for coast defences, a short description may be interesting.

She is a vessel of 1,325 tons burden; length 200ft., breadth 38ft. and depth 19ft.; and her extreme draught of water, when completed for service, will not exceed 15ft. 6in. She is armour-plated with 6in. plates, from 3½ft. below the water-line up to the gunwale, for the greater part of her length, the plates tapering slightly towards the ends. The armour rests on a backing of 10in. teak, and this again on an inner skin of 1in. supported by the framing of the ship. Her turret, which is cylindrical, and constructed on Captain Cowper Coles' principle, is protected all round by armour-plating, which in no place is in thickness less than 8in., increased to 11in. round the ports, the plates resting upon a teak backing of 13in., with an inner iron skin of 1in. As we have said, the turret will carry two 300-pounder rifle guns, having a range of fire from 10 degrees of the line of keel forward and 6 degrees aft, so that she can in rapid succession deliver her fire at almost all points; while the facility with which her twin screws will enable her to turn will make her very handy in action. Her port sills are arranged at a height of 6ft. 6in. above water. The turret, in addition to the usual apparatus for working by hand, is fitted with steam gear, for more rapid movement is necessary. On the main deck is a shot-proof pilot tower, and a poop and forecastle, fitted with supplementary cabins, in addition to excellent accommodation for officers and crew below the main deck, under the protection of the armour. By an ingenious arrangement of hatchways, carried above the main deck, excellent light and ventilation for the below deck cabins is abundantly secured; and ample accommodation is reserved below the water line for magazines, store-rooms, coal bunkers, &c. The ram-stem is of iron and of great strength, projecting about 5ft. at such a depth under the water as to enable her to strike an enemy's ship below her armour plating. This formidable weapon of offence is built solid into her framework, and is so constructed as to resist the shock of the collision. Her machinery, which has been made at the same works, consists of two pairs of surface-condensing direct-acting engines, each of 175-horse power, giving 350-horse power collectively, and are so arranged as to work to a very high indicated power, each pair of engines driving a screw under the counter of about 12ft. 6in. diameter. Her boilers are fitted with super-heaters, and the machinery generally is made in accordance with the new Admiralty specifications for engines of this class. The engines and boilers will be placed on board in the course of this week. It is expected that her speed will be thirteen knots.

Messrs. Laird Brothers have also recently launched for the same Government two of the light draft of water vessels of the monitor class, which are now receiving their machinery and fittings in the same dock as that in which "De Steir" has been placed. They are named the "Panter" and "Krokodil," each carrying one turret, on Captain Coles' principle. The dimensions of the vessels are:—Length, 180ft.; breadth 44ft.; depth, 11ft. 6in.; and draft of water when ready for service, 8ft. 6in. They are armour-plated with 5½in. plates, from 3ft. below the water to the gunwale, reduced at extreme ends to 4½in. The armour rests upon a backing of solid teak, 10in. thick, strengthened by longitudinal webs of iron; and there is an inner skin of iron plates 1in. thick. The deck is secured against the crushing-in effect of a plunging fire, by beams of great strength placed very close together and covered with wrought-iron plates, 1in. thick amidships and ⅞in. at the ends, the deck itself being of teak planks 4½in. thick. The turret is protected by plates 8in. thick, increasing to 11in. at the ports. It carries two 300lb. rifled guns, which can be fired in line of keel forward and within four degrees aft. The monitors have also twin screws, and each will be fitted with two pairs of direct acting engines, each of the nominal horse-power of 70-horse, working collectively to 140-horse power. One important feature of both vessels is, that they are fitted with a double bottom divided into compartments, with contrivances for admitting water ballast, so that the vessels can be put down in the water at pleasure to the extent of one foot lower than their ordinary sailing draft, thus reducing the height of the side, as exposed to the enemy's shot, to 2ft. Each also carries an armour-plated pilot tower, and the base of the funnel is protected by armour-plates a certain height above the decks; while the hull is subdivided by a number of longitudinal and athwartship water-tight bulkheads. The accommodation for 75 to 100 men below deck, irrespective of the deck-house aft is ample, commodious, light, and airy, so that protection and comfort are ensured in that respect, when lying "snug" in the expectation of the enemy. The hatches, conveying air and light to the cabins and berths below deck, are carried 8ft. above the main deck, and their bases are protected by plates placed at sloping angles so as to deflect shot which would otherwise strike the foot of the hatchways.

The "Panter" is far advanced towards completion, and she will probably leave Messrs. Laird's dock in a few days for her preliminary trial trip, after which she will return to receive her gun-slides and guns. The "Krokodil" is also well advanced, and will be completed some time this month. The speed of these vessels, when fully equipped, will be about 8 knots. They are rigged with light pole masts, for signalling rather than for any practical purposes; as they are not intended to carry sails. Both vessels are fitted with light falling guard rails, which, in action, will lie flat on the deck. It is believed that these monitors, by being able to keep close inshore, will be found to be most formidable to any antagonists approaching the coast, for, with small size, presenting but a small object to the enemy, and a light draft of water, they are able to carry guns equal to those for which vessels of the largest class are pierced. These two vessels may be considered as improvements in the Brazilian turret ships "Bahia" and "Laria Barros," built by Laird Brothers, and both of which have been employed in the River Plate, the former as the flag-ship at the recent attack on Humaita.

The fitting-out dock which now contains the ram "Steir" and the sister monitors "Panter" and "Krokodil" is immediately in front of Messrs. Laird's engine and boiler shop and armour-plate sheds, and is within a radius commanded by the 50-ton crane, with which the finished framework of the turrets, weighing thirty tons and more, the machinery and other ponderous masses can be placed on board and adjusted in their place to the greatest nicety. In one of Messrs. Laird's adjoining docks her Majesty's turret ship "Captain," of 4,200 tons, is making rapid progress. She is plated with 8in. plates on a solid teak backing, will carry two turrets, on Captain Coles' principle, each armed with two 600-pounder rifled guns. She will have twin screws, and will be fitted with powerful machinery, giving her a high rate of speed. In another dock, nearly completed, is a composite—wood and iron—gun-boat, the "Teazer," which is to be armed with two pivot 7in. 6½ ton guns. She is one of eight gun-boats which are being specially constructed for service in the Chinese seas.

In No. 3 dock, just laid down, is the lower frame-work of her Majesty's broadside frigate "Vanguard," of 800-horse power, one of the four ships of the "Invincible" class, orders for which have recently been issued by the Admiralty. The Messrs. Laird have been commissioned to build the "Vanguard," in consequence of having furnished the best competitive plan for an iron-clad of any class, in competition with six other private shipbuilding firms. To ensure rapid progress with the work a shed is being erected over the dock, so that the men may not be interrupted in their work by the weather.—"Liverpool Albion."

Legal Intelligence.

COURT OF COMMON PLEAS.

April 21.

(Sittings in Banco, Easter Term, before Lord Chief Justice BOVILL, and Justices BYLES, KEATING, and SMITH.)

THE BRITISH COLUMBIA SAWMILL COMPANY v. NETTLESHIP.

THIS was an action tried at the last Guildhall sittings before the Chief Justice, and was brought on a bill of lading to recover the value of a box containing the fittings of a quantity of machinery, which was sent out to Vancouver's Island. On the arrival of the defendant's ship out there, the box in question was missing. The box had been delivered at the dock side to the defendant's agent to be put on board ship. The plaintiffs sought to recover not only the value of the machinery fittings in the box which was lost, but damages beyond, on the ground that all the other machinery sent out was useless without those fittings. At the trial the plaintiffs recovered a verdict for £3,000 damages.

Sir G. Honyman, Q.C. (with whom was Mr. Lanyon), now moved for a rule for a new trial, on the grounds that there was no evidence of the defendant's liability, or that the box had been placed in the defendant's custody on board the ship, for misreception of evidence, and to reduce the damages.

After a long argument, the Court were of opinion that there ought to be no rule on the first two grounds, but granted a rule *nisi* on the third ground—that the damages were excessive.

Rule *nisi* accordingly.

Correspondence.

DEFENCE OF FORTRESSES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In my last letter on this subject, the thirty-third line in the second column should be—

"Q 1 *l.*, *r. t.* . . . Q 1 left, right triangle."

And I beg to make use of this opportunity, by remarking that I gave the described subdivision of the range field of the guns merely as an example, and that most probably other and better methods could be devised.—I am, Sir, yours, &c.,

G. J. GÜNTHER.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

SCRUTATOR.—If you will compare the descriptions of Ormerod's and Aytoun's safety shackles, you will find that Aytoun's disengages the cage from the winding tackle, but drops it, whilst Ormerod's cage, at the moment it is disengaged, is suspended, and cannot fall. This is a distinction with a material difference.

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RECEIVED.—E. H. C.—Messrs. L. and B.—J. B.—R. T. S.—Messrs. S. and C.—W. B. K.—H. W. H.—W. T. F.—Messrs. C. and D.—G. E. P.—A. I. C.—E. S.—H. J. S.—J. M. K.—L. C.—Messrs. C. Bros.—B. A. H.—S. K. M.—D. G. F.—Messrs. J. and T. B.—W. H. H.—W. B.—H. M. T.—G. J. G.—W. T. C.—B. H.—R. B.—W. W. K.—E. H. C.—W. H. K.—G. E. P.—P. I. C.—E. C. P.—W. A.—G. W. H.—F. H. P.—J. H. E.

Meetings for the Week.

MON.—Royal United Service Institution.—Major Scaky, R.E., on "Army Organization—Our Infantry Forces and Infantry Reserves," at 8.30 p.m. A discussion on this, and Major Bevan-Edwards' paper, entitled "An Organization for the Army of England," will be taken afterwards.

TUES.—The Institution of Civil Engineers.—Discussion upon the papers on "Irrigation in India and in Spain," at 8 p.m.

Royal Institution.—Dr. M. Foster on "The Development of Animals," at 3 p.m.

THURS. — Royal Institution. — Professor Odling on "Chemical Combination," at 3 p.m.

FRI.—Royal Institution.—Annual Meeting at 2 p.m. Mr. F. T. Palgrave on "How to Form Good Taste in Art," at 8 p.m.

SAT. — Royal Institution. — Professor Odling on "Chemical Combination," at 3 p.m.

Naval, Military, and Gunnery Items.

IT was announced at Chatham, on Wednesday, that Captain W. K. Hall, C.B., will retain his present appointment of Superintendent of Sheerness dockyard, by order of the Admiralty, until his promotion to flag rank.

THE "Minotaur" the other night was run into by a sailing ship, which wrought havoc with his boats, and the excuse of the skipper was at least ingenious. "I saw three masts, and thought I had cleared the ship," said he, "and put down my helm. Who, the deuce, could have thought there were five-masters knocking about?"

INTELLIGENCE from Japan announces that a boat's screw and officers belonging to the French man-of-war, "Dupleix," have been massacred at Osaca. The Japanese Government had offered satisfaction for the outrage, but all the foreign ministers, excepting the representative of Great Britain, had hauled down their flags.

ON Wednesday last, Vice-Admiral Sir Baldwin W. Walker, K.C.B., Naval Commander-in-Chief at the Nore, made an official final inspection of the screw frigate "Bristol," 31, 600-horse power, Capt. F. W. Wilson, on her completion as a training ship for naval cadets. The "Bristol" is under orders to proceed from the Nore to make her first cruise for the summer season, calling in at Spithead, on her way down Channel, for final instructions.

AN Australian paper states that the Duke of Edinburgh, after leaving Sydney, visits New Zealand, Tahiti, Honolulu, Callao, Valparaiso, Falkland Islands, Monte Video, Rio, Demerara, Trinidad, Tobago, Grenada, and Barbadoes, and thence home to Portsmouth, where he is to arrive in January, 1869. This is no yachting voyage, considering the "Galatea" will round Cape Horn in September. The "Galatea" has been docked at Sydney, and received a new false keel, and repairs to her new screw shaft bearing.

THE quarterly meeting of the Royal Naval Benevolent Society was held on Tuesday, at Willis's Rooms, King-street, St. James, under the presidency of the Earl of Lauderdale. The balance-sheet showed that the receipts had amounted to £1,367 15s. 5d. during the last quarter, and the expenditure had been £679 12s. 0½d., leaving a balance in the hands of the bankers of £688 3s. 4½d. The report of the special committee appointed at the last quarterly court to revise the by-laws was read, but it was resolved to adjourn the consideration of it for a month. A sum of £563 was voted for grants during the ensuing quarter, and the proceedings terminated.

SOME idea of the difficulty experienced by an army in traversing a mountainous country may be gathered from the fact that it took eleven hours for a small portion of the 1st Brigade, under Sir Charles Staveley, to make a march of under seven miles in Abyssinia. The descent of about 800ft. or 1,000ft. from the halting place at Belago to the plain beneath caused the greater part of the delay. With all the assistance of the infantry, numerous breakdowns occurred, owing for the most part to the miserably faulty condition of the pack-saddles with which the mule trains from India are equipped.

IT is stated in the American "Army and Navy Journal" that the "Wampanoag" is to be placed out of commission, because "she is found to be not a proper vessel for a cruiser during peace times, on account of the cost of running her." According to all accounts this vessel must be something of a white elephant. It cost a huge amount to build her, and while the expense of running her in peace times would be ruinous, her battery is too light to make her formidable in case of a war. In addition to this, she can only carry coal enough for six day's full steaming, while we are assured that, on her recent trial trip, it was found she would not tack under sail. Putting all these facts together, we could hardly wish a hostile power a worse fate than to be compelled to build and keep at sea a fleet of "Wampanoags."

Miscellanea.

A FREE library, containing about 10,000 volumes, was opened in Nottingham on Monday.

THE number of visitors to the Patent Office Museum for the week ending April 18, was 12,161; total number since the opening of the museum, free daily (May 12, 1858), 1,286,586.

A FIELD of Italian grass (a species of seed recently adopted in Surrey) is now being cut at Streatham, for green food for cattle, and the crop is fully one month earlier this year than at any previous spring since its introduction into this country.

ONE of the French law courts has just had to decide a singular question. A person recently deceased had left by will to a poor needlewoman, during her life, soup and boiled beef for every day in the year. The point to be established was the sum which such a legacy represented. The Tribunal has fixed it at 1f. 25c. per day.

IN order to approach the railway bridge over the Mississippi, connecting Dunleith with Dubuque, the Illinois Central Railway have found it necessary to undertake the boring of a tunnel 900ft. long, through solid rock. This formidable undertaking has been let to the Rock Island contractors, and they have already commenced operations.

AT the meeting of the Royal Geographical Society on Monday next, Sir Roderick I. Murchison, Bart., president, will occupy the chair. It is anticipated that the meeting will be very crowded on account of the vast interest which is felt in the despatches and letters which have been received from Dr. Livingstone, and which then will be read.

SEVERAL meetings of men employed in the works throughout the iron manufacturing districts have been held, for the purpose of determining what course shall be taken if the masters enforce the reduction of which they have given notice. At most of the meetings it was resolved to resist the reduction, but at some of them the workmen did not come to any definite conclusion.

AT the Seventh General Meeting of the Eleventh Session of the Institution of Engineers in Scotland, held on Wednesday, March 11, 1868, Mr. Jas. M. Gale, C.E., president, in the chair, the following candidates for admission to the Institution were elected as members:—Mr. S. S. G. Copestake, Glasgow Locomotive Works, and Mr. James Goodfellow, Caledonian Railway Works, St. Rollox.

THE visitors to the South Kensington Museum during the week ending April 18, which, being Easter week, was free, were 31,800, the museum being open each day from 10 a.m. till 10 p.m. To the National Portrait Exhibition, by payment, 3,441; Total—35,241. Average of corresponding week in former years, 24,692; total from the opening of the Museum, 7,329,874.

THE material advance in the copper standard and the advance of £4 in the tin standard which have occurred within the last few weeks, have caused considerable improvement in Cornish mining, and several concerns are being worked with increased vigour. There is no longer any surplus adult labour, and the supply may be said to be unequal to the demand. Full time is now the rule, and the mining districts are generally assuming a healthy appearance.

WE, "Times," are informed by the Italian Consul-General that the Italian Ministry, desirous of facilitating as much as possible the transport of the luggage of passengers passing by Susa, have made arrangements with the Central Italian Railway Company by which the baggage will not in future be examined, but merely *plombé* (sealed), to preserve its identity, and it will be forwarded to its destination under bond of the railway company. This rule will apply to such luggage as passengers may have with them.

YESTERDAY week, two labourers were clearing away the slag from the furnace at the Wigan Coal and Iron Company's Works, which had to be done by blasting. One man was holding the rammer and the other striking the blows, when the charge exploded, and the former had his right hand blown clean off, his left hand terribly shattered, and his right arm broken in several places. Amputation of both limbs was necessary, and both men lie in a precarious condition.

SLIGHT shocks of earthquake continued to be felt at St. Thomas, the heaviest of which is thus referred to in the "Tidende" of March 18th:—To-day exactly four months have elapsed since our island was visited by the terrific earthquake on the 18th of November last year, and yet we have to record another shock which occurred yesterday morning, at fifteen minutes after seven. The duration was about thirty seconds, but the vibrations felt were rather more horizontal than vertical, and not so powerful as on the 18th of November. It was observed that the sea receded several feet. No particular damage occurred further than the bursting of a few old condemnable wall-works.

FROM the report of the Minister of Public Works for 1869, we learn that on December 31, 1868, 48,200,000fr. will have been expended on the Mont Cenis tunnel. Eight millions more are to be spent in 1869. If the expenses continue at the same rate, and if the tunnel be completed, as is hoped, in 1871, its entire cost (without reckoning the two bits of railway that are to connect it with Susa and St. Michael, and which will be enormously costly) will not fall far short of £3,000,000 sterling. A portion of this will be borne by France, as is only just, for, after Italy, she is assuredly the country that will gain the most by the completion of the colossal work.

AN additional statue has now been placed at the principal entrance to the members' private arcade in New Palace-yard, viz., one of King John. There are now three statues placed in the front of this arcade, viz., Alfred the Great, William the Conqueror, and King John. The remaining three vacant niches will shortly have statues placed in them. These statues are of Portland stone, and stand 6ft. 6in. high. The bronze statue of the late Sir Robert Peel, which stood for some time uncovered at the central entrance to New Palace-yard, having been removed on account of the ineligibility of the site, will be shortly placed on a granite pedestal at the entrance to New Palace-yard fronting Parliament-street and Great George-street.

THE Lille journals reports a terrible catastrophe in that city. A few days since the large steam-engine boiler—60-horse power—in the establishment of MM. Dequoy and Co., spinners, exploded with a frightful crash, spreading death and destruction around. The workpeople rushed out as best they could, in great consternation. But the calamity did not end there, as the tall chimney of the factory, which was upwards of 60ft. high, fell in the course of a few minutes afterwards, overthrown, no doubt, by the shock of the explosion. The people of the entire neighbourhood were frightfully alarmed. The material loss cannot as yet be computed, but six of the workmen were killed, some of them fathers of families, and eight wounded more or less grievously. The cause of the explosion is thought to have been a sudden flow of water into the overheated boiler.

ON Saturday last a second show of spring flowers was held in the gardens of the Royal Horticultural Society at South Kensington. These displays are distinct from the great exhibition of the season, and bear a valuable character of their own. The bulbous and other varieties of plants which are reared in this country under glass during winter, as well as the early spring flowers, are now of themselves sufficient to furnish a show, without including the forced blooms which are produced naturally later. The prizes on Saturday were mostly for spring flowers proper, but besides these, several special premiums were given for roses, and a good show of this flower was contributed.

WHILE workmen were digging for the site of a new building in Trongate, Glasgow, a few days ago, they came upon a number of coins, embedded in the clay a few inches under the surface. It is believed that there were about 100 pieces in all, but they had got dispersed and carried off by the men before anything was said of the matter. By considerable effort, however, eighty of the coins have been recovered, and of these nearly thirty are clearly recognizable as Elizabethan. All of them are much worn, but the impression can, in almost every instance, be readily made out. There are six or eight of King James's Irish pieces. All these bear traces of long circulation, and, in some cases, the irregularity of the edges would seem to indicate that they had been clipped. The coinage of Charles is as numerously represented as that of Elizabeth. Of the Scotch 40-penny pieces two or three are in very perfect condition. Others have been a good deal knocked about, but the small size and thinness of this coin seems to have saved it from being "sweated." The whole of the pieces seem to have been coined by the old process of hammering. The edges bear no trace of milling, and the impressions in some cases seem to have been imperfectly made. A shilling of Charles, for instance, looks as if, being twice struck, its position had been shifted between the blows.

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—2768, 2772, 2773, 2777, 2780, 2782, 2792, 2825

BUILDINGS AND BUILDING MATERIALS—2791

CHEMISTRY AND PHOTOGRAPHY—2760, 2785, 2801, 2816, 2828

CULTIVATION OF THE SOIL, including agricultural implements and machines—2763, 2804

ELECTRICAL APPARATUS—None.

FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2757, 2767, 2774, 2775, 2790, 2802, 2803, 2815 2833, 2841, 2843

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—2762, 2765, 2766, 2834

GENERAL MACHINERY—2759, 2770, 2779, 2787, 2788, 2793, 2794, 2799, 2800, 2809, 2811, 2814, 2824, 2826, 2830, 2836, 2842, 2845

LIGHTING, HEATING, AND VENTILATING—2820

METALS, including apparatus for their manufacture—2789, 2813, 2819, 2832

MISCELLANEOUS—2761, 2764, 2769, 2776, 2781, 2783, 2784, 2805, 2807, 2808, 2817, 2822, 2823, 2827, 2829, 2838, 2839, 2840, 2844, 2847, 2850

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2771, 2795, 2796, 2797, 2810, 2821, 2831

SHIPS AND BOATS, including their fittings—2798, 2843, 2849

STEAM ENGINES—2812

WARFARE—2778, 2837, 2846

2756 E. P. ALEXANDER. *Improvements in the manufacture of cast steel, and in furnaces to be employed therein.* (A communication.) Dated October 1, 1867.

This invention is not described apart from the drawings. —Patent completed.

2758 H. A. BONNEVILLE. *Improvements in machinery for spinning wool and other fibrous materials.* (A communication.) Dated October 1, 1867

This invention is not described apart from the drawings. —Patent completed.

2759 J. G. JONES. *Improvements in apparatus for hauling or winding ropes.* Dated October 1, 1867.

Here the patentee constructs a pulley or drum with nipping instruments to hold a rope securely when it is passed only partly around it, in the following manner:—He forms the pulley or drum with a groove passing round its periphery; the groove has inclined sides, and so becomes narrower as it proceeds towards the centre of the pulley or drum. Against the sides of this groove sliding pieces are arranged; there is a number of them around the circumference of the pulley or drum, and each pair of sliding pieces is fitted with a spring pressing them outwards from the centre of the pulley or drum. Lips on the sides of the groove limit the outward movement of the slides, and keep them in their places, and suitable stops in the groove prevent them moving laterally. When a rope is drawn tightly around the pulley or drum, it bears against the slides, and presses them inwards, overcoming their springs, until the incline of the groove causes the slides to tightly nip the rope, and as the pulley or drum revolves, it hauls on the rope and winds it forward.—Patent completed.

2760 G. ALLIBON and A. MANBRE. *Improvements in apparatus applicable to the conversion of cereal and vegetable substances into saccharine matter, in treating and purifying saccharine substances extracted from malt, fruits, and vegetables, in treating fatty matters, and in the manufacture of chemical products.* Dated October 1, 1867.

Here the patentees construct a close vessel, usually of wrought or cast iron, and of a cylindrical form; it is built up in segments, and, by preference, each segment is made semi-cylindrical, and of a convenient length; it is made with external flanges all round, and the flanges of the several segments fit accurately together, and are secured the one to the other by screw bolts. The segments are each covered internally with a sheet of lead, tin, copper, brass, silver, platinum, or other lining metal which will not act injuriously on the liquid with which the boiler or vessel is to be worked, or be injuriously acted on thereby. The edges of these sheets are turned down over the flanges of the segments, and when the segments are fixed together, the lining sheets are firmly clamped between the flanges. The ends of the boiler or vessel it is preferred to make hemispherical, and also in segments; usually they are made of cast iron, and strengthened with suitable ribs, whilst the cylindrical part of the boiler they prefer to make of wrought iron.—Patent completed.

2761 J. L. FIELD. *Improvements in candles, and in moulds for moulding the same.* Dated October 1, 1867.

This invention is not described apart from the drawings. —Patent completed.

2762 G. F. GREEN. *An improved combined billiard and dining or general table.* Dated October 1, 1867.

The object here is to combine with a dining or general table a billiard table, so that in private houses, for example, a separate room for a billiard table is dispensed with. For this purpose, upon the framework of an ordinary table the inventor mounts a billiard table capable of being raised up from such framework the required height by a worm shaft running from end to end of the frame, and geared into worm wheels, which latter are connected to jointed levers connected to lugs on the under side of the billiard table. The dining table is formed by loose covers fitted on to the edges of the billiard table, and when it is required to use it as a dining or ordinary table, such covers being placed on, the billiard table is lowered on to the framework, and it is then the requisite height for that purpose.—Patent abandoned.

2763 W. MITCHELL. *Improvements in apparatus for sharpening the blades of knives employed in mowing and reaping machines.* Dated October 1, 1867.

This invention relates, first, to an apparatus driven by gearing or manual labour; and, second, to an apparatus to be used in a similar manner to a file, both being designed for sharpening the angular knives employed in mowing and reaping machines, and particularly for entering and sharpening the inner angles or corners of such knives. The improvements consist, first, in the use and adaptation of a rotating disc or circular plate mounted on a shaft inclined from the vertical so as to place the disc at an angle upon the disc; a covering of emery composition is laid tapering from the periphery towards the centre, and the whole is driven by strap and pulley or gearing. The peculiar position and form of surface and narrow periphery of this emery-covered disc enables the operator to grind or sharpen each edge of the angular knives from the "point" to the "root" evenly, without leaving the inner angle unground, as by the present method employed for sharpening. Second, the improvements consist in the adaptation and use of a similar tapered emery surface, which is to be placed on a metal or wood foundation, and shaped and used like a file, one side of the emery file being narrow, and the other wide, the back or foundation being also tapered (the cross section being like a wedge), and the "tang" or handle being placed out of the centre and nearer one side of the file. These emery files thus formed are to be used in pairs, "right and left-handed," and are specially adapted for entering the angles and sharpening the said angular knives.—Patent completed.

2764 W. E. GEDGE. *Improvements in match boxes.* (A communication.) Dated October 1, 1867.

The outer appearance of these match boxes is, in every respect, similar to that of other boxes, but an inside arrangement isolates all the matches, and holds them in such a way that they cannot fall out. This arrangement is obtained by two sheets of sand or emery paper, previously undulated or corrugated; in bringing these two sheets together they form a series of tubes, each of which lodge a match; these latter being placed in them with the phosphorated part downwards, in such a way that, to withdraw them from their cells, a certain amount of traction must be exercised, and this traction will cause friction, and thus the match will issue from its case alight.—Patent abandoned.

2765 R. FLETCHER. *A new or improved castor.* Dated October 1, 1867.

This invention relates to castors for furniture or other purposes, and consists of a cup and ball and bearing plate. The ball is spherical and the cup flanged at the top, and open at the bottom. The diameter of the ball is a little greater than the depth of the cup, so that, when the bearing plate which closes the top of the cup is fixed thereto, the ball projects through and below the opening before mentioned in the bottom of the said cup. The covering and bearing plate is fitted with three or more rollers which rest upon the ball when the latter is placed in position. These rollers, when three are used, are so arranged that their lines of axes form an equilateral triangle, and when more than three are used their respective axes form a regular polygon. Being thus fitted, the ball is free to rotate in any direction in which the article supported thereby is moved.—Patent completed.

2766 T. E. CLARKE. *Improvements in the construction of bedsteads and mattresses.* Dated October 1, 1867.

This invention is not described apart from the drawings. —Patent completed.

2767 W. and S. SMITH. *Improvements in the construction and working of back rollers, carriers, and carriages in drawing, roving, and spinning machinery for wool, hair, silk, flax, and other fibrous substances.* Dated October 2, 1867.

This invention has for its object the more even working or winding backwards and forwards of the back rollers, carriers, and their carriages, on the above-named machines than any other modes hitherto employed; it is also a certain method of keeping the rollers true or straight during the alteration of the "ratches" from one length to another, and, consequently, effects a considerable saving in time and labour, as any one person can with ease make the alteration. By the application of these motions the back rollers and carriers are kept straight, or in an even line, as all parts must move simultaneously, thereby preventing a breakage in the pins and couplings; also avoiding a great amount of wear and tear in the couplings; consequently, there must be a considerable saving in the power required to drive these parts of the machinery. In applying this invention to the back rollers (and their carriages) of a spinning or "dandy" roving frame, for example, the patentees provide each back roller carriage with a screwed nut passing downwards through a slot in the carriage stand, having working through it a screw mounted in the carriage stand below in a line parallel with it; the outer end of each screw is furnished with a small bevel wheel gearing with a similar wheel keyed upon a shaft running at right angles to the screws for the whole length of the machine. This shaft is carried in suitable bearings, and is provided at one end with a winch handle, by means of which it can be turned. It will be evident that upon turning this shaft, the bevel wheels will cause all the screws to turn simultaneously, and thus advance or withdraw all the back roller carriages with their rollers at the same time, and at the same speed. The above is but one of the arrangements described in the specification.—Patent completed.

2768 R. H. TAUNTON. *Improvements in the manufacture of strip or sheet iron for certain purposes.* Dated October 2, 1867.

This invention relates to the making of strip or sheet iron for the manufacture of tubes for locomotive, marine, or other tubular boilers, or tubes required to be flanged or expanded. Hitherto a difficulty has existed in the manufacture of tubes for the purposes named, even when extra quality of iron is used, to permit the operator without fracture to spread the ends outward, so as to form flanges, an operation essentially important for securing iron tubes to such boilers; and this hitherto difficulty or defect has arisen from the fibrous course of the iron on the outsides of the sheets or strips being entirely in its lengthway direction. The object of this invention is to overcome this defect, which the patentee does by so arranging and building up the pile of iron from which he purposes rolling out the finished strip or sheet that, instead of the grain of the finished tube being in its lengthway course, it is so arranged that a sufficient portion of the grain is distributed by preference on both sides in a transverse direction, or more or less oblique, thereby permitting the tube to be hammered, beat, enlarged, and spread over into a flange without splitting or cracking on its lengthway or other direction under this operation.—Patent completed.

2769 F. PARKES. *Improvements in the manufacture of certain descriptions of nails.* Dated October 2, 1867.

The patentee claims the manufacture of nails known as "clasp," or such like description of nails requiring small heads and sharp points, in the manner substantially as described, that is to say, such nails being cut from the ends of metal strips rolled thick in the middle and thin at the edges.—Patent completed.

2770 A. C. HENDERSON. *Improvements in sewing machines.* (A communication.) Dated October 2, 1867.

The object here is to produce with one machine all the various species of stitches at present known, that is to say, the chain, the lock, and the shuttle stitch. The apparatus, as usual, is mounted on a table standing on cast-iron feet, and supported by a cast-iron plate, with openings therein for the play of the various parts. The details of the invention, as set forth in the specification, are too voluminous to be produced here.—Patent abandoned.

2771 C. J. APPLEBY. *Improvements in railway fastenings.* Dated October 2, 1867.

This invention consists in the application of steel collars of suitable form to the necks of bolts or railway fastenings, and the object of the invention is to prevent the great wear on bolts or fastenings caused by vibratory contact with steel or other rails.—Patent abandoned.

2772 C. RITCHIE. *Improvements in mechanism or arrangements applicable to steam boilers and their furnaces, the said mechanism or arrangements being especially applicable to those boilers and their furnaces with which gas is the combustible used.* Dated October 2, 1867.

This invention consists in the adoption in steam boilers of arrangements of mechanism whereby a float or other equivalent contrivance may be used in connection with a damper, or other such like appliance, in or appertaining to the flue or passage for carrying off the products of combustion and heated air, thus controlling the generation and pressure of steam, with suitable provision for regulating in an automatic manner the supply (of gas for boilers heated by gas), and of air and water to boilers heated by gas or other means.—Patent abandoned.

2773 J. H. NELSON and T. BRIGGS. *Improved means and apparatus for heating the feed water of steam boilers and other general purposes requiring heated water.* Dated October 2, 1867.

Here, in the main flue, beyond the boiler or boilers, the patentees place an auxiliary flued boiler, with a certain number of tubes or pipes in the flue of the said boiler, either in a horizontal or vertical position, according to circumstances, the size of the boiler and number of tubes being dependant upon that of the amount of heated water required. This boiler or economizer is fitted with the usual fittings of boilers, some of which will require to be extended through the brickwork of the flue, so as not to impair the efficiency of the latter. The economizer is filled with cold water, and a pipe is connected to the boiler or boilers. The fire being lighted, the flames and heat, after passing through and round the boiler or boilers, on their way to the chimney stack, surround and pass through the economizer, heating the water therein. The water so heated is admitted to the boiler or boilers, and a continuous supply maintained, all cold water after the first feed passing through the adjunct or feeding boiler, which, as it will have been seen, is heated by the waste heat on its passage to the chimney stack. The other vessels referred to in the title of the invention are dye pans and vats and other vessels used in manufactories where heated water is required, the water being drawn direct from the economizer instead of from the steam boiler or boilers (as is now the case) with economical results.—Patent completed.

2774 M. WRIGHT. *An improved species of fabric.* Dated October 2, 1867.

Here the inventor produces a fabric lustrous, and having a mingled appearance, the mingling being more regular than in fabrics known as "Debeges," and those of a similar class. He effects this by weaving what is known as Grundrell warp (consisting of two colours of cotton twisted together) with what is known as melange weft.—Patent abandoned.

2775 G. RAMSDEN, L. WEBSTER, and J. WALKER. *Improvements in fulling machines.* Dated October 2, 1867.

This invention consists in the employment of a flanged cylinder, and two, three, or more pressing rollers applied thereto at different points of its circumference, betwixt which the fabrics are caused to pass in a crimpled or crumpled state as they issue from the ordinary squeezing rollers, or from a conducting spout into which they are pushed, and thereby crimpled or crumpled.—Patent abandoned.

2776 F. J. JEFFERY. *Improvements in urinals.* Dated October 2, 1867.

This invention consists, first, in supporting the urinal proper on or by hinges or trunnions, or their mechanical equivalents, so that it can be folded up when out of use, and made to lie flush with the wall, washstand, or other structure in which it is fitted, and practically be invisible, presenting only its side or back, which can be ornamented in any desired manner. Second, in combining with urinals supported according to the first part of this invention a water supply pipe with a valve or tap therein, so that the folding down into position for use shall open the valve or tap, and allow water to flow, and the folding up close of such flow; and, third, in making urinals constructed according to the first or both the first and second parts of the invention self-emptying and closing. For this purpose the patentee forms a receptacle at the back of the urinal proper into which the liquids flow. When these reach a certain weight, the projecting part is overbalanced, the contents discharged at the back, and the flow of water shut off.—Patent completed.

2777 C. MACE. *Improvements in marine steam boilers.* Dated October 2, 1867.

Here openings are made in the sides of the boiler, and through the water spaces between the tubes, by the openings, a cleansing tool can be introduced laterally between the tubes, so as to clean in between them horizontally, and this in conjunction with cleaning them from the top as heretofore practised ensures the effectual removal of the scale and deposit from every part of the tube plate, and

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from every part of the tubes. These side openings into the boiler are closed with doors or covers when the boiler is at work.—Patent completed.

2778 H. HASCHKE. *Improvements in breech-loading fire-arms.* (A communication.) Dated October 2, 1867.

This invention relates to an arrangement by which a breech block is drawn back and raised or turned upon a hinge, and the hammer by the same movement cocked or half cocked, by means of a lever at the side of the gun, provided with a knob for moving it. The invention also relates to an arrangement for extracting the empty cartridge case. Reference to the drawings is necessary for a clear description of the invention.—Patent completed.

2779 W. R. LAKE. *Improvements in machinery for sewing boots and shoes.* (A communication.) Dated October 2, 1867.

The object here is to produce sewing mechanism by which soles and welts can be united to the other portions of boots and shoes. The sewing mechanism is so made and arranged as to imitate in its operations the motions of the hand-in-hand sewing. The perforations through which the needle goes are made by an awl which recedes as the needle advances, the awl and needle being hung point to point on separate spindles or axes, or on the same axis if desired. The work is placed on a last, which is held adjustably in a last holder, and this last holder is movable on a vibrating or adjustable table, which is pressed upwards by a weighted lever, so as to press or bear the work constantly against the sewing mechanism, or against the sewing gauge. The frame which carries the sewing mechanism is made to vibrate on a weighted lever, instead of the table, if preferred. The sewing mechanism is combined with devices for stripping the leather from the awl and needle, and both the awl and the needle are operated by means of cam grooves or cams. The feed is produced by means of a feeding awl which has two movements, a vertical movement and a reciprocating lateral movement, and in conjunction with the feeding awl there is a feed dog which is connected to the same lever or arm that carries the feeding awl, the said dog having a blunt edge which rests in the usual "channel" made in the sole of a boot or shoe to receive the stitches, and the feed dog consequently serves to guide the work. The said feed dog has no vertical movement, but only a reciprocating lateral movement, and it serves also as a gauge for the work to rest against.—Patent completed.

2780 W. SPENCE. *Improvements in, and applicable to, ovens, boilers, and other apparatus in which heat is employed.* (A communication.) Dated October 3, 1867.

This invention has for its object the economy of fuel and labour, with the maintenance of an increased regularity of temperature, and consists in the adaptation and application to ovens, boilers, and other apparatus in which heat is employed, of an endless tube disposed in a coil or coils, in such a manner as to be capable of receiving heat from a furnace or fireplace, and through which heated water is caused to circulate.—Patent completed.

2781 R. DICK. *Improvements in heating blast for smelting and other furnaces, and in the apparatus or means connected therewith.* Dated October 3, 1867.

Here the waste gases of blast or smelting furnaces, in place of being allowed to escape into the atmosphere, are carried into a pipe or duct situated in any convenient position, the pipe or duct being surrounded by a series of annular chambers into which the blast from the blowing engine is led. On passing into the first annular chamber the blast escapes from it into the second annular chamber by an orifice situated at the side opposite to that from which it entered, and in passing through the series of chambers it continues to escape and enter them at alternate sides; thus a circulation of the blast around the heated pipe or duct is effected, and the blast becomes the recipient of the heat contained in the escaping gases. The blast after being heated is led from one of the chambers by a pipe into the tuyeres.—Patent abandoned.

2782 H. D. POCHIN and E. HUNT. *An improvement in the construction of furnaces, flues, and vessels which are subjected to high temperatures.* Dated October 3, 1867.

This invention consists in the use of chrome ore in the construction of furnaces, flues, and vessels, or such parts thereof as are subjected to intense heat.—Patent abandoned.

2783 G. P. DODGE. *Improvements in india-rubber mats.* Dated October 3, 1867.

This invention relates, chiefly, to mats for cleansing the feet, formed of strips of india-rubber interwoven or plaited together, and afterwards united by vulcanizing, and consists in using twisted or spiral strips instead of the flat strips hitherto employed.—Patent abandoned.

2784 W. E. GEDGE. *A portable laboratory, specially intended for photographic excursions.* (A communication.) Dated October 3, 1867.

Reference to the drawings is essential for an intelligible description of this invention, unless we devoted more space to it than we can here afford.—Patent abandoned.

2785 A. M. CLARK. *Improvements in the treatment of cotton and other fibrous materials used in dentistry.* (A communication.) Dated October 3, 1867.

This invention relates to an improved treatment of cotton or other fibrous materials, to be used for dental plates more particularly, and consists in mixing with cotton, flax, hemp, or other fibrous material which has been previously dissolved or treated with acids, as is now done in the making of collodion and gun cotton, shellac, or other equivalent material, with or without suitable colouring material in a state of solution, when the mixture is then dried on a glass or other surface.—Patent abandoned.

2786 E. B. DE RICHEBOURG. *A new and useful mode of advertising.* Dated October 3, 1867.

Here the inventor avails himself of the external and internal surfaces of all kinds of small boxes or cases of wood, cardboard, and other appropriate materials in daily use, for the purpose of containing various articles—such as lucifers, pipe lights, pens, wafers, sealing-wax, perfumery, blacking, preserved fruits, or biscuits—and which said surfaces he proposes utilizing by printing or fixing thereon advertisements of other persons than the manufacturers or vendors of the said goods.—Patent abandoned.

2787 G. TOWNSEND. *An improvement or improvements in the manufacture of machine needles.* Dated October 3, 1867.

This invention consists, first, in making machine needles with three or more longitudinal grooves, instead of two only, as at present employed. The patentee prefers to use three grooves, the third being situate just below the shank of the needle; the advantage of this third groove is that it receives the sewing material and insures the formation of the loop; or, to obtain the same result with two grooves only, he forms the back groove in different depths of sinking.—Patent completed.

2788 G. MELLOR. *Improvements in machinery for the manufacture of nails and spikes.* Dated October 3, 1867.

The patentee claims, first, the construction and arrangement or combination of the parts of feeding rolls for feeding the rod of iron into the machine, and the means of operating the said rolls, substantially as described and illustrated in the drawings. Second, the construction and arrangement or combination of the parts of the eccentric rolls and racked slides for gripping the rod during the heading process for pointing the nail or spike, and for preventing the lateral spreading of the nail or spike, and the means of operating the said rolls and slides, substantially as described and illustrated in the drawings. Third, the construction and arrangement or combination of the parts of the heading tool, and the means of operating the said heading tool, so as to make it act also as a stop, substantially as described and illustrated in the drawings. Lastly, the general arrangement or combination of the said feeding, gripping, pointing, and confining parts, and the cutting-off tools into a machine, substantially as described and illustrated in the drawings. We cannot here devote space to a description of the details of the arrangements for carrying out the invention.—Patent completed.

2789 A. T. BECKS. *Improvements in the utilization of Bessemer steel scrap.* Dated October 3, 1867.

The patentee claims treating the said scrap in a blast furnace of the kind called a lumping or charcoal fire, either with or without the addition of lime or chalk, substantially as described.—Patent completed.

2790 T. SAGAR and T. RICHMOND. *Improvements in looms for weaving.* Dated October 4, 1867.

This invention relates to the taking-up motion with a single positive taking-up roller. The novelty consists in an improvement in the method of drawing the ratchet wheel, or other wheel used for the like purpose. The inventors propose to use, instead of the ordinary catches or clicks, a number of thin metallic plates which will require no adjustment whatever for length; the thickness of the plates determines the motion of the ratchet wheel; and the motion of the plates which work the ratchet wheel is governed by the varying diameter of the cloth on the cloth beam by connecting rods, levers, or eccentrics, or other means. They also regulate the letting-off motion on the yarn beam in a similar manner. The invention relates also to the "weft fork" and grid. They propose to substitute for the ordinary weft fork (which has heretofore been made with the prongs open at the ends) one of a similar kind, with the exception that, instead of the prongs being open at the end, they are closed like a grid. They also propose to make the grid in the slay project so as to allow the weft fork to work through it.—Patent abandoned.

2791 S. JOHNSON. *Improvements in machinery for moulding, perforating, and pressing bricks and other articles.* Dated October 4, 1867.

This invention is not described apart from the drawings.—Patent completed.

2792 H. PINKUS. *Methods of constructing steam generators for engines, new furnaces connected therewith, and the mode of working them with machinery, in combination with the uses to which they are applicable.* Dated October 4, 1867.

This invention is not described apart from the drawings.—Patent completed.

2793 A. FORD. *An apparatus for assisting swimming.* Dated October 4, 1867.

Here the inventor provides a glove to be worn on each hand, between the fingers of which is placed a material which, when the hand is extended, shall represent a membrane, filling up the natural spaces between the fingers and the forefinger and thumb, and which forms folds between the fingers when they are approximated to each other, after the manner of a duck's foot.—Patent abandoned.

2794 J. GUTMANN. *Certain improvements in sewing machines.* Dated October 4, 1867.

This invention is not described apart from the drawings.—Patent completed.

2795 W. SMITH. *Improvements in points or switch indicators used on railways.* Dated October 4, 1867.

This invention relates to point or switch indicators for showing to the signalman and driver of an approaching train the position of the points or switches, for the purpose of preventing accidents. The inventor employs in connection with the ordinary semaphore signal or indicator an additional arm, which he calls the danger arm, and prefers that it should be on the right-hand side of the indicator pillar or post when the tongues of the points or switches are not properly open or closed for the main or branch lines. To the rod or stretcher that works the points or switches he joints one end of a connecting rod, the other end of which is jointed to a lever, to the top of which is jointed a bar, frame, or connecting rod having slots at each end, in which slots are placed pins or studs fixed to short arms of double levers, the long arms of which are jointed to a vertical rod extending to the upper part of the pillar or post, and connected to the lever of the additional or danger arm so that a very slight movement of the switch is sufficient to place the arm in its horizontal or danger position. At night he uses a lamp, inside of which is placed a slide or frame containing coloured glasses, which are moved between the flame and the lens of the lamp by means of a lever connected with the rod of the ordinary arm, thus indicating the position of the points or switches.—Patent abandoned.

2796 J. OFFORD. *Improvements in railway and other carriages and various parts of the same.* Dated October 4, 1867.

These improvements consist, first, in the application of india-rubber to the axle boxes of carriages. The patentee fixes two metal flanges to the axle box some distance apart from each other, and he then fits metal sockets covered with india-rubber on their outsides between the two metal flanges; these sockets are to hold the spokes of the wheel in their places. The invention consists, second, in making axle blocks of metal and india-rubber combined together in the process of vulcanizing. The patentee takes two plates of metal with holes made in them, or lugs to receive the bolts to fix them to the axle and spring; he then takes india-rubber, prepared for the purpose, and of the desired thickness, and places it between the two metal plates; he then subjects the two plates with the india-rubber between to a process of vulcanizing, which will cause the two plates of metal to adhere firmly to the india-rubber. The invention consists third, in making the glass frames of carriages of metal and fixing india-rubber or other soft material round their edges to prevent their rattling against the window frames. The invention consists, fourth, in preventing the rattling of carriage lamps. He makes metal sockets, and lines their insides with india-rubber, or other soft material, to isolate the lamp iron from the carriage, or the lamp from the lamp iron. The invention also includes the application of india-rubber to the doors and locks of railway carriages.—Patent completed.

2797 R. ELLIS. *Apparatus for disconnecting conveyances from animals drawing the same.* Dated October 4, 1867.

We cannot here quote the details of this invention.—Patent abandoned.

2798 G. H. D. MATHIAS. *Improvements in the construction of ships and vessels.* Dated October 4, 1867.

The object of this invention is to gain an increase of speed and stability for steam ships by so firmly connecting two sister ships that there cannot be the least fear of their parting at sea. The ships are built as ordinary vessels, only the proportion of the length to the breadth is about double that of ordinary steamers, about fifteen or sixteen to one. These vessels are constructed side by side with a framework in them (about four or five such in each vessel). This framework rises above the deck to some height, and is contrived so as to exactly receive the connecting tubes or girders; four or more tubes of open or lattice girder work are constructed; their length is about three times the width of one of the vessels. These tubes will also support a wooden deck extending over most of the space between the sister ships, and this wooden deck will be made of open grating work, fore and aft, to let any sea that is shipped pass through immediately.—Patent abandoned.

2799 J. H. JOHNSON. *Improvements in machinery or apparatus employed in the manufacture of bread.* (A communication.) Dated October 4, 1867.

This invention consists in the use in braid-making machines of a reciprocating "latch" needle, operating in combination with a vibrating lever, and certain thread guides, so as to produce a braid from a thread carried by the lever; also of a certain plate and spring combined with the above in order to flatten the braid as it leaves the machine. The invention cannot be fully described without reference to the drawings.—Patent completed.

2800 R. HATTERSLEY. *Improvements in mechanism or apparatus for distributing printers' type ready for hand or machine composing.* Dated October 4, 1867.

The object here is to distribute type from the line as set up for printing by operating by hand upon keys, the type being manipulated or acted upon entirely by the mechanism, the operator having simply to distinguish each type as it comes forward, and press a corresponding key to distribute the type into its proper receptacle with great rapidity. The improvements, when used for distributing type ready for use in a composing machine, are combined with a modified form of the machine for classing type, for which letters patent were granted to the present patentee December 17, 1862 (No. 3365), but when used for distributing type into the ordinary printers' type case, only a short length of the channels or grooves leading to the table are used, shoots being substituted, so that the type may slide down inclines by gravity to their own particular case. We cannot here produce the details of the invention.—Patent completed.

2801 J. ANDERSON. *Improvements in obtaining chlorine, sodium, potassium, phosphorus, and their compounds.* Dated October 5, 1867.

This invention has for its object the obtaining of chlorine, sodium, potassium, phosphorus, and their compounds, in an improved and economical manner, and it consists, principally, in the application of a very high temperature to materials containing the substances sought in the presence of other substances required in bringing about the necessary reactions, the requisite high temperature being applied by passing through the materials a gas, such as carbonic oxide, or nitrogen containing no free oxygen.—Patent completed.

2802 W. E. GEDGE. *An improved formation of wrapper or bale cloth specially adapted for packing combed wool.* (A communication.) Dated October 5, 1867.

This wrapper is composed of a strip of cloth having a length of about 11ft. 2in., by a breadth of about 2ft. 11¼in., to which are fitted two strips of the same width, and having each 5ft. 7in. in length. The most suitable dimensions for a wrapper for packing combed wool are those above given. The wool is placed in the centre of the wrapper, and the sides are folded over upon it and sewn together.—Patent abandoned.

2803 G. MARTIN. *Improvements in the treatment of mixed fabrics, and the extraction of wool therefrom, and in the construction of apparatus to be used for such treatment, and for other purposes.* Dated October 5, 1867.

Here, after the usual process of steeping the materials in acid or other chemical, the same are placed within a stove or vessel similar to the ordinary rotary boiler, but of such dimensions as may be necessary to carry the quantity of rags, cotton, or other material to be operated upon, the apparatus being actuated by suitable gearing connected with a source of motive power, as well understood. In order to raise the heat requisite to effect the objects of this invention, the trunnions at either end of the stove or vessel, and upon which it rotates, are made hollow; steam or hot water pipes or flues, charged with heated air, are so arranged as to pass through the trunnions for the purpose of heating the interior of the stove or vessel. The interior of the stove or vessel is provided with spikes, ledges, or other analogous contrivance or contrivances for agitating and separating the rags, cotton, mixed fabrics, or other materials to be operated upon or dried as the vessel rotates, the steam or moisture evolved or given off being carried away by an exhaust pipe which passes through the trunnions, or through suitable openings in the side or ends of the vessel itself.—Patent abandoned.

2804 J. S. WILLIAMSON. *An improved apparatus for drying corn, malt, or other similar substances.* Dated October 5, 1867.

This invention consists in passing corn or other substances upon a screen or screens through an intensely heated chamber, constructed either of iron or brick, whereby the smoke and gases generated by the fire are prevented from coming in contact with them. The screen or screens have perforated bottoms, and have a reciprocating motion imparted to them by a crank or other mechanical contrivance.—Patent abandoned.

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2805 W. LOW and J. TREADWELL. *Improvements in riveting the soles of boots and shoes.* Dated October 5, 1867.

This invention consists in riveting the soles of boots and shoes in a groove or channel with a particular shaped rivet, in such a manner as to present all the appearance of a sewn boot or shoe, having also greater strength, and requiring fewer rivets.—Patent completed.

2806 A. M. GILLHAM. *An improved steam engine.* Dated October 5, 1867.

The main shaft or arbour is to have a right-hand and left-hand screw, having a suitable nut or nuts or one or more proper steadfasts in lieu thereof, working either therein or thereon; the said nut, nuts, or steadfasts are to be worked backward and forward by a piston with suitable connections, so as, for instance, that, in the one movement of the piston, one nut or steadfast shall be fast in such way as in moving on the shaft the said shaft shall be caused to revolve, and on the reverse movement of the piston the said nut or steadfast shall be released from such fixture, and the second nut or steadfast shall, in such like manner, and in lieu thereof, become fast, and traversing with the reversed movement of the piston in or on the reverse screw of the shaft aforesaid, shall cause the said shaft to revolve in the same direction as at the first.—Patent abandoned.

2807 A. BRADBURN and S. T. MARSH. *Improvements in jointed rules.* Dated October 5, 1867.

This invention consists in providing a means whereby jointed rules, whether single, double, or of more folds, may be fixed and set rigidly to any desired angle, or to form a straight-edge. This is effected, for instance, in the case of a single-jointed rule, by the employment of a slide or bolt working by a slot upon suitable pins or guides, and this slide or bolt is attached upon one of the inner edges of the rule, so as to slide in and out of the jointed position which is suitably recessed at given angles for such purpose, a thumb-piece or other similar means being provided for actuating the slide or bolt. In applying the invention to rules having a number of joints or folds, the patentees can use such number of these slides or bolts as may be requisite.—Patent completed.

2809 L. WILLIAMS. *An improved combined lift and force pump.* (A communication.) Dated October 5, 1867.

The object of this invention is to enable an ordinary pump to throw a constant stream of water with only one foot-valve. To a suitable casting or valve-box containing the foot-valve of the pump, placed immediately over the suction pipe, the inventor connects three barrels, the area of the middle barrel being equal to the combined area of the two outer barrels. The middle barrel is fitted with a ram, and the said barrel is fixed immediately over the foot-valve of the pumps; the other barrels are each fitted with a bucket, and the rods thereof, as also that of the ram, are connected by their upper ends to a cross head, the ends whereof work in guides, and to this said cross head a connecting rod is attached, communicating with any suitable prime mover. The kind of valve he proposes to employ is an equilibrium valve, well known by miners as the Cornish valve. Another important feature in this invention consists in adapting a hinged or sliding door to the valve-box, by which access can be readily had to the valve when necessary. The barrels containing the buckets are connected together by a branch pipe, so as to form one outlet for the flow of water. The ram and buckets move up and down together; the down stroke of the ram forces the water through the buckets, and the up stroke thereof forms a partial vacuum in the barrels, by which they are again filled with water at the same time the buckets are forcing the water out of their respective barrels, and by these means a continuous stream of water may be raised and thrown. Instead of three barrels, two only may be used, one fitted with a ram, and the other with a bucket, the action being precisely the same, viz., to raise and throw a constant stream of water. —Patent abandoned.

2810 J. PIDDINGTON. *Improvements in pneumatic springs, specially applicable to railway rolling stock.* (A communication.) Dated October 5, 1867.

This invention consists in employing the elasticity of air for the construction and arrangement of springs suitable for any kind of industrial requirement, but chiefly for the rolling stock of railways, as buffers, drawing and bearing springs. A cylinder closed at one end, and the inner surface of which is turned so as to be perfectly smooth, is made of such strength as to contain air at any fixed rate of pressure, an air-tight piston being so arranged as to work in the cylinder. If by the force of any weight or sudden shock the piston is driven back into the cylinder, the pressure of the air increases in proportion to the decrease of volume thus produced, and upon the force being entirely or partially removed, the elasticity of the air restores the piston to its original position, or to a position proportionate to the remaining weight or force to be sustained or resisted.—Patent completed.

2811 N. F. TAYLOR. *Improvements in means or apparatus to be used in impregnating air and aeriform fluids or gases with hydrocarbons, and in burners used in burning the inflammable air obtained.* Dated October 5 1867.

Here, upon endless chains or bands having motion given to them by a pair of rollers, and supporting at short intervals apart pieces of perforated flannel, felt, or sponge, or other open work capable of holding hydrocarbon liquid in suspension, is caused to travel a tube, or endless and elongated chamber, in which the pieces of flannel or other open or porous matter act, somewhat as a series of pistons or buckets, to prevent as much as possible the passage of the air or other aeriform fluid to be impregnated except through the porous substance. The hydrocarbon liquid is supplied to the lower part of this tube or endless chamber from a suitable reservoir placed by the side of it through a passage with a valve acted upon by a float into an attached chamber, which chamber communicates with the bottom of the tube or endless chamber by a tube or limb of the endless tube or chamber, up which it is caused to flow to the top, and then down the opposite side or limb thereof, and out at the lower part of such side or limb. The upper part of the endless tube or chamber is in communication with the upper part of the reservoir of the hydrocarbon, so as to equalize the pressure thereof. There is also an air passage from the float chamber to the upper part of the reservoir. The air or aeriform fluid to be impregnated is forced through the apparatus by bellows placed in a chamber where the movable head or heads of the bellows act as a piston or pistons with sliding valve passages operated from a shaft worked by a spring or weight and suitable gear. By these means the atmospheric air surrounds all parts of the endless chamber. —Patent completed.

2812 J. GOODFELLOW. *Improvements in steam engin* Dated October 7, 1867.

This invention consists in improved arrangements for reducing the pressure on the valve and reducing the friction to a minimum. The top of the valve is open, instead of closed, as at present, and on the top there is a plate cast or connected to a piston working in a short cylinder, there being a hole through the plate and piston to allow steam to pass to the top of the said piston to balance the pressure. Or instead of the hole a passage may be made from the steam pipe to the top of the piston. The inventor supplies steam to the valve through the central port generally used as the exhaust, and exhausts the steam through the outer parts generally used as the steam ports. The steam passes through the central port into the interior of the valve, and thence through the hole in the plate and piston to the top of the piston, and as there is nearly the same pressure of steam on the under side of the plate and top of the piston, the valve is released from the pressure of the steam, and enabled to be moved to and fro with a small amount of power and diminished friction, and similar arrangements may also be applied to a cut-off valve.—Patent abandoned.

2813 J. SMITH. *Improvements in machinery or apparatus for moulding metal.* Dated October 7, 1867.

One part of this invention consists in combining and arranging mechanical means for lifting the top moulding box and lowering the bottom moulding box either simultaneously or separately. To produce the desired effect the patentee employs two or more eccentrics fixed on a rotary shaft, and places them in two opposite positions, and connects them by rods or bars to the top and bottom boxes respectively, by the action of which motion will be given to the boxes in opposite directions to each other—Patent completed.

2814 H. FAULDER. *Improvements in machinery or apparatus for washing and cleaning currants and raisins or other similar fruit.* Dated October 7, 1867.

This invention consists of a novel combination of apparatus for washing, rinsing, and drying the said fruit. The washing of the fruit is effected in a vessel, the whole or a sufficient portion of the surface of which is perforated with holes of a suitable size to retain the fruit, and at the same time to allow of the passage of the extraneous matter. The said vessel is, by preference, so shaped as that the fruit can be readily thrown into the same from a scoop or shovel, and when sufficiently washed can be discharged therefrom by tilting or inverting the said vessel, for which purpose it may be hinged to the framing of the apparatus. During the process of washing, the said vessel is partially immersed in a cistern containing water, in which the currants are agitated by stirrers or beaters attached to a shaft which revolves in the vessel, the cleansing of the fruit being assisted by admitting a stream of clean water to the interior of the washing vessel, an overflow passage being provided to maintain the surface of the water in the cistern at a constant and suitable level. —Patent abandoned.

2815 C. J. GALLOWAY. *Improvements in looms for weaving.* Dated October 7, 1867.

This invention has reference to a former patent, dated September 18, 1867 (No. 2624), granted to C. Litster and G. Storey. One of the present improvements consists in employing, in the place of the piston and cylinder, a bellows or collapsible air-tight bag, which may either be actuated in the same manner as the piston in Litster and Storey's arrangement, or, by preference, the bellows or bag is acted upon by a spring of any suitable form, or an elastic cushion inflated or otherwise tending to compress the bellows. At the forward beat of the lathe a rod connected to the bellows comes in contact with and is thrust back by a stop on the loom frame, and thus causes the bellows to be distended. The bellows are held in this position by a catch on the lathe, which is so acted upon by a lever worked by the gearing to the healds of the loom, or by any other suitable part of the mechanism of the loom, that at every alternate backward beat of the lathe the catch is released, and the bellows are compressed by the spring, so as by the blast of air produced to throw the shuttle along the race. Another part of the invention has for its object to form a cushion in the shuttle-box for the shuttle to strike against. Another part of the invention consists in providing the internal surfaces of the shuttle-box with a packing of leather, india-rubber, cloth, or other suitable material of a yielding nature, between which the shuttle fits sufficiently tight to prevent its rebounding from the shuttle-box until it is forced out by the action of the blast.—Patent abandoned.

2816 C. D. ABEL. *A new or improved process and apparatus for refining camphor.* (A communication.) Dated October 7, 1867.

This invention consists in refining camphor by a process of distillation, and by running the same while in a fluid state into moulds, instead of by the process of sublimation heretofore employed, whereby the cost of manufacture is greatly reduced.—Patent abandoned.

2817 R. P. FAUCHEUX. *Improvements in pipes and cigar tubes.* Dated October 7, 1867.

This invention has for its object improvements in pipes and cigar tubes, and relates to the applications of means whereby the nicotine and other condensible noxious vapours given off during smoking are arrested and prevented passing into the mouth of the smoker. For this purpose the patentee forms on or fixes to the stem of the pipe or cigar tube a pointed tube which enters a tube or reservoir placed on the stem of the pipe or cigar tube. He also employs another pointed tube which also enters the tube or reservoir, which may be fixed at the middle, end, or other suitable part of the stem of the pipe or cigar tube. If desired, the tube or reservoir may be supplied with water, and in some cases he forms such reservoir in two parts separated from each other by a portion of the stem of the pipe or cigar tube, each part having one of the pointed tubes entering therein.—Patent completed.

2818 J. A. MAYS. *Improvements in mining and other lamps, and in lamp and candle cases and holders.* Dated October 7, 1867.

Provisional protection has not been granted for this invention.

2819 D. SWAN. *Improvements in the manufacture of zinc.* Dated October 7, 1867.

This invention consists in separating the zinc from the materials operated on, and condensing it in the form of fume, which is collected and afterwards treated by well-known processes to obtain the pure metal. For this purpose, a cupola blast furnace, or other convenient furnace, is employed, and into it the ores or materials are introduced with such a quantity of coke or other carbonaceous matter as is sufficient to bring the entire mass to the heat that will reduce and volatilize the zinc, when the impurities will sink to the bottom of the furnaces, whence they can be withdrawn from time to time. In order to collect the zinc fume the furnace is provided with a flue leading into a series of chambers of sufficient capacity to allow the whole of the vapours to condense, and the zinc is collected in these chambers and is removed thence to be treated in the ordinary way.—Patent abandoned.

2820 H. TROTTER. *Improvements in the manufacture and packing of fire-lighters and artificial fuel.* Dated October 7, 1867.

Here turf is first cut into sods from the bog in the ordinary way, and then weathered and dried in the usual manner. The sods are then taken into a hot room and thoroughly dried, after which they are taken to a sawmill and cut into pieces of suitable form and size, according to the purpose for which they are intended. These thoroughly dried pieces of turf are then either dipped into a thick solution of clay and water first, and, when dried, immersed in cold coal tar oil alone, or they are immersed in a sufficient quantity of cold coal tar oil mixed with clay, which latter regulates in either case the infusion of the oil into the turf, which retains its solidity and requires no further labour or expense in drying out the surplus oil with which the turf is overcharged, as is the case when the turf is saturated with oil alone, and it also leaves a coating of clay which fills up the pores of the turf and prepares it for the next process. The pieces of turf thus prepared are now dipped into hot resin, which is mixed and tempered with tar oil or mineral shale grease or oil (about 1lb. to 2lb. of resin) to make the resin together, and not so liable to break, and also to cause it to flow and spread over a larger surface by being more liquid. The dipped pieces of turf are then thrown into sawdust from the turf, which may be mixed with a little ground cannel or other coal to increase the heating properties, and are afterwards packed into pasteboard, strawboard, wooden or tin canisters, or other vessels or parcels capable of obtaining the same, with a sufficient quantity of sawdust, ground turf, or other cheap dust or like material to cover them well over when packed, the packing material being in most cases consumed with the fire lighter or fuel.—Patent abandoned.

2821 T. OLLIS. *Improvements in registering apparatus applicable to omnibus and other vehicles.* Dated October 7 1867.

This invention consists in the application of apparatus similar to that used for stamping or endorsing purposes, for registering or indicating the number of passengers that have travelled by an omnibus or other vehicle. We cannot here give space to the details of the invention.—Patent completed.

2822 J. H. BROWN. *Improvements in utilizing refuse animal matters, and producing skins and sheets therefrom.* Dated October 7, 1867.

This invention has for its object the production of skins or sheets for the purposes of writing, drawing, tracing, bookbinding, box and case covering, and other purposes for which vellum, parchment, cotton, cloth, and the various sorts of leather are employed. For these purposes the inventor takes the refuse skins, or parts of skins, fleshings, roundings, tendons, and all other suitable animal matters possessing a fibral character, and having cleansed them of all dirt and impurities by submitting them to a caustic bath composed of quick lime and alkali and water, in which they are to remain until they are quite soft and flexible; they are then removed, and by means of a rotary knife, or other suitable machinery, are cut into slivers, and beaten into a plastic mass. In this condition he adds sulphurous, sulphuric, hydrochloric, nitric, acetic, or other suitable acids, in the proportion of 1 or 2 per cent. of the water required to bring the mass into a partly fluid state. It now undergoes a thorough disintegration by beating in a rag engine used by paper makers, until it assumes the character of what is called by paper makers "half stuff." It is now submitted to the bleaching process in the same manner as rags are, and freed from the lime and acid obtained during the bleaching process by means of washing and the usual processes, as employed in the production of paper from rags. It is probable that a petition will be lodged for an extension of time for completing this patent, but at present it is in that stage which we designate as—Patent abandoned.

2823 R. GARRATT. *An improvement in ball and other cocks* Dated October 8, 1867.

This consists of an improvement in the construction of ball and other water cocks, which is particularly applicable where the supply is at a high pressure. The end of the supply pipe is turned upwards, and in it is mounted a central spindle capable of sliding up and down. On this spindle is fixed an inverted cup of lead or other metal, inside which is a disc of india-rubber, forming a water-tight valve, which, when the spindle is pressed down, effectually closes the orifice of the supply pipe and shuts off the flow of water. The body of the cock which encloses this valve may be of a globular or other convenient form, having an opening below for the escape of the water, and another at the top through which the upper part of the valve spindle works. This valve spindle is connected to the ordinary lever and ball when a self-acting arrangement is required, and if otherwise the spindle is provided with a screw thread working in a screw formed in the opening through which it passes out, and the valve is opened or closed by turning the spindle round by means of a key or otherwise.—Patent abandoned.

2824 E. BENINGFIELD. *An improved lifting machine, applicable as a fire-escape and for repairing and decorating houses and other buildings.* Dated October 8, 1867.

Here the inventor takes three pieces of light metal tubing, or tough light wood, from about 20ft. to 30ft. long, more or less, and hinges or otherwise connects each piece about midway of its entire length, so as to be capable of doubling up when out of use, and of forming three entire long legs when undoubled for use, forming, in fact, three long legs as a tripod stand.—Patent abandoned.

2825 J. DEAN and T. TURTON. *An improved apparatus for the prevention or consumption of smoke.* Dated October 8, 1867.

This invention consists in an arrangement of serpentine

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flues, whereby the smoke and other unconsumed products of combustion are prevented from passing away directly to the chimney until the whole has been consumed, and not only is smoke thus prevented, but a great economy fuel is also effected, as little or no waste heat from the fuel passes away uselessly up the chimney.—Patent abandoned.

2826 J. B. HULME. *An improved apparatus to be used in excavating.* Dated October 8, 1867.

This invention relates to an improved apparatus for "getting" the earth to be excavated. The patentee employs a pick, which, instead of being worked by hand, is fixed on a shaft driven by a small engine, and he prefers to give the pick a continuous revolving motion, which may be done by the ordinary crank motion. The engine and pick are mounted on a suitable frame, which is supported in such a manner that it may easily be raised or lowered or moved from side to side, as may be required, and so that it may be turned round to enable the pick to work in different directions.—Patent completed.

2827 J., S. A., G. E., and F. F. READING. *A new or improved mode of securing or uniting stay, corset, or legging busks.* Dated October 8, 1867.

This invention applies to the description of busks composed of two strips, usually of steel, and connected together, wholly, or partly, by means of hooks and studs, and consists in the addition of a spring bolt sliding in a case which locks the shank of one of the studs within the seat of the hook, which prevents the stud so locked from disengaging until the bolt is withdrawn from the hook sufficient to allow the stud shank to pass.—Patent abandoned.

2828 A. TICOZZI. *An improved preparation or lotion for diseases of the eyes.* Dated October 8, 1867.

To 1 quart of water the inventor adds ½oz. of extract of onions, ½oz. of powdered sugar, ½oz. of sulphate of zinc, and 1oz. of white copperas, which contains magnesia, cream of tartar, and arsenic. When all the ingredients are dissolved in the water, the liquor must be filtered, and then it will be fit for use.—Patent abandoned.

2829 R. BEARD. *Improvements in stoppers for bottles, jars and other vessels.* Dated October 8, 1867.

One part of this invention relates to the rendering wood stoppers, such as are described in the specification of a patent granted to N. Thompson, dated January 1, 1866 (No. 3), or others of similar construction, impervious to air and water, and causing such stoppers to fit or pack more closely to the neck of the bottle. This is accomplished by coating the outer surface of the stopper with a composition which can be rendered sufficiently hard to drive well into the bottle, and to extract cleanly from the same, and yet possessing sufficient pliability to form a tight packing into the neck of the bottle by giving or yielding to any inequalities therein. This composition by closing or hermetically covering the pores of the wood on the outer side prevents the escape of air or gas from the bottle, or the oozing of any fluid; still the wood not being impregnated thereby is left in its natural state, and will swell or expand in the bottle, and the composition also possessing sufficient elasticity to expand with it. By preference the inventor uses a composition of drying oil (well boiled), and resins, into which he mixes cotton or other fibre and pigment to give any desired colour and assist in giving the desired solidity; or a composition of resins, fibre, and pigment without the oil may be used. Vulcanite or ebonite composition may also be employed.—Patent abandoned.

2830 F. LOVE, W. ARMSTRONG, and L. WIDDOWSON. *Improvements in apparatus for boring holes in stone, shale, and minerals.* Dated October 8, 1867.

Here the inventors employ a drill or auger carried at one end of a long screw; the screw works through a nut or nuts on disc plates, or other support, carried by a post capable of being lengthened or shortened, so that it may be fixed between the floor and roof of a mine, or between its sides. At the opposite end of the screw is a crank handle or pulley or wheel by which rotary motion may be given to the screw, or the screw may be otherwise driven a forward motion is thus imparted to the drill or auger at the same time that it receives a revolving motion. The stem of the drill is twisted, or of a spiral form, so that the pieces cut away are by it discharged at the mouth of the hole that is being bored. The nut or nuts or other supports through which the screw works can be raised or lowered on the post so that the drill can be set to work at any desired height, and the nut or nuts (or disc plate or other support) are also so mounted as to be capable of turning on an axis at right angles to the length of the post; the drills can thus be set at any desired angle to the face of the rock or work.—Patent abandoned.

2831 J. B. BROWN. *Improvements in railway carriage and other lamps.* Dated October 8, 1867.

In constructing railway carriage lamps suitable for burning petroleum and other oils the inventor encloses the burner in a glass bowl, as heretofore, but, according to this invention, he makes this also the reservoir for the oil which is contained in the lower part of it, protected by a cover or diaphragm of glass inserted into the bowl, so as to rest upon a flange within it, or it might be otherwise supported. In the centre of this cover or diaphragm is an opening to which a petroleum oil burner is fitted, and the wick dips down into the oil. The burner carries a glass chimney which surrounds the flame. Air is supplied to the glass bowl by perforations through it a short distance above the glass cover or diaphragm. A flange at the top of the bowl is set into the end of a metal drum which enters and fits the aperture in the roof of the carriage, and over this there is a cylindrical hood perforated with small holes to check any sudden current of air past the chimney of the lamp. Down the sides of the drum air passages are formed which aid in supplying air to the bowl. Within the metal drum a reflector is placed to throw down the light from the flame; it also serves to enclose the bowl at the top. The chimney passes through the centre of the reflector, and its upper end is enclosed in a casing of wire gauze, which the reflector carries, and which is intended to check any blast of air descending the chimney or otherwise.—Patent abandoned.

2832 J. PLAYER. *Improvements in the manufacture and refining of iron and steel.* Dated October 8, 1867.

This invention consists in the refining, dephosphorizing, and desulphurizing crude pig iron by mixing it in a furnace, cupola, or refinery (in addition to the coke or other fuel by which it is melted and suitable fluxes) with ores or minerals containing a large percentage of titanium, manganese, or copper mixed with iron; for instance, as minerals found in Norway, New Zealand, and elsewhere, and sold and known as titanic iron ore, ilmenite, and by other names.—Patent abandoned.

2833 E. G. WOLFFGANG. *Improvements in the manufacture of ribbons.* (A communication.) Dated October 8, 1867.

This invention has for its object the manufacture of ribbons of cotton velvet with silk, satin edges, or stripes, and consists in the mode described of preparing the velvet to receive strips of silk satin as required, and of applying such strips to the same. For this purpose the face of the velvet is indented in stripes of the requisite width, and at the requisite distances apart, by passing it through a pair of rollers, the lower one of which is smooth, and the upper one has ribs or projections formed on it, corresponding with the required widths and positions of the stripes. The silk satin out of which the strips are intended to be formed is covered on the back with a thin coating of caoutchouc, or other suitable adhesive substance, and then divided into strips of the required width by its being passed between two suitably formed steel cylindrical cutters. The strips are applied to the velvet by the pressure of suitably formed rollers, which are heated, and by means of their heat dissolve the caoutchouc or adhesive substance, thereby causing the strips to adhere firmly to the velvet as required.—Patent abandoned.

2834 R. REID and E. H. CRAIGIE. *Improvements in mattresses, sofas, couches, ottomans, easy chairs, railway carriage seats, and other such like or similar articles.* Dated October 8, 1867.

This invention is not described apart from the drawings.—Patent completed.

2836 J. BARKER. *Certain improvements in the method of consuming smoke, and in apparatus connected therewith.* Dated October 9, 1867.

This invention consists in the application of jets or flames of gas, or other equivalent, to ignite the gas which is abundantly contained in the smoke after it has passed along the flue, and is passing to the chimney, for which purpose the inventor applies one or more gas supply pipes in the space behind the flue (or in the flues, if desired), and provides burners in such pipes in such a position that the draught from the furnace will not extinguish them, which is accomplished by placing them in the opposite side of the pipe to the draught, so that the back part of the pipe protects the gas flames. When gas is admitted to these tubes and ignited, such gas flames are surrounded by the gas and smoke from the furnace, and the said gas becomes ignited by the jets, and the combustion extends and is maintained the whole length of the flue, which also consumes the carbon in the smoke.—Patent abandoned.

2837 J. H. JOHNSON. *Improvements in projectiles.* (A communication.) Dated October 9, 1867.

This invention relates to the manufacture of shells, and other self-exploding projectiles, and consists, essentially, in so constructing such projectiles that the necessity for caps or priming is obviated, and, consequently, greater simplicity and economy of construction are obtained. The invention cannot be described without reference to the drawings.—Patent completed.

2838 H. WALLWORK. *Improvements in machinery for the manufacture of hats.* Dated October 9, 1867.

One part of this invention relates to machinery for "curling" or shaping the brims of hats, that is, shaping and turning up the edge of the brims, and the invention consists in improved arrangements and combinations of mechanism for the purpose. The hat, previously to being shaped or "curled," must have its brim softened by heat, and the improvements in arrangements for this purpose consist in applying the heat so that it will only act upon the brim, and not also upon the body of the hat, as hitherto. The patentee accomplishes this part of the invention by making the heating chest or bed with holes through it opposite the body of the hat, so that the brim only of the hat comes over the heated surface, and also by causing a current of cold air to circulate within or over the body of the hat to keep it cool, such current being produced by a fan or other means. A similar heating chest to that above described is used for giving the finish to the "curl" when the brim of the hat is "bound."—Patent completed.

2839 J. JAMES and T. JONES. *Improvements in the manufacture of rails, bars, and other articles of iron, and in the apparatus employed therefor.* Dated October 9, 1867.

This invention is not described apart from the drawings.—Patent completed.

2840 W. POTTS. *Improvements in gaseliers.* Dated October 9, 1867.

The patentee claims the combination of a hollow screw and stuffing box, and the parts connected therewith, substantially as described and illustrated, whereby, on the rotation of the said screw, the movable part of the gaselier is raised and lowered without the arms and body of the lamp moving round with the screw.—Patent completed.

2841 J. SPEIGHT. *Improvements in machinery or apparatus for spinning, twisting, and roving worsted or other fibrous substances to facilitate the doffing.* Dated October 9, 1867.

This invention relates to that class of machinery or apparatus for spinning, twisting, or roving, known as throstle frames and cap frames, and the improvements consist in the employment of duplicate spindles or bobbin studs, that is, in having two sets of spindles or studs so arranged that, while one set is in position for spinning, twisting, and roving, the other set is in position for doffing. Each set, according to one method, is mounted on a shaft capable of turning on its axis, and also of sliding endwise, such shafts being placed and operated so that each set of spindles or studs may change position alternately, or as and when required.—Patent completed.

2842 R. SMITH. *Improvements in mounting and driving millstones.* Dated October 9, 1867.

The patentee claims fixing one of the mill stones on a rotating vertical axis, whilst the other stone is hung upon a universal joint or gimbals contained in the eye or opening in the centre of the stone. He also claims the combining with stones so mounted and driven a set screw or screws to control the stone hung on the universal joint or gimbals.—Patent completed.

2843 E. G. P. THOMAS. *Improvements in dyeing black and grey, and in preparing materials therefor.* (A communication.) Dated October 9, 1867.

At the present time there are well-known processes by which an aniline black colour may be printed upon cotton, but there is no known process by which either wool or cotton can be successfully dyed with aniline black. These results may, however, be attained by the following processes. To dye wool—The wool is first mordanted by maintaining it for about an hour in a boiling bath composed in the following manner:—Water, 1 litre; bichromate of potash, 10 grammes; sulphate of copper, 6 grammes; sulphuric acid, 1 gramme. The wool is then washed and introduced into a bath of oxalate of aniline containing a slight excess of oxalic acid. This bath, which should contain about 40 grammes of oxalate per litre of water, will enable the dyer to obtain in a few moments a most intense black. The wool should not be dipped into the bath until the latter has acquired a temperature of about 40deg. Centigrade. The heat must then be continued, but it should not be raised to the boiling point.—Patent abandoned.

2844 T. NELSON. *Improvements in preparing the surfaces of paper or other material for drawing purposes, and in the application of the same to lithographic and other kinds of printing.* Dated October 9, 1867.

Here the patentee employs a plate or cylinder of metal or other material, or a sheet of film of any substance or material with a minute granulated or lined pattern on the surface for impressing the paper or other material. The paper or other material so impressed is then ready for ordinary drawing purposes. The following is the manner in which the patentee usually operates:—He takes a sheet of copper or other metal, and he grains the surface (it may be by the aqua tint process, or by the use of a graver by hand, or by a ruling machine and he lays a sheet of paper on the plate so prepared, and passes it, together with the plate, between calendering or hot-pressing rollers.—Patent completed.

2845 W. WARREN. *Improvements in the arrangement and construction of street sweeping and cleaning machines.* Dated October 9, 1867.

This invention relates to improvements in the arrangement and construction of machines for sweeping and cleaning streets of the character described in the specification of a patent granted to J. Whitworth, dated August 2, 1842 (No. 9435), and one part of these improvements consists in constructing the axle driving the endless chain of brushes in two parts socketed together, or otherwise arranged so as to render their action independent of each other, which arrangement enables the patentee to apply driving gear to each of the supporting and travelling wheels of the cart, so as to give motion to endless chains of brushes or cleaning instruments carried by axes, the parts of which are also arranged to act independently. The endless chains and brushes are also arranged in separate sections, so as to work separately, or in combination. By this arrangement of the driving gear the power is equally applied (in giving motion to the sweeping and cleaning apparatus) in place of actuating it from one side only of the machine, as heretofore practised. By this arrangement of the driving gear the width of the cleaning apparatus may be greatly increased without increasing the draught power required to draw the machines.—Patent completed.

2846 C. AVERY. *Increasing the celerity and safety of loading guns and pistols at the breech, and of discharging the same.* Dated October 10, 1867.

This invention relates to firearms wherein the breech is closed by a block pivoted at its rear end to the sides of the breech chamber, which has an aperture in the top, the forward end of the block being turned upward through this aperture when the breech is opened. The improvements consist, chiefly, in the novel arrangement of the breech block, and in the peculiar construction and combination of the devices for operating the said block to open and close the breech, and for securing the same when the breech is closed; also in the peculiar arrangement of the trigger and main spring, in the devices employed in connection with the same, and the firing pin; and in the means for preventing the accidental discharge of the piece before the breech is properly closed. The said improvements also consist in the novel mode of fixing and adjusting the bayonet. The breech block is made to slide back away from the end of the barrel, and to turn upward upon its pivot to allow the cartridge to be inserted into the charge chamber, which is formed in the said block; the latter is operated by a hinged piece which is fitted below the breech chamber, and is forced down when released by its locking bolt by the main spring, which is a flat piece of steel bent into the proper form, and lying in a recess in the breech shoe. The locking bolt is drawn back by a lever and forced into its recess by a spiral spring. When the breech is closed, the block is kept solidly in place by a projection on the hinged piece which lies in the breech chamber behind the said block, and is connected thereto by a link or swivel; the firing pin is arranged to penetrate the under side of the charge chamber, and is driven into contact with the cartridge by a hammer which is pivoted to the hinged piece. This hammer is held when the arm is cocked by the trigger, which is arranged in line with the hammer and bolt lever, the said hammer, lever, and trigger being protected by a trigger guard of suitable form attached to the hinged piece. The bayonet is attached to a ring or ferrule, and is fitted to slide in a groove at the under side of the barrel, and when pushed forward is held by a spring catch.—Patent completed.

2847 R. BROTHERTON and J. MALDRON. *Improvements in the manufacture of lamp-posts.* Dated October 10, 1867.

The patentees claim making the principal post of the lamp, and the crossbar of the said post, of wrought-iron tubing, and fixing the crossbar, lamp-iron, and cast-iron or wrought-iron skeleton frame to the said post, substantially as described and illustrated.—Patent completed.

2848 T. BLACKHURST. *A new or improved composition to be used to prevent the oxidation of iron, the fouling of ships' bottoms, and other submerged things, and preserving wood from decay and from worms, and also preserving iron and wood exposed to the action of the atmosphere.* Dated October 10, 1867.

This composition is made of pitch and crude naphtha or light oil, the said pitch being the residuum after distillation of coal gas tar. The crude naphtha or light oil is the first runnings from the still in the process of distillation of coal gas tar, the specific gravity of which is, usually, about 900 deg., water being 1,000deg. The patentee mixes these ingredients together in very nearly the following proportions—namely, pitch, 1lb., crude naphtha or light oil, 4oz. to 6oz.; he then puts these ingredients into a vessel, taking care to stir them occasionally until the pitch is dissolved, or has arrived at the consistency of paint.—Patent completed.

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2849 A. F. HOBHOUSE. *Improvements in apparatus for propelling vessels.* (A communication.) Dated October 10, 1867.

This apparatus consists, chiefly, of a chamber intended to be immersed in water, alternately contracting and expanding, or closing and opening, and by its contraction or closing expelling the water contained within it in the direction required, and also thereby propelling the vessel to which it is attached.—Patent completed.

2850 W. R. LAKE. *An improved device for bunging barrels or casks.* (A communication.) Dated October 10, 1867.

Here the patentee employs a metallic bushing which is to be both screwed into the stave and riveted into the same. The bung is then screwed into the bushing, and a cap plate screwed down over it, so as to thoroughly protect it during transportation. An air channel is cut in one side of the bung for the purpose of admitting air to the interior of the cask for vent when the bung is but slightly withdrawn.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated January 14, 1868.

124 A. Cowling and W. Turner, Eccleshall-road, Sheffield, brass turners. An improvement in the construction or ornamentation of tape measure cases.

Dated February 18, 1868.

176 E. Dorsett, London-street, City. Improvements in the utilization of coal tar and the products arising from the distillation thereof, and in the apparatus employed therein.

Dated January 29, 1868.

306 R. Wilson, Manchester, ironmonger. Improvements in the method of, or means for, forming connections or joints to pipes and other articles for conveying fluids and liquids.

Dated February 24, 1868.

612 R. Nicolls, Aldermanbury, City, fancy trimming manufacturer. A new or improved combined material or fabric to be applied to the manufacture of bags, reticules, writing cases, wristbands, cuffs, collars, belts, and various other articles.

Dated February 26, 1868.

644 E. R. Walker, Fenton, Stoke-upon-Trent, Staffordshire, engineer. Improvements in transmitting motive power to potters' machinery.

Dated March 5, 1867.

766 J. B. Fell, Sparke Bridge, near Newton-in-Cartmel, Lancashire, engineer. Improvements in, or applicable to, locomotive engines, carriages, and permanent way.

768 H. Conybeare, Duke-street, Westminster. Improvements in the manufacture of rails for railways.

Dated March 17, 1868.

910 W. E. Newton, Chancery-lane. Improvements in the process of preparing iron ore for smelting, and in furnaces therefor. (A communication.)

Dated March 19, 1868.

936 J. E. Lane, Great Berkhampstead, Hertfordshire. Improvements in apparatus for heating or warming buildings or apartments, and for other similar purposes.

Dated March 20, 1868.

946 J. G. Tatters, W. Keeble, and B. Newberry, Plymouth, Devonshire. Improvements in the preparation of cigars and mode of lighting the same.

Dated March 21, 1868.

968 R. G. Greenhow, Llanidloes, Montgomeryshire. Improvements in breech-loading firearms and cartridges.

Dated March 30, 1868.

1082 A. B. Walker, Warrington, Lancashire, brewer. Improvements in the application of hot blast or heated air for evaporating salt, brine, and other liquids, sugar, or chemicals, also for heating gas and oil retorts, raising steam in boilers, boiling worts in breweries and distilleries, which improvements are also applicable for bleaching, tanning, and baking, likewise improvements in apparatus used in some of the aforesaid applications.

1085 J. Jordan, Liverpool, engineer. Improvements in the construction of firebars for furnaces.

Dated March 31, 1868.

1086 W. Austin, Greville-street, Hatton-garden, Middlesex, match and box manufacturer. Improvements in the composition, boxes, and surfaces for obtaining instantaneous light from chemically prepared matches intended to be ignited by friction.

1087 F. Taylor, Carey-street, Chancery-lane. Improvements in the fittings of railway carriages.

1089 J. Sinclair, Stirling, North Britain, engineer. Improvements in screw propellers.

1091 H. B. Woodcock, Low Moor, Yorkshire, forge manager. A new manufacture of metal for axles, shafts, rails, tyres, and other purposes.

1093 L. F. P. Riviere, Mark-lane, Middlesex, merchant. An improved velocipede.

1094 J. H. Weston, Kennington-road, Surrey, gas engineer. Improvements in the means or apparatus for lighting and ventilating the interior of buildings, combining a decorative effect.

1095 H. Bessemer, Queen-street-place, Cannon-street, City. Improvements in the manufacture of malleable iron and steel, in the heating and melting of metals, and in the machinery or apparatus employed for such purposes.

1096 J. H. Johnson, Lincoln's Inn-fields. Improvements in sewing machines. (A communication.)

Dated April 1, 1868.

1097 T. Coulдrey, jun., Kirkdale, Lancashire. Improvements in pumps for ships and other purposes, and in the construction of buckets or valves for the same.

1099 A. Scatchard, Cambridge-road, Mile End. Improvements in the apparatus used in the manufacture of aerated bread.

1101 W. A. W. Sleigh, Bayswater, Middlesex, and A. Pye, widow, Howard-street, Strand. An improved appliance for protecting trousers from mud. (A communication.)

1102 W. Smith, Glasgow. Improvements in the manufacture of pig iron.

1104 G. Davies, Serle-street, Lincoln's Inn. Improvements in the construction of centrifugal ventilators or fans. (A communication.)

1105 J. Norris and T. Quarm, Great Russell-street, Bloomsbury, engineers. Improvements in cooking apparatus.

1106 J. Walker and J. Candlin, Wolverhampton, machinists. Improvements in flooring sash and bench cramps.

1107 G. Kynoch, percussion cap manufacturer, and W. Whitehill, manager, Birmingham. Improvements in cartridges.

1109 R. J. Morison, Great St. Helen's, Bishopgate-street, City, merchant. Improvements in cotton gins. (A communication.)

Dated April 2, 1868.

1113 E. Leahy, Cardington-street, Euston-square, London. An improved movable railway for ordinary carriages.

1114 T. Baker, Buckingham Villas, Stratford, Essex. Improvements in umbrellas, sunshades, and parasols.

1116 H. Lafone, merchant, and J. Nicholas, oil refiner, Liverpool. Improvements in the mode of, and means or furnaces for, burning petroleum and other like liquids.

Dated April 3, 1868.

1122 A. De Metz, Wolverhampton, manufacturer. Improvements in commodes or vessels to be used as water-closets, expectorating utensils, or for other purposes.

1124 C. D. Abel, Southampton-buildings, Chancery-lane. A new or improved process and apparatus for refining camphor. (A communication.)

1126 J. M'Culloch, Shawlands, Renfrewshire. Improvements in utilizing old or waste tarpaulin in the manufacture of grease and other useful products, and in apparatus therefor.

1130 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of cast steel and malleable iron from cast iron, and in the apparatus or means employed therein. (A communication.)

1132 G. Piggott, Birmingham, manufacturer. Improvements in electric telegraphs.

1134 J. G. Tongue, Southampton-buildings, Chancery-lane. Improvements in lamps or apparatus for lighting or illuminating purposes. (A communication.)

Dated April 4, 1868.

1136 H. C. Butcher, Wellington-street, Strand. An improved tobacco pipe.

1140 T. Faucheux, Caversham-road, Middlesex, engineer. Improvements in the construction of axles of the wheels of railway rolling stock and other vehicles and other axles and driving shafts.

1142 F. A. E. G. de Massas, Hoxton, Middlesex. Improvements in machinery for cleaning cotton seeds.

1144 R. Nabbs, Peckwater-street, Kentish Town-road. Improvements in locks and latches.

1146 G. Davies, Serle-street, Lincoln's Inn. Improvements in apparatus for washing and separating ores and other materials. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated April 11, 1868.

1212 S. W. Huntington, Augusta, Kennebec, State or Maine, U.S. A new and useful mode of preparing of veneering paper, cloth, leather, &c.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," April 21, 1868.

3477 F. Roper. Apparatus for driving straw elevators.
3485 O. Barrett and H. Leggott. Knife cleaner.
3506 W. H. Barlow. Apparatus for measuring approximately the quantities of earth work in continuous cuttings or banks.
3508 W. B. Leachman. Rotary water engine.
3512 G. Holcroft and W. N. Dack. Steam engines.
3514 W. J. Fraser. Tubular steam boilers.
3519 J. M. Napier. Appliances for serving mustard.
3522 T. A. Weston. Saws. (A communication.)
3527 J. Ward. Lamps.
3532 W. G. Hanning, G. B. Knott, and L. C. F. Clerc. Lamps. (Partly a communication.)
3534 P. Bawden. Machinery for the manufacture of bricks.
3535 E. R. Sintzenich. Treating paper.
3540 J. Robinson. Manufacture of mohair fabrics.
3542 E. R. Sintzenich. Treatment of gutta-percha. (A communication.)
3546 J. Williams. Abacus for imparting instruction in arithmetic.
3549 A. Bullough. Looms for weaving.
3550 J. G. Settle. Door bolts.
3551 T. Pebardy. Surgical appendages.
3554 H. Atkinson. Gas retort ovens. (A communication.)
3558 W. and F. Bates. Washing machines.
3567 E. and A. Tatham. Manufacture of sinkers for hosiery.
3581 W. Huskisson. Manufacture of bicarbonate of potash.
3584 A. Shrimpton. Papering needles
3585 W. Simons and A. Carmichael. Moulding.
3612 A. Cochran. Machinery for finishing woven fabrics.
3628 E. Lord. Reducing the friction of revolving surfaces.
3657 A. M. Clark. Colouring matter. (A communication.)
3667 G. J. and T. C. Hinde. Manufacture of iron and steel.
3704 A. M. Clark. Permanent way of railways. (A communication.)
3719 J. H. Johnson. Machinery for spinning cotton. (A communication.)
3720 A. M. Clark. Road-sweeping machines. (A communication.)
200 J. H. Johnson. Ships for containing and transporting oils. (A communication.)
215 J. H. Johnson. Furnaces. (A communication.)
740 E. Clifton. Adjustable door handles.
913 J. M. Ure. Apparatus for lifting the driving wheels of a locomotive off the rails.
990 W. E. Gedge. Smoke-consuming fireplace. (A communication.)
1037 W. Manwaring. Reaping machines.
1042 J. Lyall. Looms for weaving.
1057 H. Jones and W. F. De La Rue. Whist counters.
1075 B. Mitford. Apparatus for communicating with deaf and dumb persons.
1078 J. H. Johnson. Manufacture of cast steel. (A communication.)
1085 J. Jordan. Firebars.
1130 J. H. Johnson. Manufacture of cast steel. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed April 15, 1868.

2892	M. Vogl and H. Van Dyk	2939	M. J. Matthews
		2941	W. R. Lake
2894	T. H. Baker and T. Woodroffe	2943	L. Newton and J. Swailes
2895	M. Samuelson	2952	W. Crossley and T. C. Hutchinson
2896	W. R. Lake	2969	W. Beale
2905	D. Pidgeon and W. Manwaring	3054	J. Maddocks
2908	M. Wilkin and J. Clark	3067	O. C. Evans
		3069	W. R. Lake
2914	L. Hamel	3072	A. Chaplin
2916	T. Bell and J. Richardson	3126	R. Leake and J. Beckett
2918	J. Bannehr	3180	C. B. Hodgetts
2920	W. Tredgold and J. M'Neil	3222	J. Morrison
		3285	T. H. Tilley
2922	F. Prudencio, F. Cooper and J. F. Cotterell	3341	E. Townshend
		3570	W. Conisbee
		3685	J. Goodfellow
2925	E. Casper	397	J. A. Jones
2931	H. J. Bale	616	W. R. Lake
2934	J. King	647	A. V. Newton

Sealed April 17, 1868.

2923	H. W. Garrett and G. Holcroft	2960	W. R. Lake
		2961	J. Adams
2926	J. Hill and S. Shelley	2976	T. Welton
2948	M. W. Shove	2994	S. Stackard
2949	R. Watkins	3064	W. S. Dixon
2953	W. Barrett and C. Martin	3122	W. E. Newton
		3665	S. and F. Lennard
2956	J. Clapier	3715	C. G. Hill
2957	A. H. Brandon	182	A. Bockholtz
2958	C. Duncombe	540	W. Betts

Sealed April 21, 1868.

2968	J. White	3063	W. Hall, J. Wren, and J. Brandwood
2982	A. Chambers		
2986	R. W. Thomson	3083	W. Darcey
2987	J. Ellison and J. Stirk	3148	J. F. Brinjes
		3152	T. Blackburn
2988	W. E. Gedge	3153	C. Anderson
2990	J. Dodge	3186	W. R. Lake
2998	R. Weare	3488	J. Rae and G. Miller
3006	W. R. Lake	3668	J. Lightfoot
3008	A. M. Clark	416	S. Read
3009	A. M. Clark	430	J. Howard and E. T. Bousfield.
3026	A. M. Clark		
3032	J. Young	438	W. T. Sugg
3035	J. Glover	610	J. Fordred, F. Lambe, and A. C. Sterry
3038	W. Potts		
3047	W. Bishop and B. Burningham	648	F. Lambe, A. C. Sterry, and J. Fordred
3051	G. Davies		
3079	J. Gilmour		

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1068	W. Clark	1107	H. Caudwell
1071	A. Henry	1108	J. Y. Betts
1084	T. Whitehead and N. Nussey	1117	W. Scarratt and W. Dean
1086	J. E. H. Andrew	1123	C. Hall
1092	G. T. Bousfield	1193	R. Ferrie and J. Murray
1102	F. A. Abel	1244	E. G. Smith
1103	W. Hale		
1106	W. Robinson		

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

980 R. A. Brooman

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending April 18, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d		s. d.
2301	0 4	2544	0 10	2558	0 4	2568	0 8	2582	0 4	2602	0 8
2314	0 4	2545	0 4	2559	0 4	2569	0 4	2583	1 2	2604	0 4
2493	0 8	2547	0 6	2560	0 4	2570	0 4	2585	0 4	2622	1 4
2497	1 0	2548	0 4	2561	0 4	2571	0 4	2586	0 4	2623	0 4
2503	1 6	2549	0 8	2562	0 4	2573	0 4	2589	0 4	2708	0 4
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2509	0 8	2554	0 10	2564	0 10	2576	0 4	2597	0 4	2750	0 10
2527	2 0	2556	0 4	2565	1 4	2577	0 4	2601	0 4	2110	0 6
2543	0 4	2557	0 4	2566	0 4						

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, MAY 1, 1868.

COOKING FOR THE ARMY.

BEYOND a doubt the physical condition of an army is almost wholly dependant upon the character of the food supplied to it, and the manner in which it is prepared. This important point was greatly neglected until Captain Grant, some years since, effected a reformation by introducing some radical improvements in the messing of soldiers. The matter has gone on improving up to the present time, when we find Captain Warren taking the question up, and bringing it to a very successful and practical issue. This officer has turned his attention to the better and more economical cooking of food for some time past, and he has succeeded in perfecting an apparatus which answers admirably in every respect. This apparatus formed the subject of a paper by Captain Warren, which was read at the Royal United Service Institution on Friday last. The apparatus consists, primarily, of a stand or plinth, about 8in. high, upon which the body, containing the oven, furnace, and two boilers, are placed. The apparatus thus fitted stands about 4ft. high by 2ft. square on the top. At each side is a tray supported by arms, and which can be closed up when the apparatus is not in use. When in use a tin meat steamer is placed on one and a potato cooker on the other of these trays, the tops of the steamers being level with the top of the oven. Over the potato steamer is another with a perforated bottom for the same purpose, whilst over the oven are two cookers for meat and soup, and over the meat cooker first referred to is another steamer, with a perforated bottom, for puddings or potatoes. Thus put together the apparatus is of T-shape in elevation. Steam is supplied to the steamers from the boiler by pipes through the sides and top of the body of the stove. The boiler is supplied with water through pipes at the back, which are fitted with steam whistles, and give warning directly the water is low. The fire is lighted with a little wood and coal, and with a good draught steam is got up in thirty minutes. The fire is never replenished with more than 2lb. of coal at a time, and the total consumption of fuel (sea coal) should not exceed 25lb. of coal per day per company of 100 men, for breakfast, dinner, and tea.

Captain Warren's apparatus, as now made with an enlarged oven, is calculated to cook for 120 men, or two companies. One of these was in operation in the servants' hall of the Institution during the lecture, and in it was cooked soup, fowl, joints, puddings, and potatoes, all of which were done to perfection. The following statement shows how rations for 120 men can be prepared, each mess being kept separate:—

Company A, consisting (say) of 60 men, in	3 messes
Company B, consisting (say) of 60 men, in	3 ,,
Total . . .	6 messes

	Men.
1st mess. A full bake, or roast in oven, consisting of joint and potatoes under	20
2nd mess. One meat pie in oven, or a second joint and potatoes	20
3rd mess. Meat and soup in top cooker	20
4th mess. Stew	20
5th mess. Warrenized meat in right-hand cooker. (This is cooked in hot air without water) .	20
6th mess. Ten meat puddings in top right-hand cooker . . .	20
Total . . .	120

In addition, 120lb. potatoes are cooked simultaneously in the potato steamer. A dish, termed a sea-pie, consisting of meat and paste in layers, can also be prepared in the top cookers. The total consumption of fuel for the day for 120 men is found to average under 28lb. As regards the economy of this apparatus, it is to be observed that in the early trials of the apparatus at Aldershot, the economy in fuel showed a reduction of fifty per cent. over the steel boilers and ovens. This, Captain Warren states, would have been far exceeded had not the company system been adopted, as the larger the numbers cooked for, the greater the reduction in the consumption of fuel.

Besides the saving by fuel in this apparatus, a reduction in the waste of meat is effected by the process now termed "Warrenizing." This point—as well as that of economy of fuel—was investigated by a committee by direction of the Horse Guards, and they arrived at the most satisfactory conclusions. The points to which they directed their attention were—The time of cooking; the quantity of fuel used; the quality of the food when cooked; and, the general adaptability for use by soldiers. In the first experiment, the meals of an entire company of forty-seven men were cooked in Warren's apparatus and in the usual Deane's boilers and ovens. The result was that coffee for breakfast was prepared in Captain Warren's apparatus in 45min., but in Deane's boiler the time was only 20min. The dinners, however, were the test, and here three messes, one of soup, one of stew and potatoes, and one of baked meat and potatoes, were prepared in Warren's apparatus in 3hrs. 35min., whilst in Deane's the time was 3hrs. 45min. The teas were prepared in each apparatus in 1hr. 45min.; the total time, therefore, was—Warren, 6hrs. 5min.; Deane, 5hrs. 50min.; the latter having the advantage in point of time. This, however, is not so material to the issue, because a certain weight and quantity of food cannot be properly cooked under a certain time, which must be tolerably constant. When, however, we turn to the economy of fuel we find a different result, the total quantity used in Warren's being 23lb. of coal and 1lb. of wood, and in Deane's 71lb. of coal and 3lb. of wood. The coal used was a very fast burning inland coal. The ordinary allowance for forty-seven men being 50lb. of coal, it will be seen that the Warren apparatus was 27lb. or more than fifty per cent. under the allowance, whilst the Deane was 21lb. over. With regard to the third and fourth points—the quality of the food cooked, and the adaptability of the apparatus—the report states that in both cases the food was excellent, and that the Warren apparatus was specially adapted for the army, and was superior in many respects to the Deane boilers and ovens. These results are more than confirmed by the numerous reports from commanding officers, who speak very highly of Captain Warren's apparatus. In fact, most ample evidence was afforded by the viands which were prepared on the occasion of Captain Warren's lecture.

The saving to the country in the matter of coal for cooking in the army, resulting from this invention, is something very considerable. Taking the economy effected, as shown by the published reports, and putting the average cost of coal at £1 1s. per ton, we find a difference of £8,722 per annum at home, and quite independently of the Indian and other foreign establishments. Under these circumstances, then, it is but fair to expect that an officer, who has devoted so much time to the subject, and whose invention is admitted on all hands to be of the most perfect character, should receive some acknowledgment of his important services. This view of the subject, of course, formed no part of the lecture, nor was it in any way referred to. But we happen to know that the question has been raised elsewhere, and we hope it will not be lost sight of until it has been satisfactorily answered. The truth is, Captain Warren has applied to the War Office for remuneration, and after a great deal of hard fighting we believe he managed to obtain his travelling expenses—which, however, were reduced to £78—and £240, for nearly two years' constant work, after having proved how a saving of fifty per cent. in fuel could be effected. We are glad to say that Captain Warren was awarded a medal by the jurors of the Paris Exhibition, where the apparatus was shown. This led him to entertain renewed hopes of reward from his own Government, but these hopes have not yet been realized; so, as a last resource, the gallant Captain has written to the Secretary of State for War, setting forth the whole facts of the case, and asking to be placed on the same footing as other inventors. The War Office Circular, No. 942, March 3, 1866, states that "no invention will be adopted into the service without considering the claims of the person interested to a suitable remuneration." Captain Warren's invention has been adopted into the service, and we think that the least that can be done is to remunerate him in a suitable manner. Precedents for such rewards are to be found in the case of Captain Grant, the pioneer of reform in army cooking, and in those of Colonel Boxer and Major Palliser. In accordance, therefore, with these precedents—which we could easily multiply—we unhesitatingly say it will be a crying shame if reward is withheld from one who has so benefited the army and the nation.

SOIREE OF THE ROYAL SOCIETY.

THE second soirée of the Royal Society for the present year was given last Saturday evening by General Sabine, R.A., the President of the Society, and, as on the first occasion, proved highly attractive. It might aptly be termed an electrical evening, so greatly did apparatus in this branch of science preponderate. The rooms were thronged throughout the evening by a distinguished company of *savants*, who gathered round the General to the number of about 400. The company included all the Vice-Presidents, principal officers, and a very large number of Fellows of the Royal Society, also men of mark in politics, diplomacy, law, and physic, among whom were Lord Chelmsford, Sir H. Keating, Sir C. Trevelyan, the Persian Minister, the Swedish Minister, Viscount Eversley, Sir W. Erle, the Dean of Ely, the Dean of Chichester, Sir C. Wentworth Dilke, Sir J. Pennefather, the Earl of Mountcharles, &c., &c.

Turning to the electrical apparatus, we will first notice Mr. Apps' collection. Here we found an improved magnet and dia-magnetic apparatus combined, which is capable of sustaining 5cwt. with the current from a single cell. There was also an improved arrangement of vacuum tubes in connection with a large electro-magnetic engine, and a galvanometer of greatly improved construction. By this latter instrument currents from the lowest to the highest power may be tested with equal facility. The chief point of interest, however, was Mr. Apps' patent inductorium, which gave sparks 18in. in length through air. The discharges from a very large size Leyden jar, arranged as a secondary condenser according to Mr. Grove's original experiment, were from 3in. to 4in. in length, extremely thick and rapid. The great advantage of these induction coils over others is, that the insulation is permanent. There is a great saving of battery power, the contact breaker acts perfectly regular, and is under

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very easy control, and either small or large battery power may be used. For heating or calorific effects, and for experiments with the Leyden jar and fulminating or snapping panes, two or three times the usual battery power may be used. For a given battery power, the effects are more than double those produced by coils on the old system. Many experiments, quite impossible with other coils, can be tried with safety; such, for instance, as that of testing the nature of the induction of the secondary upon the primary wire at the moment of discharge. Any experiment involving a connection between the primary and secondary may be performed with safety. Comment from us upon the merits of Mr. Apps' inductorium is superfluous in the face of the remark made by Mr. Grove at the soirée, that the coil was "decidedly the finest and most powerful he had ever seen."

Mr. Ladd exhibited a new form of break to be used with inductoriums, which was constructed by him from a design by Mr. Jerry Barrett. It was shown in action with M. Gassiot's large induction coil, which gave 12in. sparks. The object obtained by this break is, that it is self-acting, and, by a peculiar arrangement of a second hammer, long sparks can be obtained with great regularity and rapidity. Mr. Ladd also showed a new form of mercurial air-pump with which a vacuum of the most perfect description could be obtained. A new form of medical magneto machine by Mr. Ladd, with a circular magnet giving the currents all in one direction, was used to decompose water in a small cell under a microscope, which it did very freely, showing great power for so small and compact a machine. On the same table was also exhibited Mr. Warren De la Rue's new battery, consisting of 200 cells, by which an electric light was shown. In this battery chloride of silver takes the place of the copper or platinum of ordinary batteries. Mr. J. Browning had several astronomical instruments, and an excellent little magneto-electrical machine, in which the current flows continuously in one direction. This instrument is for medical use, for which purpose it is most appropriate, on account of the continuity of the current. The magnet is bent in a circular curve, and thus one bobbin only is required. Mr. Cromwell F. Varley exhibited and worked a most interesting and highly ingenious system of artificial telegraph cables, by which he showed the retardation of electric signals through long circuits by electrostatic induction. We also observed some original electric machines, by the same gentleman, for converting mechanical force direct into electric power without friction, by influence only. Considerable interest was taken by the company in some beautiful experiments showing the advanced state of stratification produced by electricity in phosphoric vacua, which was shown by a machine exhibited by Mr. Jerry Barrett.

Captain Colomb, R.N., with whose system of flashing signals our readers are familiar, exhibited, in conjunction with Captain Bolton, of the 12th Regiment, a new signal light, to which the name of the Chatham light has been given. This light has been designed to meet the want of a safe, powerful, and cheap light for signalling by means of the flashing system. It is certainly the simplest and cheapest portable signal light we have seen. It consists of a lamp on the top of a pole in communication with a box of inflammable powder and a pair of hand-worked bellows, which blow the powder in puffs across the flame when it ignites. To enter a little more into detail, we may observe that an outer chamber, below the flame of the lamp, is filled with a powder termed "Chatham powder." This powder is highly inflammable when burned in the Chatham light, but will not ignite in any other way. The outer chamber being filled with the powder, closes up the bottom of an inner chamber, and leaves an air space therein. By means of the bellows a current of air is made to pass up an air-hole, which current finally emerges in a sharp jet from an opening. This jet of air striking on the surface of the powder (which is very light) disturbs it, and mixes it thoroughly with the loose air in the inner chamber. This air, so mingled with the powder thus held in suspension, issues in two jets from two pipes. Between and below the mouths of these two pipes is the flame of a spirit lamp. The jets of air charged with Chatham powder meeting above this flame, at once burst into the most brilliant and dazzling light. So long, therefore, as pressure is kept up on the bellows, the light is continuous, but the moment pressure ceases, the light ceases also. In this way the long and short flashes necessary for making signals are produced with the greatest ease and certainty. The light is surrounded by a glass cylinder, in order to protect it from rain and wind, and within it is a gauze cylinder to protect the glass from heat. The present lamps are made for a range of about ten miles, but there is no actual limit to the range of the light, as this can be varied in the same lamp by varying the strength of the powder. This apparatus has been adopted for the Abyssinian Expedition, a number of the lamps having been taken out by the Signal Corps. This lamp appears to possess the necessary requirements for the purpose to which it is applied. There are no springs or any parts likely to get out of order, and the lamp may be trusted in the roughest and most inexperienced hands.

Mr. E. J. Reed, the Chief Constructor of the Navy, exhibited some beautiful models of ships in the entrance saloon. There was a model of the "Invincible," showing the system of upper deck batteries with all-round fire. There was also a model of the new Indian troop-ship "Serapis," full rigged, and a model design for an armour-plated breast-work monitor of 10,000 indicated horse power, and fifteen knots speed, having 15in. armour on the hull, and 18in. on the turrets. Mr. F. N. Gisborne exhibited his mechanical engine-room signals, and some specimens of auriferous quartz from the gold reefs of Nova Scotia. The steering compass has recently been greatly improved by the Earl of Caithness, and one of these gravitating compasses was exhibited by Mr. W. Nunn. We shall not allude further to the subject here, as we hope shortly to place it in detail before our readers. Mr. Nunn also exhibited his convertible signal lamp, which will be found fully described and illustrated in the MECHANICS' MAGAZINE for March 24, 1865. It suffices, therefore, to mention here that this lamp meets all the requirements of the Order in Council, dated January 9, 1863, which regulates the lights to be carried by small yachts, fishing vessels, and similar craft. This lamp renders it unnecessary for this class of vessels to carry more than one lamp. It is so constructed that, when the vessel is under weigh, the green and red lights can be shown at a moment's notice, and in such a manner that the green light shall not be visible on the port side, nor the red light on the starboard side; either can be shown separately, or the light can be entirely darkened at pleasure. When boats are at anchor, or attached to their nets, the same lamp, by a very simple contrivance, can be instantly converted into a globular anchor lamp, showing an unbroken light all round the horizon. In addition to this lamp, Mr. Nunn exhibited his binnacle for enabling mariners to take cross bearings.

Messrs. Weir's atmospheric telegraph apparatus attracted attention, on account of its simplicity and efficient action. These signals are now being fitted on board some of our war steamers, for steering and engine-room purposes, for which they are specially adapted. The operator can, with his thumb and finger, give all his orders. Tell-tales on the dial of the communicator, moving automatically by connection with the engine shaft or rudder, instantly communicate the fact of orders being or not being obeyed. These signals are most effective for ships in preventing collisions at sea, and by their instantaneous action are very valuable in fogs, when the common system of giving orders by the motion of the hand, or even by lights, would be unintelligible. In war steamers entering an enemy's port at night, all orders can be given and received instantly and noiselessly without a word being spoken. The communicator being portable can be readily and quickly removed to any part of the ship. Messrs. Weir exhibited three other applications of their atmospheric telegraph. First, a model was shown of a railway engine, passenger carriage, and guard's van. In the railway engine a bell is placed, which is connected with a small tube leading to the guard's van, and attached to a metallic flexible sided air vessel, to which is attached a push or button. The guard can, by pressing his thumb on this button, ring a bell near the engine driver. A similar air chamber and button is placed in each passenger compartment, and on a passenger pressing his thumb on this button a bell will ring upon the engine as well as in the guard's van. But to deter passengers from using these bells unnecessarily, the button, on being pressed, locks itself, and it cannot be replaced until the guard unlocks it. At the moment of pressing the button and giving the alarm, a shutter is thrown out from the side of the carriage, which shows the guard in which compartment the alarm has been given. The connection between the carriages is very simple, and the coupling and uncoupling is accomplished instantaneously. Second, an apparatus (also shown by model) is placed under the rail about a mile or so from the station to which the train is approaching. When the train passes over this spot a bell rings at the station, giving warning that the train is coming. Before the train enters the station it passes over a similar apparatus, which at once, by a pneumatic tube leading to the warning signals, blocks the line with lights and the semaphore arm, and the line thus remains blocked until the porter removes it with his haul. The third application was shown by another apparatus, by which, on pressing the thumb on a button, the bell rings at a distance, and at the same time a shutter rises and discloses the order. Thus it will be seen that the atmospheric principle, as patented, can be applied to a variety of purposes in every-day use. The value of this principle is its great simplicity, uniformity of action, and non-liability to get out of order. We may add that the apparatus can be seen at all times at 10, Philpot-lane, London.

Amongst the various apparatus of a miscellaneous but interesting character may be noticed an excellent machine for testing aneroid barometers by slow exhaustion, which was constructed by Messrs. Elliot, and exhibited by Colonel Strange. There was also a model illustrating the action of one of the applications of Captain Moncrieff's protected barbette system, as applied to a 7-inch rifled gun. A practical trial of this invention is being arranged, and we hope soon to place all particulars before our readers. Nicholl's system of bituminous cables for underground telegraphs was also shown. It is laid in 10ft. lengths, and the joints are simple, strong, and rapidly made. The insulating material is not liable to decomposition, and four men can, in one day, lay one mile of cable, containing several wires, and which are not liable to wilful or accidental damage. It is stated that the cost does not exceed that of any existing system. Mr. Henry Perigal sent a dissected model of the coffer in the Great Pyramid of Gizeh, showing that the same component parts will form the walls and bottom, or will exactly fill the interior, of the coffer. Says Mr. Perigal:—Each end = one-ninth of interior = half one side; each

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side = two-ninths of interior; ends + sides = walls = two-thirds of interior; bottom = one-third of interior = half of walls; interior = half of exterior volume. Professor W. H. Miller exhibited a most interesting Clepsydra clock, or frictionless escapement, which deserved a more prominent position than it occupied. Messrs. T. Cooke and Sons exhibited two important inventions. One was a clock for giving motion to the great equatorial refracting telescope, constructed for Mr. R. S. Newhall, and the other was a sidereal and mean time clock, in which one of the times is converted into the other by a system of light wheels. There were, besides, numerous paintings, drawings, and statues, and the rooms were decorated with some choice and rare plants and flowers, lent by the Royal Botanic Society, which added to the pleasure of the evening.

THE INSTITUTE OF NAVAL ARCHITECTS.

IN continuing our notice of the interesting papers read at the recent meeting of this Society, we first turn to the Chief Constructor of the Navy, who is one of the vice-presidents of this Institution, and who contributed a very valuable paper, the object of which was to show that monitors are a class of vessel which cannot be trusted at sea under canvas. Before he proceeded to the immediate subject of his paper, Mr. Reed pointed out the difference of stability as the term is usually understood by theoretical men and as it is employed by nautical men, as a synonym for steadiness; and it was one of the most convincing arguments Mr. Reed could have used, had he wished to teach us the lesson that we must be sure of the meaning of the terms we use before we can begin to argue upon them, when he showed that the "Achilles," which has earned the reputation of being the steadiest ironclad in our Channel fleet, owes that reputation to the fact of its having the least stability; while, on the other hand, the "Lord Clyde," whose stability is great, is a very ugly roller. Another important point not neglected was the difference between statical and dynamical stability. The former is the moment of the couple formed by the two equal forces, the weight of the ship acting downwards through its centre of gravity, and the buoyancy acting upwards through the centre of buoyancy, when the ship is heeled over to any angle; while the latter is the work necessary to heel the ship from its upright position over to that angle. If a curve be drawn whose abscissæ represent different angles of heel, and ordinates represent the statical stability at those angles, the area between any ordinate, the curve, and the line on which the abscissæ are measured, will represent the dynamical stability. Mr. Reed exhibited some diagrams of the curves so obtained for the "Duncan" as it is, cutdown to a freeboard of 3ft. 6in., and fitted with two heavy turrets, and the "Duncan" as it was once. Formerly, the statical stability varied very nearly as the angle of heel, the consequence of which was that under canvas it would have been a safe vessel. The moment of the wind on the sails decreasing with the inclination, and the stability increasing, must, in time, become equal, and, after that, the stability having the better of the wind, brings the ship to rest. Under the action of these two forces, the vessel will oscillate about the position which, after a time (considering the wind uniform), it will take up, owing to friction, and then the two forces will have equal moments, and the ship will remain inclined at a constant angle of heel.

For small angles of heel, all this is true for the "Duncan" monitor, but as soon as we come to an inclination of only 7deg., the edge of the deck comes to the level of the water, and the law of stability suffers a break of continuity. The stability still increases, but only until 10½deg. is reached, after which it steadily decreases, and before we get to 25deg. it has vanished. The buoyancy of the vessel after that helps the wind to turn her over. We cannot conceive a vessel endowed with more dangerous properties than this. Take the same vessel weighted so that its freeboard is diminished to 2ft. 6in., and, again, 2ft. Instead of a maximum stability occurring at 10½deg., it now is met with as early as 8deg. and 6½deg. respectively, and the angle for which the stability is zero has shifted to 18½deg. and 16deg. respectively. This is quite enough to convince us that a berth on a monitor under canvas in a stiff breeze is anything but desirable, except to persons of a suicidal turn of mind. In fact, we entirely believe that it would be little short of madness in the captain of a monitor to make any great use of his sailing power; in other words, monitors are not fit to go to sea. They are fair weather sailers, and nothing more. One has recently been built for the Melbourne Government, and a temporary side and upper deck were thought necessary to give it anything like a fair chance of finding its way to the Antipodes.

With reference to dynamical stability, we may say that Mr. Reed's diagram showed clearly that the "Duncan" as a monitor, with 3ft. 6in. freeboard, had, in dynamical stability, scarcely half of what it had before its conversion, and that, reducing the freeboard as before to 2ft. 6in. and 2ft., we reduce the dynamical stability, in the first case, to one-third of what it has with its present freeboard, and in the latter case to practically nothing.

An interesting discussion followed this paper, but we are sorry to be forced to say that the opening of this discussion was disfigured by a personal attack on Mr. Reed. Had his assailant's language been half as expressive as his tone, we think he must have been shown the door, but, luckily for him, his eloquence is not of the highest order, and he escaped with a slap in the face from Mr. Scott Russell, and a quiet lecture from Dr. Woolley.

Muzzle-pivoting gun carriages for naval armaments are now demanding and securing great attention on all sides. It was always a matter of moment to save our men and guns from the action of an adversary's projectiles, but now that guns cost from ten to one hundred times as much as formerly, and the men to work them are hardly to be got at any price, to protect both has become a vital question. The narrow loopholes and embrasures of the past, show the value of this protection in the opinion of our ancestors, but now, with the whole of the broadside of the old 74 combined into a single gun, or, at most, some half-dozen, it is evident our risks are commensurately increased, and we are staking our safety, or perhaps our existence, on a single cast of the die. To narrow our ports, and thus afford protection, is further necessitated by the lengthened inaction of the guns. The massive machines now in use, and the ponderous projectiles which they gorge, cannot be manipulated in a hurry. Tons of metal have now to be handled, where our forefathers saw difficulties in cwts. In the paper read by Captain Heathorn, R.A., we have many points of great interest brought out in connection with muzzle-pivoting guns. The methods he divides into the following classes:—1. Those that absolutely or approximately muzzle-pivot a gun on a fixed material pivot. 2. Those that do the same thing on an imaginary pivot. 3. Those that, using the imaginary pivot, have the mechanical arrangement for producing muzzle-pivoting motion wholly apart and separate from that employed to lift the body of the gun through the necessary passage in space, which necessity is, of course, common to all. The Captain promised to enlarge on this subject at the United Service Institution, in a paper he has since read. We have been on the *qui vive*, for the benefit of our readers, to see the additional light which he is well qualified to throw upon this interesting and important matter, and the paper has already been noticed in this journal. In minimum embrasures we think we see the great desideratum of more complete protection to the men and materials of our ships of war; and as ofttimes per contra reasoning and examples (partaking of the *reductio ad absurdum*) are most powerful auxiliaries to the direct argument, so we think that the instructive experience of large ports in the case of the Brazilian war vessels, instanced by Mr. Barnaby, must act as a serious warning to them and to us.

At the Friday morning meeting, Lord Hardwicke in the chair, Vice-Admiral Sir Edward Belcher, K.C.B., read a somewhat lengthy paper on naval construction from 1800 to the present time. It is manifest that such a review must afford ample scope to even a superficial observer, of whom we do not mean to call Sir Edward one. His paper, indeed, brings forward many points of great interest, and, in regard to our present modes of construction, of unsurpassed importance. It must be conceded on all hands that our ironclad fleets are not intended to keep the seas. They are wholly incapacitated for that by their heavy draught, and consequent want of speed; their unseaworthiness, their contracted stowage of fuel, and for other reasons. They must, therefore, be chiefly used, if used at all, in home and harbour defence. This at once compels us to have as many fleets as we have homes to defend—no small matter, considering the fabulous sums our ships now cost. Bnt it has always struck us as a probable result of the present construction of armour clads, rams, &c., that whenever they shall be called into action, we shall experience a woeful disappointment, if not suffer an irreparable catastrophe. If a ram, for instance, can get a fair opportunity to have "a go" at an adversary, no doubt she will inflict serious if not fatal damage. But what of herself? How is she to get free from the wreck which she has wrought? Wasp-like, she may sting, but, whether leaving her sting behind or not, she will in all probability pay the forfeit of her own existence. It is not so certain, however, that she will be able to secure at will a favourable position and opportunity for an assault. The unwieldy projecting submerged ram will be to herself a source of constant trouble and danger. Sir Edward considers the best form of ram to be the overhanging prow of ships of good speed; for these would, as he says of the "Warrior," "make terrific rams above water." The impact of the submerged ram on her adversary would tend to throw it inwards on to herself, while the "Warrior"-like ram would throw the adversary outwards on to her beam ends, cut her down, and finally run over her. A struggle between two of our large unwieldy ironclads at close quarters, if such could be imagined, must be war *a l'outrance*. It would be the tale of the Kilkenny cats once again, with only this difference, that these respectable mythic animals left their caudal extensions to point the moral of their fate, while our unmanageable, panting mammoths, with a slight variety of the nursery rhymes—

> "Would never come home,
> But leave their tales behind them."

Sir Edward introduces also the consideration of modes of propulsion. However valuable screws may be, they are exceedingly liable to injury from shot or fouling. The turbine is wholly exempt from such risks, and, moreover, aids the rudder in rapidly turning the vessel, almost as if it were on a pivot. After the lapse of the conventional twenty years of probation, or reprobation, at the Admiralty, this principle has had a trial. But we think with the speakers on this paper,

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that it would be well if some suggestive board were established to recommend inventions of promise to the authorities. This would do away with the system of "dry-nursing" and "stepmothers" to which the mental bantlings of inventors are now too subject, and prevent the transfer to other countries of ideas which might be judiciously worked up into important principles. We cannot sum up our opinions on this paper better than in the words of the noble chairman; and wishing Sir Edward somewhat of a clearer style, and a better reporter, with sincerity we say to him "go a-head." The chairman's remarks were:—"The question raised by my excellent friend Admiral Belcher is for the purpose of endeavouring to elicit from us a prophecy as to what will be the future of the navy. Gentlemen, I will venture to prophesy that within the next twenty-five years or thirty years ships will be propelled by steam—that there is no doubt of. The form of propulsion will be the turbine. The vessels will be full-rigged, and the armour-plate will be very much reduced, but not lost sight of. That is my prophecy as to what will happen in twenty-five years."

ELECTRICITY AND TELEGRAPHY.

WE are happy to announce that the Malta and Alexandria Telegraph has at length been repaired. The repairs were successfully completed on the 25th ult. The great delay has been owing partly to the inclement weather preventing the "Hawk" from attempting any operations, and partly from the number of faults that have taken place. It is to the circumstance of the re-opening of this cable that we probably owe the fact of having the late glorious news from Abyssinia so soon. Considering the distance that had to be traversed over such a difficult country, and the amount of sea passage up the Red Sea, it must be acknowledged that the message from Magdala, arriving within a fortnight of the victory, deserves mention as being a case of extraordinary despatch.

The Persian Gulf cable continues to be interrupted, and in consequence of the repairing ship, the "Amber Witch," being at Bombay undergoing repairs, it is very probable that it will be some time before communication will be again restored. In order to expedite messages over the broken section, steamer arrangements have been completed between Gwador and Mussendom for the conveyance of messages, so that the delay in the transit over that section is now expected not to exceed from forty to ninety hours.

We lately announced the presence over here of General Smith, President of the International Ocean Telegraph Company, for the purpose of having a second cable made and laid between Key West, Florida, and the Havana. The contract for the cable has been given to the India-rubber, Gutta-percha, and Telegraph Works Company, who are now progressing rapidly with its manufacture at their works at Silvertown. The cable is to be slightly shorter than the previous one, and is protected externally by a bituminous compound outside the galvanized iron wires. Sir Charles Bright is the superintending engineer for the American company, who are, on this occasion, going to lay the cable themselves. We believe Sir Charles goes out to lay the cable for them. The steamship "Narva" is engaged for this work, in consequence of her being found so well qualified for it as she proved on the first occasion. The expedition will leave England about a month earlier this year, so it is to be hoped that the work may be successfully accomplished before the sick season sets in.

We hear that there is a strong probability of the extension of telegraphic communication to Jamaica and to Panama, a company having been specially formed for that purpose in America. A proposition has been brought before the Jamaica Legislature for connecting that island with the United States. The cable now working so successfully between Florida and the Island of Cuba has materially increased confidence in submarine lines, and we hope shortly to hear of some definite steps being taken with the view of bringing about more extended communication with the West Indies.

For the first time, some experiments on a large scale of military telegraphy are to take place this year at the camp of Chalons; for this purpose several employés of the French telegraph lines have been drafted off and placed under officers specially appointed.

The Mexican Government have just given to M. Villarti a concession for a telegraphic line from Leon to the coast, and placing Mexico in communication with the Mexican ports of the Pacific. The works of the line from San Luis-Potosi to Matamoras are rapidly advancing. This system once complete there will then only remain to construct one section between Brownsville and Saint Antonio—Texas—to place Mexico itself in direct communication with New York.

M. Gerard has lately tried a most interesting experiment, which he has communicated to the Academy of Sciences, at Paris, in which he sees a new system of electric telegraphy, and he believes that later we shall be able to succeed in obtaining from this principle very powerful machines. His experiment is simply placing above an electro-magnet a metallic ring formed of wire of a greatly but regularly varying diameter, so that on the one side the wire is very fine, on the other very thick. These conditions being fulfilled, the electro-magnet when excited is capable of giving movement to the ring.

We lately noticed the fact that in the electric light the current could be spontaneously re-established after a cessation of a small amount—about the twentieth of a second. This fact has been taken advantage of to illuminate two lights by the action of one current, the interruptions being made of less duration than the above time, the currents being sent in two different directions, and two lamps are kept consequently in a state of illumination. For each of these the interruption is very short, and the current is spontaneously re-established without the necessity of bringing the charcoal points together. Owing to the retention of an image upon the retina of the eye, the light, though intermittent, appears continuous.

We learn from "Cosmos" that M. Leroux has obtained from the following expedient an electric light of a fixedness and an intensity greater than by the machines usually employed. In a certain direction he throws a small jet of oxygen upon the incandescent carbon; they waste slower, and the voltaic arc, in place of a variable oscillation on account of the impurities of the carbon, rests fixed in the position opposite to the oxygen jet, showing on that face the greatest quantity of the illuminating power of the lamp.

The Indo-European Telegraph Company have just issued their prospectus, and so favourably has the scheme been received that the applications for shares in the various continental towns greatly exceed in number those allotted to them. We may, therefore, hope to see almost immediate steps taken to commence this work, and probably by this time next year we may be able to congratulate our readers upon direct communication with India. Of the plans brought before the public none offer so speedy, direct, and economical a means as the present. Agreements have been concluded with the Electric and International Telegraph and Reuter's Telegram Companies for the use of two wires from London to the Prussian coast, and from that point a concession has been obtained from the Prussian Government who undertake to erect at their cost two wires to Thorn, and concessions are also obtained from the Russian and Persian Governments for the erection of two wires from Thorn, via the Black Sea, which is coasted by a submarine cable to avoid the mountainous passes in Asia, to Teheran. Messages passing through have to pay certain royalties to each government, but the charge per message, deducting these royalties, working expenses, and other charges, will leave ample room for profit. The concession and all arrangements have been carried out and obtained by the Messrs. Siemens, who hand over their rights to the company, and who undertake the necessary work, which, with their large continental staff, will be a comparatively easy undertaking. The difficulty hitherto experienced in obtaining a line through the various states of Europe has, through the exertions of the Messrs. Siemens, assisted by some Government influence, been overcome, and we may therefore congratulate ourselves that we have obtained now, through them, certainty almost absolute, of a direct and uninterrupted communication with our possessions in the East. We may, therefore, expect that, by the employ of our experienced operators, messages will be received with but little transmission, and free from those sources of error which heretofore have rendered our telegraphic service with the East a hazardous proceeding.

Opposition to the Government Telegraph Bill has set in, and we have now before us a pamphlet stating the case of the Electric and International Telegraph Company against the Government project. We have also the parliamentary papers giving the reports to the Government in favour of it; press of matter prevents us from discussing the question in our present number, but we hope next week to give our readers some details of this subject.

PHOTOGRAPHY.

ACTINOMETERS—WASHING APPARATUS FOR SILVER PRINTS—NEW MATERIAL FOR PHOTOGRAPHIC DISHES—ALLEGED EXTRAORDINARY PHOTOGRAPHIC DISCOVERY.

IN several photographic processes a sensitive and reliable actinometer would be very valuable. In carbon printing an actinometer is a great aid, because the picture cannot be seen as it is produced by light, so that only in the subsequent washing operations does the operator discover, whether or not the film has been long enough exposed, and then it is too late to remedy any defect. Out of the numerous methods of approximately measuring the chemical activity of light, Professor Roscoe's more scientific methods are not found to be practically useful in photography, and the only plans hitherto brought into commercial use are very simple. Mr. Bing made a "step-by-step" actinometer consisting of many sheets of glass each successive piece being rather smaller than its predecessor. These were laid over each other, the largest downwards, so as to form a flat ladder, the light at one end of the bundle having to penetrate only one sheet of glass, but at the other end having to penetrate the whole number, whilst between the two ends it had to penetrate all the different thicknesses successively. When a piece of sensitive silver or bichromate paper is placed beneath such an arrangement, it will first be changed by light where the glass is thin, but as the layers grow thicker, the chemical change is retarded in proportion. Each thickness of glass is numbered, and the paper used must always be prepared in the same way, so that it shall not vary in sensitiveness. With every new negative, the amount of actinic action it requires to print properly must be ascertained by comparison with the foregoing little instrument, and when this is once done, and the negative marked with the number of the actinometric thickness of glass, which corresponds with the time it must be exposed to light, the actinometer will in future give evidence when the film has been subjected to light the proper time. Dr. Vogel has since made a new little actinometer on the same principle, different thicknesses of paper being substituted for the different thicknesses of glass.

Such actinometers, likewise the more scientific contrivances of Professor Roscoe, only give the aggregate amount of actinic action after the lapse of a prolonged space of time. They do not show the momentary changes caused by every passing cloud, and other atmospheric influences, and are of no value in instantaneous photography. Every photographer who has practised this beautiful and difficult branch of the science, knows that there are great differences in the light, which one day enable him to get rapid pictures with comparative ease, and on another render his attempts hopeless, though to the eye and memory both days may appear to be equally sunshiny and bright. The chemicals and lenses may be alike in both instances, so that the differences cannot be laid at their door. Moreover, the records that were taken for a time at the observatory of the British Association, at Kew, show on special days a very great increase above the average in the chemical intensity of daylight. It would thus be a great boon to the instantaneous photographer if he could know not only the days when the actinic rays penetrate the atmosphere most freely, but the very moment when he can expose his plate to most advantage. At present the only mode by which this can be done is by the actinometer described some weeks ago in these columns, wherein a method is pointed out of making an iron needle

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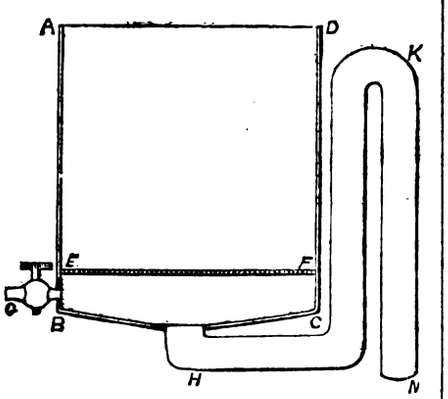
swing round in proportion to the amount of actinism present each instant in the etherial waves.

To make the present silver prints as durable as possible, thorough washing in many changes of water is absolutely necessary directly the pictures are finished. An efficient method of doing this, when only a few pictures are to be washed, is to lay them one by one upon a plate or other slab of porcelain, then, beneath a tap of running water, sponge them well on both sides. The sponge sucks out the chemicals which adhere so persistently to the pores of the paper, so that after five minutes' treatment in this way, and half an hour's subsequent soaking in running water, the prints are better washed than if simply left for many hours in running water, in the usual way. Moreover, quick washing preserves the brilliancy of the prints in a greater degree.

In commerce, this amount of attention can rarely be given to the washing of great numbers of prints, so that numerous washing machines have been invented, some of them also being very objectionable. Mr. G. Dawson, M.A., of King's College, showed us last week a very ingenious and simple washing machine, just brought under photographic notice by an anonymous writer in one of the journals. It is found so efficient that already two or three persons are claiming to be the real and original inventors of the same, though it would seem that such a trivial matter is scarcely



worth quarrelling about. The accompanying cut shows the principle of the apparatus. A B C D is a zinc tank, with a false bottom made of perforated zinc at E F. The prints are put in the upper part of this vessel, and water from a large source of supply is turned on through the tap G. It then enters the tank, rises through the perforated zinc, and lifts up the prints, which are thus kept moving in the water in the vessel. The tank thus gradually fills, but directly the level of the water nearly reaches the top A D, the great iron pipe H K N acts as a syphon, and lets all the water now impregnated with chemicals from the prints run away. This large pipe must be a little flattened at the bend K. After the water is thus all drawn off, the tank slowly fills again by the small stream constantly running through the tap G; when full it is again suddenly emptied, and so on as long as the operator pleases. Thus large quantities of prints may be left to themselves for hours, and the little hydraulic arrangement will wash them efficiently in successive changes of water.

We were shown at the same time, in the photographic laboratory at King's College, a method employed by Mr. Griggs, of the India Museum, to abolish the ordinary glass or porcelain photographic dishes, except for nitrate of silver solutions. His plan is to get a flat square piece of wood, the size of the dish required, and nail four narrow strips of wood upon it near the four edges, the ridge formed by these strips being intended to serve the purpose of the rim of the dish. Then he paints the bottom and sides with india-rubber solution, and, lastly, presses down all over the wooden dish a sheet of "Hancock's india-rubber canvas," and nails the extreme edges down over the outside of the tray. This canvas costs only about 2s. 3d. per square yard, so that dishes thus made are much cheaper than those made of glass or porcelain, and are not liable to breakage. They are not well fitted for nitrate of silver solutions, but other photographic chemicals may be used in them with impunity.

A provincial photographer, of the name of M'Lachlan, for some months past has been writing to the photographic periodicals, saying that he had made an important discovery, but would not publish it except upon some very complicated conditions, involving the appointment of a committee and other curious items. However, at the last meeting of the Photographic Society, in Conduit-street, he said that he had discovered that a solution of nitrate of silver, exposed for a long time to light, is changed in its chemical properties. He said that, if nitrate of silver be dissolved in water in the proportion of one ounce of the salt by weight to one ounce of the water by measure, and a portion of this solution be exposed to light for two or three months, its chemical and photographic characteristics will be altered. He alleged that if one drop of solution of caustic potash—strength, one grain to the ounce—be added to the unsunned nitrate solution, oxide of silver will be precipitated. But if the sunned portion be treated in the same way, the precipitate formed is immediately redissolved; in fact, this solution will bear a considerable addition of the weak potash solution before it will throw down a permanent precipitate. He said that the solution after being thus treated with potash possesses remarkable and useful photographic properties, which he has investigated for many years. He also stated what these new properties were, but it is scarcely worth while to reproduce the other statements here till the main fact about the change in nitrate of silver is authenticated. Mr. Glaisher, F.R.S., who presided at the meeting, asked Mr. M'Lachlan to write a paper on the subject, so that the different points of his discovery may be fully considered at the next meeting. This he promised to do. The society also at once appointed a committee to investigate the subject. Mr. M'Lachlan states that one of the results of his discovery is, that hundreds of negatives without spot or blemish may be taken consecutively with certainty in a small quantity of the improved bath solution. If these statements turn out to be correct, the importance of the discovery is very great, not only from a photographic point of view, but in consequence of the new field it seems to open for investigation in molecular physics. If the statements turn out to be inaccurate, the speaker thereof had better retire forthwith to those regions whence he came. The fact that bad samples of nitrate of silver may be very much improved for photographic use by sunning is not encouraging. When solution of nitrate of silver contaminated with organic matter is exposed for a few hours or days to sunlight, much of the impurity is precipitated.

Mr. Spiller, F.C.S., of Woolwich Arsenal, thinks that particular impurities in nitrate of silver may possibly cause the alleged change in the solution by sunlight, and he is trying experiments on the point.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

A MODE OF STOPPING POROUS CYLINDERS FOR HYDRAULIC PRESSES—A SIMPLE WAY OF BREAKING IRON—A PROCESS FOR OBTAINING PURE IRON—PROCESSES FOR TREATING SEWAGE.

KOHN, an engineer in Berlin, gives the following as a method of effectually stopping up a porous cylinder cast for a hydraulic press. The cylinder is to be heated over a charcoal fire to about 170deg. Fahr. It is then to be filled up with rosin and suspended by a crane over fire until the liquefied rosin is seen sweating through on the outside. The excess of rosin is then poured out and the cylinder allowed to cool, when the pores will be found completely stopped, and no water can possibly pass.

The same engineer gives a simple way of breaking a mass of iron, which we hardly think is novel In a mass 2ft. square and 4ft. long, he bored a perpendicular hole 1in. in diameter, and between 3in. and 4in. deep. This he filled with water and closed with an accurately fitting iron bolt. One heavy blow on this bolt broke the mass into two pieces.

Troost gives a method of obtaining very pure soft iron. He melts cast iron in a lime crucible by means of the oxy-hydrogen flame, directed downwards, we presume. When the metal is fused he increases the proportion of oxygen, and thus burns away the silicon, carbon, and sulphur. The slag formed is absorbed by the crucible. When the operation is finished, a button of very pure metal remains at the bottom of the crucible. This process would be extremely useful on the large scale if oxygen could be procured at a cheap rate, but pending the discovery of means whereby oxygen can be prepared for industrial purposes, pure iron obtained in this way must remain a metallurgical curiosity.

The question of the disposal and useful application of sewage is one that continues to agitate the public mind in London and a great many other cities. It may not be out of place, therefore, to refer to a report by Dumas, on a process recently experimented with at Paris. In carrying out this plan the sewage is collected in reservoirs, and precipitated with a solution of sulphate of alumina. The quantity is not stated, but the cost of the precipitant is said to be one centime to the cubic metre of sewage—that is, less than half a farthing a cubic yard. The precipitate is quickly deposited, and contains all the phosphoric acid, and nine-tenths of nitrogen, and organic matters in the original sewage, and it is therefore a valuable manure. The weight of dry precipitate obtained is six kilogrammes (7lbs.) per cubic metre. The supernatant liquor is limpid and completely deodorized, and may be run into a stream without any fear of disagreeable consequences. It is only right to say that the use of sulphate of alumina has been suggested in this country, but with addition of lime and sulphuric acid, which have greatly lessened the value of the precipitate for agricultural purposes. There are many towns in England where this precipitation by sulphate of alumina alone might perhaps be carried on with profit.

Another suggestion much less reasonable has been made for the extraction of ammonia from town sewage. The inventor of this process adds phosphoric acid and magnesia to the sewage, with the idea of precipitating the ammonia in the form of ammonio-magnesian phosphate. The precipitate he gets, he collects and dries, and then distils with quicklime in gas retorts, condensing the ammonia which passes over in the usual way. The residue in the retort will contain the phosphoric acid, and be applicable for manure. As a method of obtaining ammonia, this process is not worth a thought. But while writing on sewage, we may remark that a similar precipitation formed the subject of a patent by Mr. Blyth, the chemist to the Board of Health, which never, we think, attracted the attention it deserved. The patent has long expired, and the information contained in it is fully at the service of the public. The sewage being conducted into reservoirs, a calculated proportion of superphosphate of lime was added, and the mixture strongly agitated. Lime water was then added in sufficient quantity to render the whole rather alkaline. The mixture was again strongly agitated, and then allowed to deposit. A precipitate was thus obtained rich in ammonia, and all the suspended matters were carried down by it to the bottom of the reservoir. This we believe to be a valuable process, but it requires intelligent superintendence.

DR. LIVINGSTONE.

NOT less on account of the great explorer than on that of Dr. Stenhouse, will our readers be interested in the perusal of the following extract of a letter from Dr. Livingstone to Mr. James Young, the paraffin manufacturer, of Limefield:—"Country of the Chipeta, Feb. 1, 1867. I am sorry that I never could write to Dr. Stenhouse about his invention. The sheet his agent gave me to place on the ground beneath my bed has been invaluable as a tent overhead. He offered me a covering of a lighter kind, and I regret exceedingly not having accepted it. The Mackintosh sheets I have tried are not to be mentioned in comparison. This black sheet is lighter and lasts wonderfully, while the india-rubber sheet so glues itself together that you soon tear it to pieces in drawing the folds asunder. The first pair of boots have lasted during a five hundred mile tramp, often over a rough stony soil and in the driest and hottest season. I gave away the first pair, not because the uppers were broken or the soles worn out, but because the inner seam had given way at the toes and the heels were gone. I ought to have had a pair not Stenhoused to try against the others. I am now putting a second pair to a severe test daily, wet outside and in and then exposed to a broiling sun. If they last long at this I shall let the Doctor know. I think his invention really very valuable, and I wish you would give him this extract as a sort of acknowledgment for kindly providing that brick of a sheet."

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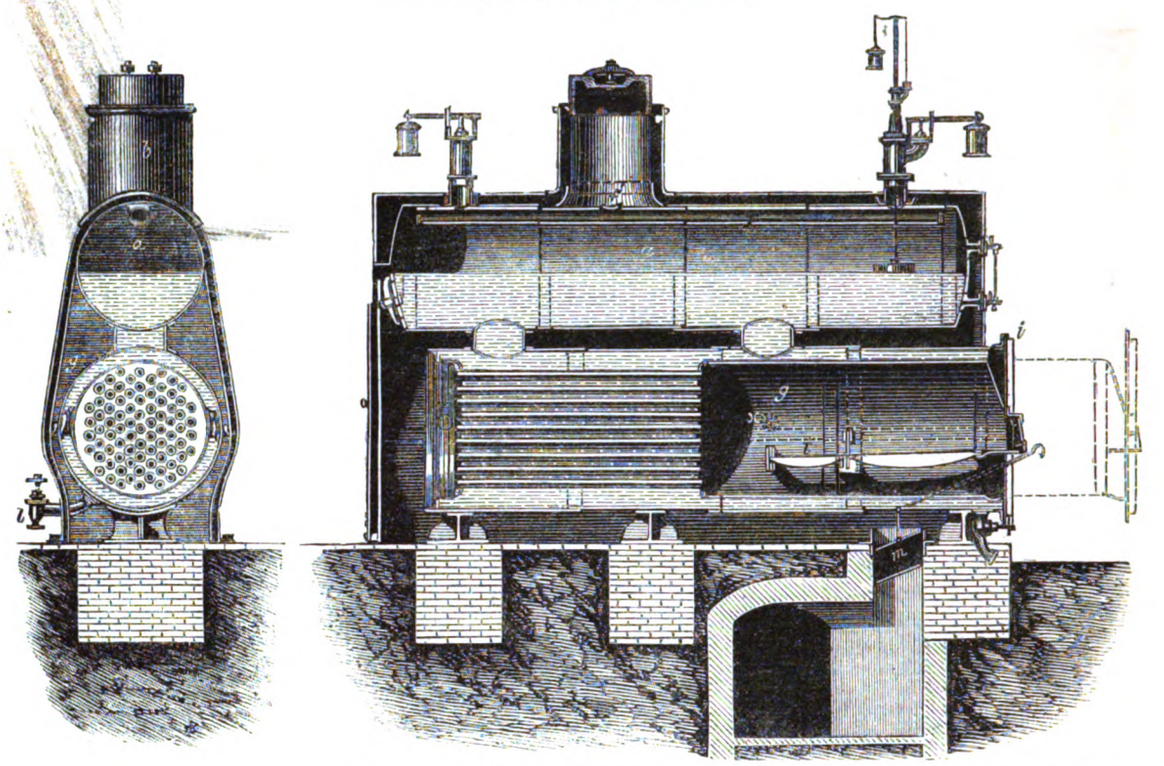
SPECIAL STEAM BOILER.

BY MESSRS. FARCOT AND SONS.

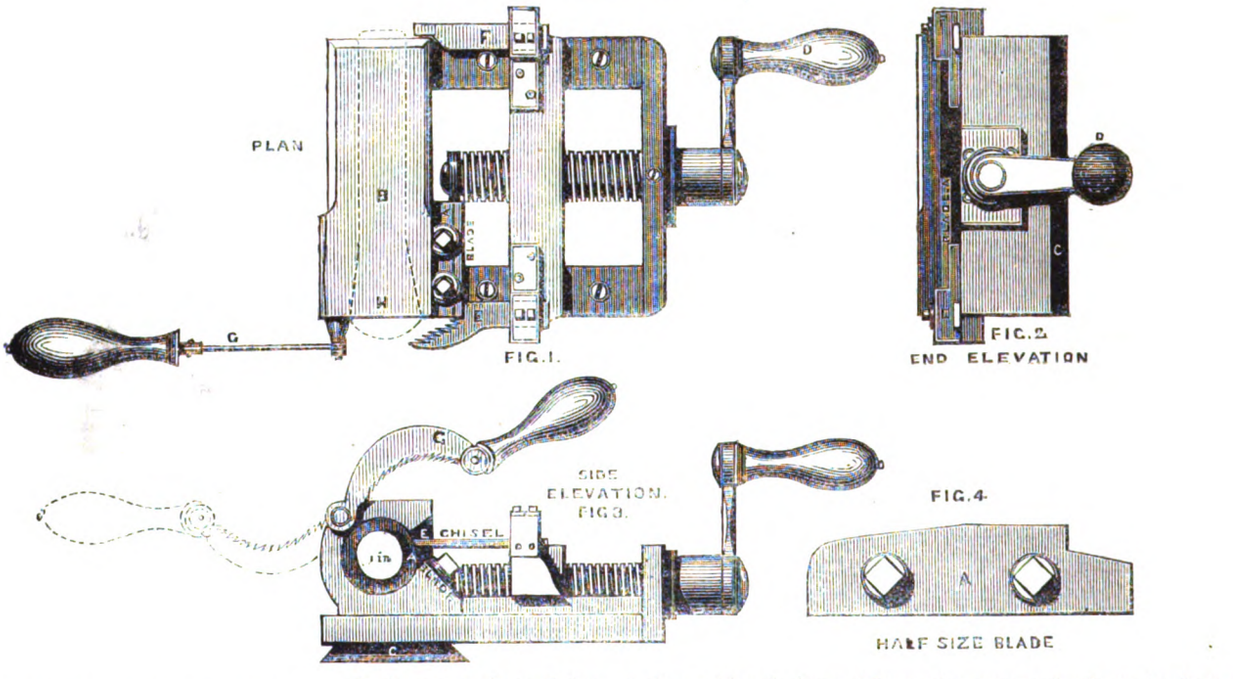


SPECIAL STEAM BOILER.

THE above illustration represents a boiler by Messrs. Farcot and Sons, of St. Ouen, and which is constructed after a system introduced by that firm. It will be seen from the engraving that the boiler consists of two chambers placed one above the other, and connected by waterways. The lower chamber contains the firegrate and tubes, and is so constructed that they may be drawn out for the purpose of cleaning them. The small rollers *v* and *x* are intended as supports to the tubes and grates when so removed. The whole boiler is surrounded by a casing of iron plates strengthened with angle irons, and which casing forms an external flue for conducting the heated gas from the lower boiler to the chimney.

PATENT TREENAIL CUTTER.

BY MR. ADDIS, C.E.



PATENT TREENAIL CUTTER.

MR. ADDIS, C.E., of Bombay, has recently patented the neat little mechanism for making treenails illustrated in the accompanying engraving. It is intended to facilitate and render perfect the formation of treenails which are being extensively used on some lines of railway. These machines have been successfully employed in the patentee's workshops, each machine delivering, on an average, 500 treenails a day, at a cost of 18 rupees a thousand. They were also effectually used at Erode, on the Madras Railway, where there were no provisions made for large deliveries, and their want seriously felt. The machine is a simple and inexpensive one, and consists of a single cutting tool A secured in a box B, which is rendered capable of being removed for repairs or renewals; the mode of operation is exceedingly simple, and can be conducted by an ordinary labourer. The timber for the purpose is first roughly shaped and cut into lengths from 18in. to 20in., so as to be admitted into the box B. One of the pieces is centred on a puppet, and by motion communicated in any convenient way is made to revolve. The machine, which is placed on the bed of a lathe, and by means of a

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groove C, is slided forward, and on its approach to the wooden pin the chisel E is gently advanced by working the handle D, which serves to remove all superfluity on the surface of the intended treenails, which, during its transit through the box B, is formed and rendered smooth and clean by the cutter A within. After the pin has passed the whole length of the box B, the chisel E is worked home, which completes and finishes the treenail by forming the head, and adapting it for the cap, while the other end is bevelled by chisel E. Lastly, the saw G is pressed down on to the treenail, which detaches it from the puppet, leaving it formed, as shown by the dotted line H, in fig. 1. By the application of an inndependent motive power, so as to dispense with direct manual motion, the utility of these machines may be greatly enhanced. In the engraving, fig. 1 shows the machine in working order, with appliances for adjusting; figs. 2 and 3 side elevation. Fig. 4 represents the cutting blade of the machine.

A SEARCH FOR SOLID BODIES IN THE ATMOSPHERE.*

By Dr. R. Angus Smith.

I HAVE so frequently for many years attempted to find, and have found, organic substances which have passed from the air into liquids in which they were collected, that perhaps the Society will scarcely attend to another attempt although it indicates, I think, some progress. It was in the year 1847 that I first collected what I believe was matter from the respiration and perspiration, and found that as it was kept it grew into distinct confirmed forms. Whilst examining some matters relating to the cattle plague I found one or two remarkable points. I had before that time used aspirators to pass the air through liquids, except in the oxidation experiments. At that time I used simply a bottle which contained a little water. The bottle was filled with the air of the place and the water shaken in it. The difference of air was remarkable. A very few repetitions would cause the liquid to be muddy, and the particles found in many places were distinctly organic.

It may, however, interest the Society to hear of a few of these previous attempts, the latest made till recently. I shall therefore read from a report to be found in the appendix to that on the cattle plague.

Mr. Crookes also brought me some cotton through which air from an infected place had passed. It was examined at the same time. Taking cotton in the mass nothing decided was seen; but when it was washed some of the separate films were coated over with small—nearly round—bodies, presenting no structure, or at least only feeble traces of it, and perhaps to be called cells. I had not sent gun-cotton, as I intended, to Mr. Crookes, fearing the rules of the post; otherwise there would have been more certainty that the bodies spoken of did not exist previously on the cotton. However, Mr. Dancer, who has examined cotton with the microscope oftener than most persons, even of those experienced in the subject, had never observed a similar appearance. The liquid had also a number of similar bodies floating in it.

It was then that Mr. Crookes sent a liquid which he had condensed from the air of an infected cow-shed at a space a little above the head of a diseased cow. It was also examined, and it presented similar indications of very numerous small bodies. Not being a professed microscopist I shall not attempt a description, but add that they clearly belonged to the organic world, and were not in all cases mere débris. We found also one body a good deal larger than the rest; it resembled somewhat a paramecium, although clearly not one. We found no motion whatever, and only this latter substance could be adduced as an absolute proof of anything organized being present. Next day I examined the same liquid: and, whether from the fact of time being given for development or from other causes, there was a very adundant motion. There were at least six specimens in the field at a time, of a body resembling the euglena, although smaller than I have seen it. When these minute bodies occur it is clear that more may exist, and germs in this early stage are too indefinite to be described. The existence of vital sparks in the organic substances in the air alluded to is all I wish to assert, confirming by a different method the observations of others. It might, of course, be said that since the bottle was opened at Mr. Dancer's the air at that place may have communicated them. I answer that, before it was opened, a good glass could detect floating matter, some of it, however, as in the microscope proved, indefinite enough.

Finding this, and fearing that the long time needful to collect liquid from the atmosphere might expose it also to much dust, I used a bottle of about 100 cubic inches dimensions, and putting with it a very little water, not above five cub. centimetres, I pumped out the air of the bottle, allowing the air of the place to enter. This was done six times for each sample, the water shaken each time, and the result examined. This was done with the same bottle that was used in my early experiments with permanganate, and by the same method, except that water instead of that salt was used. At first considerable numbers of moving particles were found; but it was needful to examine the water used, and here occurred a difficulty. It was not until we had carefully treated with chemicals and then distilled the water again and again that we could trust it. Particles seemed to rise with the vapour, and if so, why not with the evaporating water of impure places.

Having kept an assistant at the work for a week, and having myself examined the air of three cow-houses, I came to the conclusion that the air of cow-houses and stables is to be recognized as containing more particles than the air of the street in which my laboratory is, and of the room in which I sit, and that it contains minute bodies, which sometimes move, if not at first, yet after a time, even if the bottle has not been opened in the interval. There is found in reality a considerable mass of débris with hairs or fine fibres, which even the eye, or at least a good pocket lens, can detect. After making about two dozen trials, we have not been able to obtain it otherwise. Even in the quiet office at the laboratory there seemed some indications.

I found similar indications in the cow-house with healthy cows; so I do not pretend to have distinguished the poison of cattle plague in these forms; but it is clear that where these exist there may be room for any ferment or fomites of disease; and I do not doubt that one class is the poison itself in its earliest stage. It would be interesting to develope it farther. I have recorded elsewhere that I condensed the liquid from the air of a flower garden, and found in it, or imagined I found, the smell of flowers. I do not remember that I looked much to the solid or floating particles, thinking them to be blown from the ground, but it does not effect the result, whether they be found constantly in the air or are raised by the action of currents.

Lately I tried the same plan on a larger scale. A bottle of the capacity of 4990 c.c. was filled with air and shaken with water. The bottle was again filled and shaken with the same water, and this was repeated 500 times, nearly equal to 2½ million cbc., or 2,495 litres. As this could not be done in a short time, there were considerable variety of weather, but chiefly dry, with a westerly wind. The operation was conducted behind my laboratory, in the neighbourhood of places not very clear, it is true, but from which the wind was blowing to all parts of the town. I did not observe any dust blowing, but if there were dust, it was such as we may be called on to breathe. The liquid was clouded, and the unaided eye could perceive that particles very light were floating. When examined by a microscope the scene was varied in very high degree—there was evidently organic life. I thought it better to carry the whole to Mr. Dancer and to leave him to do the rest, as my knowledge of microscopic forms is so trifling compared to his.

*Literary and Philosophical Society.

THE BOILER INSURANCE COMPANY.

WE have lately had occasion to notice the annual reports of the various companies which have been established for the inspection of steam boilers with a view to preventing explosions. How well they have succeeded in deserving the confidence of the public is evidenced by the immunity enjoyed by those who avail themselves of their assistance. We have taken these reports seriatim, in the order in which they were received by us, and we now come to that of Mr. Longridge, the engineer to the Boiler Insurance and Steam Power Company, Manchester. Mr. Longridge's report is carefully prepared, and extends to a considerable length, embodying a series of practical remarks which it would be well for every steam user to read and ponder upon. Mr. Longridge opens by admitting the explosion of one boiler under his inspection, and this is the second company which met with an accident during last year. However, in this instance—as in the previous one—no injury to life or limb was sustained. The report goes on to deal with defects, and the various causes which lead to accident. All these matters have been treated in previous notices, so that we need not again refer to them here. One point, however, which we have not previously touched upon should certainly have notice here, and that is, the difficulty of getting steam users to submit to a proper inspection. It may seem strange, but it is no less true, that, notwithstanding the numerous fatal explosions that have occurred, resulting from defects which could not have escaped the notice of a competent inspector, many of the users of steam power appear to be indifferent as to the condition of their boilers. They will rather incur the risk of an explosion than stop their works one day in the year that their boilers might be thoroughly examined. All seem to expect that any examination that may be required shall be made at one of the general annual holidays, when their works are necessarily idle. Even then many of them will not be at the trouble or expense of having the boilers properly cleaned and the flues swept, without which a satisfactory examination is impossible; but possibly in some cases this want of preparation may be the result of mere forgetfulness. As an example, we may refer to one instance where, by special appointment, an inspector was sent a distance of nearly one hundred miles, and as there were six boilers to be examined he proceeded thither the day before that appointed for the examination. Proceeding to the mill early on the following morning he found it closed, and no preparation whatever made. On seeing the owner he was requested to stay another day, but as this was impossible, on account of other engagements, orders were given forthwith to cool the boilers by running cold water into them, and to sweep the flues. This was accordingly done, but, it is scarcely necessary to add, the cleaning and subsequent examination were anything but satisfactory, and in consequence of the excessive heat in the flues, the inspector was very unwell for many days after. We cannot too strongly condemn this conduct, which is unfair to the company. Every facility should be afforded to their agents for making the inspection under fair conditions. If this is not done the company ought hardly to be held responsible for accident. Mr. Longridge's report is illustrated with five lithograph drawings from photographs of exploded boilers.

COLOUR OF SUN SPOTS.

MR. S. BROUGHTON recently informed the Literary and Philosophical Society that on observing with high powers a group of fine spots on the sun, one of which was of considerable magnitude, it occurred to him to remove the dark glass, and by keeping the eye much beyond the focus of the heating rays, and at such a distance that the spot almost filled the apparent field of the eye-piece, to see if any phenomena could be observed different from those seen through the dark glass. The spot was at once seen to be of a dark blood red; but, thinking this perhaps might be from the strong contrast of colour, he attached a disc of plaster of Paris to the telescope, and projected the image of the spot on it. On looking at this with a common pocket magnifier, the image was observed to be a dark blood red, although the observatory was not darkened, and the disc merely shielded from the direct rays by an intervening opaque substance. If these observations are confirmed, it will corroborate the opinion long held that the spots are not black, but appear so by contrast, and, as it would seem, from the intervention of the coloured glass.

Dr. Shortt is expected shortly to arrive here from India, bringing with him about a dozen and a-half of the walking fishes of India, Murrul and Korava, many of them intended as a present to the Zoological Society's Gardens from Dr. Day. The largest species, known as Ophiocephalus striatus, grow to upwards of 3ft. in length, and, if they succeed in England, will make a capital addition to our lakes and canals. The smaller variety, Ophiocephalus gachua, will perhaps be more interesting than useful, as they only grow to about 1ft. in length. Pains have been taken to accustom them by degrees to confinement before shipping them in tin boxes. Dr. Day is said to have come to the conclusion that they breathe air direct from the atmosphere, as well as air in solution in the water in which they live.

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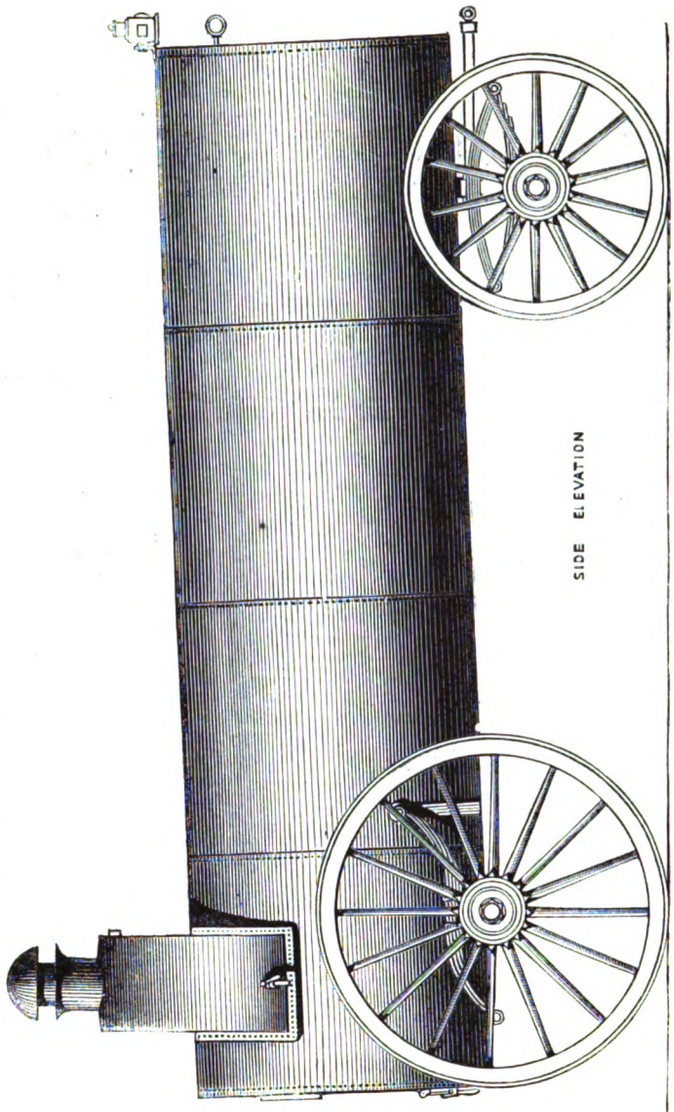
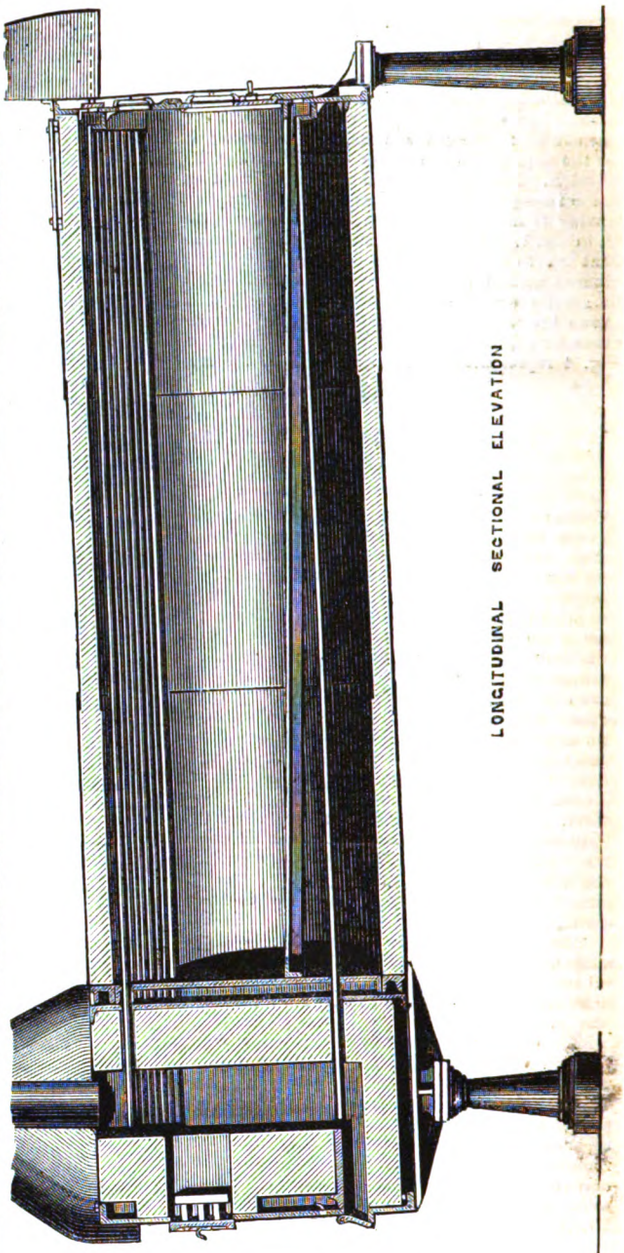
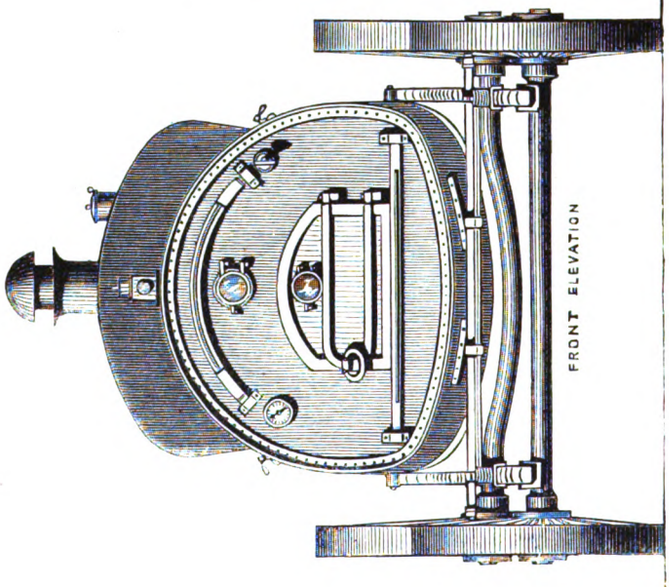
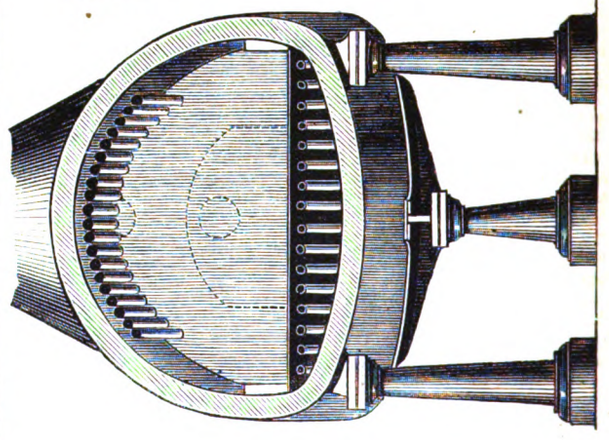
PORTABLE AND STATIONARY OVENS.

BY MR. A. M. PERKINS.









PORTABLE AND STATIONARY OVENS.

WE this week give engravings of the portable oven introduced by Mr. A. M. Perkins, as an improvement on the hot water ovens long manufactured by the well-known firm of which he is a member. These ovens have been approved and adopted by our own War Department, and since the exhibition of the oven in Paris last year, an important order for them has been given by a foreign government, and the attention of the French Commissariat Department has been directed to them by the Emperor himself. The mode of conveying heat from the fire into the body of the oven is decidedly original, and as the entire apparatus, as in the case of the portable, and the very similar stationary oven are of iron, their description will probably be interesting to others besides those for whose use they are more especially intended. The principal object of the inventor has been to dispense with the use of numerous joints which were necessary in the hot-water oven, and for this purpose he has substituted for the continuous circulation principle a set of simple butt-welded boiler tubes, each perfectly separate in its operation, and hermetically sealed at each end.

A carefully ascertained quantity of water is introduced into each of these tubes previous to closing it, and it is by the continuous evaporation of this water that the heat is transmitted from the fire to the oven. As will be seen in our engravings, the fire is made at one end of the oven in a

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THE STEEL BRIDGE OF THE QUAI D'ORSAY.

BY THE TERRE-NOIRE WORKS.

FIG. 1

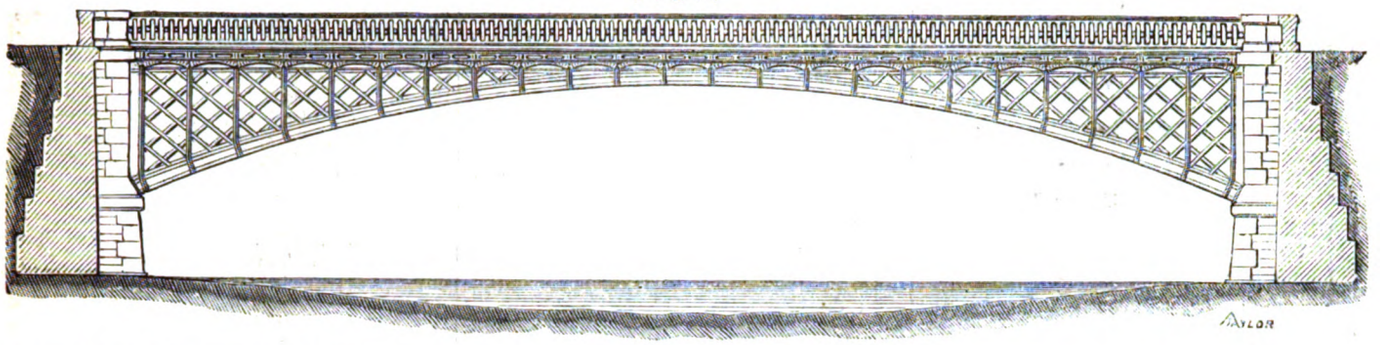


FIG. 2

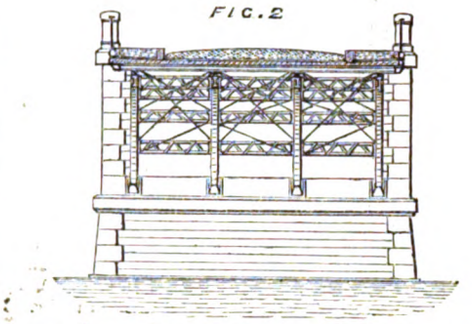
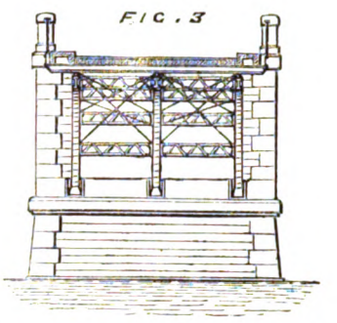


FIG. 3



firebox of Stourbridge ware; the lower range of tubes passing under the bottom plate of the oven, have their ends projecting a few inches into the fireplace, and, in fact, form the firebars; the upper range have about an equal projection over the fire, and the smoke passes amongst them on its way to the chimney; both ranges of tubes are given a considerable slope towards the fire so as to provide for the return of the water, which is being continuously but very slowly condensed in the oven, as the steam imparts to it the heat it brings forward from the fire. The casing of the oven is double, the space between them being filled with non-conducting material. The stationary ovens are of cast iron, and peat or other substances are used for the non-conducting envelope, but in the case of the portable oven the double casing is of sheet iron, and the filling material is vegetable black, of which only 40lb. are required to fill the space of 3in. thick encircling the entire oven, and so completely intercepting the heat that when the temperature is 450deg. inside the outer surface of the oven is absolutely cold.

Our engravings show a side elevation of the portable oven and sections of the stationary one, which, however, in all essential particulars except the supporting pillars are also correct sections of the portable. The hood-like projection at the fire-door end of the portable oven is only a boiler placed around the chimney for the assistance of any other cooking operations in the camp. As may be supposed, the economy of fuel in these ovens is very great, the Deputy Commissariat-General, War Department, states that whilst the common oven for a given quantity of bread required 224lb. of coke to heat it, Mr. Perkins' oven only used 56lb. for the same quantity. Scarcely anything can be more conclusive of its economy.

USE OF STEEL IN BRIDGES.

SOME time ago, previously to the discovery of the numerous difficulties that attend the production of a reliable and homogeneous description of steel, it was confidently expected that it would supersede cast and wrought iron, in a manner similar to that in which those materials have been substituted for their ancient predecessor timber. These anticipations, it is needless to remark, have not yet been realized. Partly owing to the want of accurate information respecting the constructive qualities of the material, and partly to its high price, it has made little or no progress towards deposing ordinary iron from the position it holds. One insuperable drawback against its general adoption is the apathy displayed by the Board of Trade, and their entire unrecognition of its merits. So long as that great and inappealable authority continues to ignore its superior qualities, and refuses to make any alteration in its arbitrary rules with respect to metallic structures for railway purposes, so long will it be impossible for the engineer having regard to economy, to adopt it in his designs. If no greater strain than the stereotyped one of five tons per square inch is to be placed upon a material calculated upon the assumption of its minimum strength to be able to bear eight, then, since it is a more expensive article than the material competent only to bear that strain, its employment is at once doubly forbidden. Although we are, as usual with the Anglo-Saxon, in the background regarding any modern improvement and advancement, scientific or otherwise, yet, fortunately, other nations are neither so timid nor so lethargic, and the contents of the present article, together with the accompanying illustration, will convince our readers that the new material is receiving, at any rate, elsewhere, the attention it deserves.

Among the many interesting specimens of construction exhibited at the late "Exposition" was the steel bridge connecting the Quai d'Orsay across the passage which brought the Champ de Mars into communication with the Seine. It is the first work of a similar character built in France, and wherein Bessemer steel has been used as the principal component. Some years ago, the price of steel was so high that it would have been preposterous to have thought of applying it to bridge construction, but latterly the manufacture of that substance by the Bessemer process has placed in the hands of engineers and architects a new agent of construction. At the establishment of Terre-Noire this well-known process has been put into operation, and upon a large scale, in the manufacture of rails, plates, bars, and other special forms suitable for mechanical purposes. By the employment of certain ores, especially adapted for the process, and by the adoption of various precautions in its different steps, many of the difficulties hitherto attending its success have been overcome, and it is possible to produce steel, *a la* Bessemer, possessing different degrees of hardness and elasticity, according to the use it is intended for. When once this fact is clearly established, steel will no longer occupy the place of an unknown and untried material, but will take that position in the constructive arts it is indisputably entitled to. In comparing the steel manufactured at Terre-Noire with ordinary iron, there would be an economy of forty per cent. obtained by the use of the former, so far as the theoretical sections and weights were concerned. The saving, it must be borne in mind, has a double value, as it affects not merely the actual quantity used, but also diminishes the cost of transport. Having made these preliminary remarks, let us now turn our attention to the system adopted in our example, the conditions it fulfils, and the results that have been obtained from it. The bridge of the Quai d'Orsay is represented in fig. 1 in elevation, and in transverse section in figs. 2 and 3. It has a span of 82ft., and supports a paved roadway, the footpaths being formed of asphalte concrete with curbs of stones set on end. The ribs are of the solid or plate form, having a rise of 8¼ft., and the flanges are composed each of a pair of steel angle irons united to the web by steel rivets. Ordinary iron was employed in the cross girders and bracing shown in the transverse sections. By order of the authorities the following regulations had to be adhered to most stringently in the design and execution of the bridge. The roadway was to be formed of oaken blocks, 5in. in thickness, covered with metalling or paving 10in. in thickness, and the proof test for the ribs was to be at the rate of half a ton per square yard of surface of superstructure. For every square inch of sectional area of wrought iron, five tons was the limit permitted, and this was increased to seven for the steel ribs. During the testing of the bridge, the load was increased twenty-five per cent. above what had been prescribed, and allowed to remain upon it for three days, without, however, producing a deflection greater than 1¼in. Upon the removal of the testing load the ribs recovered, practically speaking, their original form evincing no permanent set beyond what is inevitable in all structures submitted to a heavy test. In addition to the action of a dead load, the bridge was subjected to that of a rolling one, consisting of two waggons loaded with stone and each drawn by five horses. One of these had but a single axle and weighed nearly twelve tons; the other weighed rather more, and was furnished with two axles. The two waggons were drawn over the bridge separately, together, in the same, and in contrary directions, and scarcely any deflection was appreciable at either the crown or haunches of the arch. This bridge resisted during the whole time of the Exposition a very heavy description of traffic, including the passage of some enormous cannons and other huge monuments of mechanical skill and industry. At the close of the Palace it was taken to pieces, and is destined to be reconstructed, as a bridge of three arches, at Port-de-Roche, Langon. That the use of steel in these instances allows of a diminution of dead weight there is no doubt, but at the same time its value must not be exaggerated. In all structures of this description, there are numerous component parts in which neither the weight nor sectional area can be reduced with safety, even by the employment of a lighter material, and, therefore, in these cases the adoption of steel would simply entail an increase of expenditure without any equivalent advantage. Until, therefore, Bessemer steel can be produced at a price nearly equal to that of iron, it will be necessary to reserve its use for those parts of a bridge, roof, or other structure, which are most severely strained, and in which the entire sectional area is susceptible of useful work. In girder bridges the thickness of the flanges would be lessened by the employment of steel instead of iron, and by so doing the riveting would be better accomplished. There is not so much advantage to be gained by the adoption of steel in cross

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girders unless they are placed far apart, as in the main beams, but still, under certain conditions of loading, an economy will be effected by so doing. The absolute saving in the cost of transport, by the substitution of steel for iron, will depend upon the type of construction selected, but it may be considered as ranging from twelve to twenty-five per cent. In large roofs steel presents more advantage than for other examples of a similar nature, as the rolling load is reduced to zero, and no great insistent weight or vis inertiæ is required, provided that the roof be effectually braced against the violent and irregular action of the wind.

RECENT LAUNCHES.

THREE fine ships have recently left the stocks, two of which were ironclad, the other being unprotected. Taking them in the order of launching, the latter comes first. This is the screw sloop "Sirius," which was built at Portsmouth, from the designs of the Chief Constructor of the Navy, and was launched on Friday. She is one of the vessels built or building of the improved "Amazon" type. She measures between perpendiculars 212ft.; her length of keel for tonnage is 185ft. 8in.; her extreme breadth, 36ft.; her breadth for tonnage, 35ft. 10in.; her breadth moulded, 35ft. 2in.; and her depth in hold, 19ft. 4·75in.; her burden in tons, o.m., 1,268 8-94. Her machinery will consist of a pair of Maudslay, Sons, and Field's patent compound engines, of a nominal power of 350-horse, driving a Griffiths-Maudslay screw. The "Sirius" is a wood-built vessel with rolled iron deck beams, iron stringer plates under the upper deck at the water ways, and iron diagonal strap fastenings. She will carry no armour, in common with all others of her class. Her armament will consist of two 6½-ton 7-in. muzzle-loading rifled guns, mounted on iron carriages and slides, and two rifled and converted 64-pounders. The official estimate of the cost of the ship fitted for sea, but exclusive of machinery and armament, is £43,000.

The two remaining launches took place on Saturday; the first was that of the "Repulse," built at Woolwich. This ship is an ironclad of 3,734 tons burthen, and is pierced to carry twelve heavy guns. The third launch took place at the Thames Iron Shipbuilding Company's Works, of an ironclad of much larger dimensions, the "Konig Wilhelm," built for the Prussian Government at a cost of nearly £450,000. The ship was originally intended for the Turkish Government, who, failing in providing the necessary funds, the directors of the Thames Ironworks cancelled the agreement, and succeeded in persuading the Prussian Government to purchase her. Her principal dimensions are as follows:—Length between perpendiculars, 365ft.; length of keel for tonnage, 320ft.; breadth of tonnage, 60ft.; depth of hold amidships, 41ft.; engine power, 1,150-horse (manufactured by Messrs. Maudslay); tonnage, 6,127 tons. The ship came off the slips in magnificent style, decorated with the Prussian national colours.

INSTITUTION OF CIVIL ENGINEERS.

AT a meeting of the Institution of Civil Engineers, held April 21, 1868, Mr. C. H. Gregory, President, in the chair, a paper was read on irrigation in India, by Mr. Allan Wilson, M. Inst. C.E.

Having had fourteen years' experience in the construction and superintendence of irrigatfon works in the central and southern provinces of India, where wet cultivation was extensively practised, the author proposed in this communication mainly to refer to that part of the empire. A brief account was, in the first place, given of the former and present systems of irrigation, followed by a detailed description of the accessory works; and the cost of providing the water was then noticed.

The value of artificial means of irrigation, for increasing the fertility of the soil, was recognized in India at an early date. In the Punjaub, canals for this purpose, as well as for navigation, were constructed as far back as the middle of the fourteenth century. But it was in the southern parts of India, where the rainfall was more precarious, and the river supplies less easily available, that the most extensive works were to be found. It had been estimated that, prior to the establishment of British rule, there were, in fourteen of the principal irrigated districts of the Madras Presidency, upwards of 43,000 tanks and channels in repair, besides about 10,000 out of repair, having, probably, 30,000 miles of embankments, and 300,000 separate masonry works. Some of these tanks and reservoirs were on an immense scale, for irrigating many thousand acres, while there were smaller tanks, wells, and springs, which watered only a few acres. It was remarkable that the Government should have allowed so many fine works gradually to fall into decay, without replacing them by others; as great natural facilities existed for storing water, and for forming canals to lead it on to the land. The irrigation works on the Godavery and Kistna rivers, in the northern Circars, and on the Coleroon, in Tanjore, had only recently been completed; but many large rivers were still allowed to flow into the ocean, almost unused for agricultural purposes.

With regard to the most general and least expensive mode of irrigation by means of artificial reservoirs, and to the methods adopted in forming such reservoirs, it was stated that in selecting a site it was essential to ascertain, in the first place, that the foundation was suitable; the next point to be determined was the extent of land to be irrigated and the quantity of water necessary for such irrigation. The area of the drainage or gathering grounds could be estimated from the trigonometrical survey maps of India, and the quantity of water that would pass into the tank during floods should be calculated according to the known rainfall, due allowance being made for absorption and evaporation. With these data, the dimensions of the different works could be fixed. It should, however, be borne in mind, that depth of water was of greater importance than a large surface area, as the evaporation would be less in the former case. An examination should also be made of the valleys in the vicinity of the proposed reservoir, with a view to ascertain whether the surplus water flowing through the tank during floods could not be carried across intervening ridges, and be stored in natural basins at a small outlay, so as to fill a chain of tanks. It was explained that a tank was simply a reservoir formed by throwing an embankment, or bund as it was called in India, across a valley to dam up the drainage. The most simple description of bund was constructed entirely of earth, which was generally dug from the bed of the intended reservoir. The breadth at the top was usually about 12ft. The inner slope was three to one, and this was faced with a pitching of loose stone, while the slope of the land side varied from two to one to one to one. Puddle was seldom, if ever, used; indeed, it was not required, as, owing to the lodgment of silt, a tank would puddle itself as soon as it had been once filled. In illustration of this fact it was mentioned that Major-General Sir Arthur Cotton had stated that in a channel cut through loose sand, within a yard of the water's edge to a depth of 5ft., not the least moisture was found in the excavation, the lining of silt having rendered it completely water-tight. In addition to this embankment, some of the large Hindoo works had a massive retaining wall of masonry in front. Many of these walls were built of dressed stone, close-jointed, backed with rubble and a rough description of concrete; and flights of steps of cut stone were constructed down to the edge of the water.

To obviate the danger of an excessive influx of water during floods, most tanks were provided at one end, and not unfrequently at both ends, of the embankment, with a waste weir (known in India as a calingulah), to allow the surplus water to escape after the tank had been filled. In constructing a tank, the discharge capacity of the calingulah was an essential feature. It was a safe rule to allow one-fourth more than the dimensions obtained by calculation, so that the water might have a free passage in the event of an excessive flood, as otherwise the earthwork might be entirely destroyed.

The author had found that many of the tanks which were now useless had been breached from no other apparent cause than the want of sufficient outlet to carry off the surplus water during floods. In constructing these calingulahs, upright stones, varying from 2ft. to 5ft. in height, were fixed in the body of the masonry, at intervals of from 3ft. to 4ft. When the rains were moderate, as the monsoon was declining, these spaces were filled with brushwood, straw, earth, or rubbish, to prevent the further escape of water, and to store up as much as possible. This contrivance showed how highly water was appreciated by the natives of India; but unless the process of filling up was very gradual, and its completion deferred until the rains had entirely ceased, the results were often most disastrous. Many of the ruined tanks appeared to have been breached solely from the desire on the part of the cultivators to retain the utmost quantity of water. The forms and dimensions of the calingulahs must, of course, be regulated according to the capacity of the tank, the area of the gathering ground, the rainfall, liability of drought, and other local circumstances; so that it was not possible to lay down any general rule, having regard to the great differences of rainfall, &c., in the several districts of India.

In order to draw off the water for cultivating the fields, each tank was provided with one or more sluices, their size and number depending entirely upon the area of land to be irrigated. The sluice in general use in Southern India was exceedingly simple. It was merely a tunnel through the bank, built of brick, or rubble, either arched at the top or covered with flat stones, the floor being paved with flat-jointed flags, and the side walls lined with the same. The inner end or head of the sluice or tunnel was closed by stones, and the water was allowed to enter through one or more orifices, generally from 3in. to 5in. in diameter, cut in these covering stones. The flow of water through these orifices was regulated by means of conical plugs of wood, each of which, being attached to a long handle, could be withdrawn or inserted as required.

At the end of the sluice tunnel below the bank, a cistern was generally built, having its sides pierced with holes at different levels, to enable the water to be drawn off at various elevations. From this point the water was carried forward in open ducts of the requisite dimensions, in the sides of which subsidiary or distributing channels were cut, generally at the expense of the farmer, to lead the water on to the land to be irrigated. The mode of preparing land for wet cultivation was by laying it out in squares, rectangles, &c., each plot being separated from the rest by mud walls of sufficient height and thickness to prevent overflow or percolation. These squares or rectangles were kept level, and were as large as the nature of the ground would admit. When one was sufficiently flooded, the water was let off at the lower corner of the field into the next division, and so on until the whole area had been irrigated.

With a view of showing how favourable some parts of India were for forming reservoirs of large capacity, attention was directed to a design for a large artificial lake, which it was proposed to construct by damming up the gorge of a valley. This reservoir would be capable of storing sufficient water to irrigate 200,000 acres of land, an area equal to the county of Buckingham, allowing the usual average of 500 acres to the square mile as being under cultivation. Taking 170,000 acres as the extent of land to be irrigated for a single crop, this would require provision to be made for the discharge of 170,000 cubic yards of water per hour at each end of the tank; and discussion was invited as to the best description of sluice for discharging such a vast volume of water.

Another method of providing a supply of water for artificial irrigation was by damming up rivers by anicuts, or masonry dams (also called weirs). The sites for many of these had been so judiciously chosen by native engineers, that but little expense had been incurred in building them. They were generally formed of boulders and stones thrown promiscously together. The side next the water had the outline of a retaining wall with a slight batter, and was laid with some care. On the downstream side, two rows of stones composing the lower edge of the apron were carefully laid by hand, and the upper courses on both sides were similarly placed. A detailed description was given of some old anicuts across the river Toombuddra, as well as a modern one over the same stream; of an anicut across the Kistna river, near the town of Bizwarrah; and of temporary weirs, of rough stones, which were not now so generally used as they were formerly. These masonry dams were, when practicable, taken advantage of for forming means of communication from one bank of the river to another, by building a bridge on the top of the weir. These dams had sluices at each end, and if requisite at other parts, to be kept open at times, so as to prevent the lodgment of silt above the weir. A head sluice should also be constructed, to enable the water in the river during a flood to be shut off, and so prevent sand, &c., from entering the irrigating channel. These sluice openings were closed by wooden shutters consisting of teak-wood planks, a native system which had been found to answer so well that it had been adopted more or less by English engineers.

Great differences of opinion existed as to the cost of storing and distributing water for irrigation. Thus, in a report made by Colonel Dickens, in 1855, on the Shahabad district, the estimated cost of storing and supplying water from four different tanks, including the cost of the distributing channels, was 400, 352, 350, and 494 cubic yards per rupee respectively, or an average of 400 cubic yards per

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rupee, giving a cost of 8 rupees 12 annas per acre irrigated with 3,500 cubic yards, a quantity which was amply sufficient to raise more than an average rice crop. Colonel Rundall stated the rates per acre in the Madras Presidency at 6 rupees and 8 rupees 3 annas, giving an average of 7 rupees 15 annas per acre as the cost of storing water; but it did not appear whether the expense of the engineering establishment and of the distributing channels was included in these rates. The author stated as the result of personal experience, that a few years ago, in the south of India at least, an extensive area in the immediate vicinity of the work could have been provided with irrigation works, including distributing channels, at a cost of 10 rupees (£1) for every 3,500 cubic yards. Owing to the increase that had of late years taken place in the rates of all kinds of labour, the cost would now propably amount to 15 rupees per acre irrigated.

Water was also raised from wells, banks of canals, and rivers, for irrigation purposes, by means of the Persian wheel, and pumps of all kinds, worked either by men or by bullock gin; the môt operated by bullocks, and the picottah by men being employed. From springs water was lifted by basket scoops worked by men. A minute account was given of these several methods, accompanied by a statement of the quantities and cost of water, as well as a comparative statement of the number of cubic feet raised 1ft. high per day of ten hours, raised by these different plans in various parts of India.

As to the relative value to Government of irrigated and dry cultivation, it was stated that, in the fourteen districts of the Madras Presidency already referred to, there were about two million acres of irrigated and twenty-five million acres of dry land, and that the revenue derived from the former was one and a-half million sterling, against barely two millions from the latter, so that the irrigated land yielded three times the revenue drawn from an equal surface of dry land. As regarded the gain to the cultivator from irrigated land independently of the certainty of reaping the crop, it might be stated that the average intrinsic or market value of crops raised on irrigated land was twenty rupees per acre, against six rupees for the produce from unirrigated land, or more than three-fold.

The great superiority of river and tank water for irrigation purposes, as compared with well and spring water, was next adverted to, as an additional argument in favour of the formation of river and tank reservoirs. In many localities, large profits might reasonably be expected to be realized, both from the construction of new works, and from additions and improvements to existing ones. Statistics regarding the extent of land at present irrigated were meagre, but it might be safely stated that not more than four million acres were watered by artificial works; and there appeared to be no prospect, in spite of the large remunerative results obtained therefrom, of an outlay commensurate with the requirements of the country being incurred by Government within any definite period. Judging from personal experience and observation, the author was of opinion that, considering the vast area requiring to be provided with these works, the comparatively small extent of the Government establishments, and the large capital that would be needed, the object could be best attained through the agency of private companies. This view would, he thought, be fully supported by a comparison of the operations of the railway companies with those of Government, in regard to irrigation works. The utmost sum that had been spent by the various governments and communities of India, on those primary and highly-remunerative works, was about four millions sterling, during a long course of years; whereas, no less than about seventy millions sterling had, within a few years, been spent by private companies on railways, which were far less remunerative, and might, moreover, be called subsidiary works, dependant for their full development and success upon the prosperity of the people. It was true that objections had been raised, and possibly not without reason, against the management of private companies; but the defects that existed were not inherent in their constitution, and might, the author believed, be obviated under suitable arrangements. Indeed, there was every inducement for a company to press on the construction of public works in the most rapid and efficient manner, so as to obtain a better return than the moderate rate of interest guaranteed by Government; and the realization of these advantages could not fail to attract capitalists. A feeling in favour of such companies was beginning to spring up among the natives of India, and this feeling would increase as the remunerative results of irrigation works became more apparent.

THE NEW ALABAMAS OF THE U. S. NAVY.

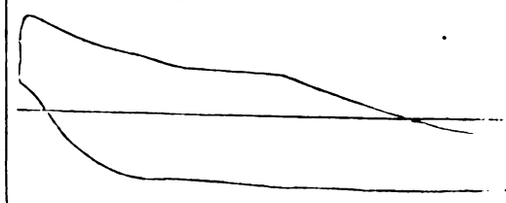
AT the time the last American war broke out the United States practically possessed no navy. Immense exertions were put forth by the Northern States to produce a fleet of fighting ships. Things were done in a hurry, and many mistakes were made. Since the war was brought to a termination much has been done at leisure to supply the country with an efficient fleet, and still graver mistakes have been committed. The first was excusable; the latter are not, and those who complain of the nepotism and prejudice which exist in official circles in England, may learn from the progress of events across the Atlantic that a republic is not necessarily exempt from the defects held by a class to be peculiar to our Imperial system of government. No Chief Constructor, no Board of Admiralty, no marine engineer in England has ever manifested the official incompetency displayed by the Bureau of Steam Engineering in the United States; and we cannot select a more interesting subject for a large class of our readers than the latest doings of Mr. Isherwood and his fellow officials in that department. Reports of their operations reach us tolerably regularly. These, it is fair to say, are often tinted, and sometimes highly coloured by prejudice. They require to be examined and sifted and compared carefully: but after every allowance is made which it is possible for an impartial observer to make, enough still remains to prove that the United States Bureau of Steam Engineering do not know how to design a good marine engine, and are thoroughly competent to commit blunders of sufficient magnitude to startle English marine engineers out of their propriety.

The United States navy is divided into two distinct classes, one intended for coast and harbour defence, and the weightier operations of warfare; the other to protect the commerce of the country. The first class consists of monitors, ironclad, and carrying 15-inch and 20-inch guns; the second of unarmoured cruisers, styled generally, "new Alabamas," which will act the part of a naval police. As regards the first class we are not nowabout to speak. The second claims all our attention. It is obvious that unarmed cruisers to be of use must possess great speed. They ought to be faster than the fastest blockade-runner if they are to be as efficient as it is possible to make them, so that they may be able to run away from ships of greater fighting powers on the one hand, and on the other to pursue and capture the fastest ships which a foe can employ in commerce. We have recently learned ourselves the value of such vessels, and the attempt has been made to supply England with them, it must be added, with but partial success; yet our Alabamas are immeasurably superior to anything which brother Jonathan has yet turned out or is likely to turn out while Mr. Isherwood remains in power.

The United States Alabamas will consist, first, of twenty ships with unpronounceable names, of which the largest will be 3,177 tons and the smallest 2,348 tons burthen; and secondly, of four vessels of greater size and speed called the "Wampanoag," "Neshamony," Pompanoosuc," and "Aminonusuc." These ships, if properly engined, would constitute a most formidable naval force. They have been built solely for speed on one of the sharpest and most beautiful models ever produced. They will be of wood and coppered. Their principal dimensions are—length on water-line, 335ft.; length over all, 345ft.; beam, 45ft.; depth in hold, 23ft.; mean draught, 18ft. 2in.; immersed mid-ship section, 720 square feet; displacement, 4,105 tons. It should be a comparatively easy matter to drive such ships as these at sixteen knots. Mr. Isherwood and the authorities proposed that they should have a sea-speed, in moderate weather, of fifteen knots. It may be easily shown, by calculation, that such a vessel could be propelled at the former speed by about 5,500-horse power, and at the latter speed by about 1,000-horse power less. As we are not in possession of drawings of the hull we hesitate to endorse the statement of American authorities, which is to the effect that the speed of fifteen knots could be obtained by 3,500-horse power. The truth probably lies between ours and the American estimate, and we prefer to adopt the larger measure in order to avoid any imputation of injustice as regards Mr. Isherwood. Up to the present moment only one of these large Alabamas, the "Wampanoag," has been tried at sea. It is stated that an average speed of 16·71 knots has been maintained for several hours consecutively, while a speed of 17·25 knots was kept up for some hours. But the report to this effect must be received with the utmost caution, as will be seen presently.

It is obvious that on the construction of the engines the success of such a craft as the "Wampanoag" must altogether depend. The model is so excellent that the engine builder cannot shift the responsibility from his own shoulders to those of the naval architect, and Mr. Isherwood's reputation must stand or fall by his machinery. Such machinery, we venture to state, never before was sent afloat; and before we proceed to indicate its character we feel it necessary to assure our readers that we exaggerate nothing, the accuracy of every statement being guaranteed by authority which may be regarded as indisputable.

The "Wampanoag's" machinery consists of two cylinders, each 100in. in diameter by 4ft. stroke. The pistons drive the screw shaft through the intervention of eighteen cogged wheels fixed, nine on the crank, and nine on the propeller shaft, and so proportioned that the screw makes two revolutions for one of the engines. The cog-wheels measure 13ft. over the face. The ship being of wood, it is certain that in a sea she must strain and change her shape. Precautions should, therefore, have been taken to prevent the twisting out of line of the bearings by using a bed-plate. Instead of this, the engines are bolted directly on the timbers, and, to make matters worse, the crank shaft, which is 40ft. long over all, is fitted with no fewer than four bearings, each 4ft. long, thus, including the crank pins, there is not less than 20ft. 8in. of bearing surface on the shaft. As a result, we need hardly say the consumption of lubricants must be prodigious, and, in a rough sea, the bearings cannot be kept cool at full speed. We shall not say one word as to the folly of using gearing at all. It is simply a thing at which English engineers laugh. They cannot condescend to argue about it. One result of its use is, that as the screw runs at but sixty revolutions, or thereabouts, per minute, the engines makes but thirty, and, consequently, the power of the 100in. cylinders of the "Wampanoag" is only equivalent to that of two 70in. cylinders with pistons running at the speed proper to the screw—that is to say, at 480ft., instead of 240ft., per minute. We shall come to the boilers presently, but, before speaking of them, it will be well to say something of the power of the engines. We give here a diagram



for which we are indebted to the "Army and Navy Journal of New York," which diagram may be regarded as perfectly authentic. It was taken when the engines were at little over half-speed—eighteen revolutions—with the throttle valve a quarter open, and the link in full gear. The steam pressure in the boiler was 27·5lb., and the vacuum in the condenser 20in.! Nothing can well be much worse, the compression being excessive, although the ports are 40 per cent. larger in area than any English engineer allows. The engines are fitted with a Sewell surface condenser, which, with the engines at half speed, and the temperature of the sea 32deg. Fah., gives, as we have said, 20in. of vacuum only. This wretched result is due to the fact that the circulating pumps are too small, and is magnified at higher speeds, because the weight of steam passed through the cylinders increases in a more rapid ratio than the speed, while the weight of condensing water varies directly as the speed. Under these circumstances, it would be wrong to assume a greater effective average pressure in the cylinders than 20lb. per inch, the average boiler pressure being 32lb.—probably, this is over the mark a good deal. Now, at the time the "Wampanoag" was said to have attained 16·71 knots, the engines made, we are told, but thirty-one revolutions per minute. This is equivalent to a piston speed of 248ft. per min. The area of a 100in. piston is 7,854 square inches; multiplying this by the speed in feet per minute, and dividing by 33,000, we get 59-horse power, nearly, as the power of one engine per pound of average cylinder pressure, or, for two cylinders, 118-horse power, or for 20lb. 2,360-horse power only. We have seen that, on the lowest estimate, about twice this power would be required to propel the ship at 16 knots, and we are therefore forced to the conclusion that, if such a speed was ever attained, the screw must have run off over 120 revolutions per minute, or the cylinder pressure must have averaged 40lb. throughout the stroke, while the vacuum was but 18in. or 19in. of mercury. We leave our readers to choose their own alternative; for ourselves, we state plainly that we do not believe that a speed of 16 knots was, if attained at all, ever maintained for more than a minute or two, unless, indeed, which is not unlikely, she was running before a strong wind in a powerful tide race.

We now come to the most extraordinary features in Mr. Isherwood's abnormal designs. We think it is plain that under no circumstances can the engines of the "Wampanoag" develope more than 3,500-horse power. What boiler power do our readers suppose has been provided to supply a pair of 100in. cylinders at thirty revolutions? The reply cannot fail to startle them. The "Wampanoag" is fitted with no fewer than twelve boilers, containing fifty-four furnaces, affording 30,000 square

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feet of heating surface, and 1,130ft. of grate surface, and weighing, with their fixtures, over 400 tons. Boilers and engines together occupy a space of 175ft. in the length of the ship, and owing to her small beam there is little or no space in the boiler-room for coals, which are carried, therefore, in bunkers on the berth deck!! In fact, with the exception of a few storerooms aft and a little space forwards, the entire orlop deck is occupied by machinery. As a climax to the whole, the engines of this new "Alabama" are at least 70 per cent. heavier than the heaviest engines of equal power used by any other nation, while an idea of her capacity for sailing may be formed when we state that she has four funnels, each about 7ft. in diameter, so profusely stayed that an awning cannot be put up without taking down some of the guys.

In order to fully realize the nature of the enormous blunder committed by Mr. Isherwood, we shall compare the engines of the "Wampanoag" with those of the "Lord Warden" ironclad and the "Orlando," an unarmoured frigate not very unlike the United States ship. The "Lord Warden" engines have worked up to 6,700-horse power. The boilers have but 700ft. of grate surface and 13,000ft. of heating surface to supply three cylinders 92in. diameter, 4ft. 6in. stroke, running over sixty revolutions per minute. The "Orlando," engined by Penn, has two cylinders, with an effective diameter of 92in. and 4ft. stroke; she has eight boilers and thirty-two furnaces, and a grate surface of but 688ft. Total length of space occupied by machinery and boilers, 90ft.; indicated power of engines, 3,992; the total weight of propelling apparatus, including the water in the boilers, being but 648 tons. The engines of the "Wampanoag," without the propeller, but including its shaft, weigh 400 tons, while the whole weight of the propelling apparatus, including water in boilers, is about 1,200 tons.

We need say little more. Mr. Isherwood has sacrificed every necessary quality in a sea-going ship, and has sent a cargo of machinery of the most inefficient description afloat. While he is at the head of the Steam Bureau English engineers need not fear competition; the English public need not dread the action of the United States as regards the production of a fleet of Alabamas. We have said nothing regarding the other twenty-three ships of the new Alabama class. They manifest nearly the same faults of design. Only one thing is more remarkable than these modern innovations in marine engineering; that is, that they should be suffered by an intelligent nation keenly alive to the value of naval supremacy to have any existence.—"The Engineer."

AERONAUTICS AT THE CRYSTAL PALACE.

THE programme of the new season, just published, gives notice of an aeronautical exhibition to be held in June, which may be expected to excite much interest. The exhibits will include,—light engines and machinery, working aerial apparatus and models, plans and illustrative drawings, kites for use in shipwrecks, or other nautical purposes, and for traction, landscape and cloud scenery as observed from a balloon, and other articles and objects connected with aerostation. A captive balloon will be employed during the exhibition for meteorological and other experimental ascents. During the new season, which commences to-day, numerous novel attractions are promised, which are likely to increase greatly the number of visitors, and especially of season ticket holders, whose privileges are extended in some important particulars. The fine library and reading room in the north-west gallery is now completed, and in full use. The free lectures, we notice, are to be continued.

THE WILSON FURNACE.

A MEETING of the members of the Cleveland Institution of Engineers was held on Thursday week, in the Corporation Hall, Middlesbrough. Mr. David Joy occupied the chair. Mr. Thomas Whitwell read a paper on the Wilson furnace, of which the following is an abstract:—In opening, the writer stated that he proposed to bring under the notice of the institution one of the most important sources of practical economy in iron making that had come under his notice. In a previous paper read before the institution, the subject of 2s. 6d. per ton being saved to iron manufacturers was brought before them, but unfortunately that was dependant on Acts of Parliament, railway opposition, &c. He now proposed to save 2s. 6d. per ton certain, and was doing it without waiting for permission of any one. In the present day, in the fight for the foremost place, they found a most important means of economy in the true utilization of heat, with the least possible waste known as regeneration. The mechanical engineer designed his boiler so that the greatest amount of heat might be taken up by the heating surfaces ere it passed the damper, the most perfect example being perhaps the locomotive, where the heat in the smoke-box, after passing through the tubes, was lower than in almost any other form of boiler, so low, indeed, that the waste steam in the blast pipe was necessary to maintain a draught. The Cornish tubular boiler was also a well known economizer of fuel. If, then, from the economy of the steam engine, they turned to the ordinary methods of making iron by puddling and heating, they found in one great point at least the most shameful waste of power to be met with in almost any scientific operation. They here saw coal burnt or destroyed with the most shameless prodigality, dense volumes of carbon being forced up the chimney, while the residue of the coal was shot into the ashpit in a half-consumed and almost raw condition. Should the engineer try to make any alteration, he was at once informed that the best iron had ever been thus made; that if they spoiled their iron it far counterbalanced any saving in coal; that the puddling furnace was so perfect and withal so mysterious a thing that the least alteration might throw it wrong, &c.; and hence puddling had been what it was for years, the prejudices of puddlers and managers being ever against meddling with the present perfect state of things, and hence no patent puddling furnaces had hitherto got forward.

Mr. Whitwell proceeded to give an interesting description of the furnace, patented by Mr. E. B. Wilson. This invention related to the construction and working of furnaces or fireplaces, in such a manner that when fresh fuel was supplied as usual, on the top of the fuel already ignited, the gases generated therefrom were made to pass downwards through the hot fuel, in lieu, as heretofore, of ascending through the fresh fuel, and air was also supplied at such points and in such quantity as might be suitable for complete combustion. He next explained the *modus operandi* of one of the earlier furnaces at work in Glasgow, where the coal entered at the top and the air passed through the coal to support combustion. Diagrams showing the principle of the Wilson furnace were next explained by Mr. Whitwell, who proceeded to remark in reference thereto, that during the introduction of this invention a series of battles had to be fought with the puddlers. The time was unfortunate, puddling was 10s. 6d. to 11s. 6d. per ton, and new things, both from the apathy of masters and the opposition of the men had very little chance of succeeding. This was the case here. The men struck first against the furnace itself; a fresh strike arose against the underhand having to fill the hopper, which was some 8ft. from the ground; a third strike was made against the men going into the ashpit to rake out the clinker once a day; and a fourth strike arose from the men asserting that the masters saved 10s. a ton by the furnaces, and that they would not work the furnaces unless the masters gave them 5s. per ton on puddled bars extra, as it was not fair that the masters should have all the profit. Was it to be wondered that a furnace made so little way against such determined opposition, or that the masters should give up the improvement in disgust.

Statistical results of the operation of a similar furnace adopted by the Bolton Steel and Iron Company for the Lancashire coal were next given by the speaker, who thereafter went on to describe the Wilson furnaces, as they were in operation at the Thornaby Ironworks. Relative to the latter, he remarked that on account of the Durham coal having the quality of coking, and being more bituminous than those of other districts, it was found that the conditions were wholly dissimilar. The experiments carried out in order to arrive at a proper result were next commented on, and after giving a detailed account of the mechanism of the furnace, which he was enabled to render more intelligible by a series of diagrams suspended on the walls, Mr. Whitwell stated that all points were provided for in this furnace. The gases only took up enough air to burn them properly; the action of the damper secured the yield, whilst the large generator provided a constant supply of gas; at the same time no other furnace would work with the damper in the same position, owing to the difference in the size of the firegrate and damper. The advantages of this furnace he declared to be—1st. It would make more puddled bar out of a given quantity of metal than any other furnace. 2nd. It would under proper treatment consume all its own smoke. 3rd. It would, owing to its conditions, make a better and more regular quality than other furnaces, as it never burned the iron, and never worked "rash." 4th. It would not use more fettling than an ordinary furnace. And 5th. It would not cost more per ton of iron than other furnaces in repairs, as a less quantity of fuel being burnt there was less cutting action on the brick-work. Having given returns to show that at Thornaby Ironworks the furnaces worked successfully—fifteen tons of puddled bars being manufactured per week of fifty-nine heats at 17½ cwt. of rough small coals per ton, Mr. Whitwell went on to describe another form of iron furnace now working at Thornaby Ironworks, which promised to exceed the results arrived at by the one he had already commented upon. This last system of furnace was applied in Lancashire, not only to puddling bar and heating furnaces, but to boilers and furnaces at chemical works for making soda-ash. It was applicable to all purposes where great heat was desired, whilst in first cost and economy of fuel it had no equal.

Legal Intelligence.

ADMIRALTY COURT.

April 24.

(Before the Right Hon. Sir R. J. PHILLIMORE.)

THE "LION."—JUDGMENT.

THIS was a cause of damage. The "York Town," an American ship, on December 8, 1867, left the London Docks on her voyage to New York in tow of two tugs, and when rounding Blackwall Point her starboard quarter was run into by the screw steamship "Lion," and sustained considerable damage.

The Solicitor-General and Mr. C. P. Butt appeared for the plaintiffs; and Mr. Milward and Mr. E. C. Clarkson for the defendants.

The defendants admitted the damage, and pleaded that the "Lion" was a passenger ship, bound from London for Hull, having two passengers on board, and being at the time of the collision in charge of a duly licensed pilot. That the employment of such pilot was compulsory by law upon the owners of the "Lion"; that the orders of the pilot were promptly and implicitly obeyed; that collision, if it was caused by the "Lion," or any one on board of her, was solely caused by the pilot, and that neither the "Lion" nor her owners were liable in respect thereof.

The cause was argued in March, and the Court, having taken time to consider the question of compulsory pilotage, now delivered judgment. The pilot, in his evidence, said there were no passengers on board, but it appeared that the master's wife and father-in law were on board, and the master said he treated them as passengers; but it appeared that they did not pay anything for their board; no receipt was produced of the payment of fare by them, and nothing was said about such payment until the "Lion" arrived at Hull. The master said he did not know that the carrying of passengers imposed upon him the necessity for compulsory pilotage, and yet that was the defence set up. The common law makes the *status* of passengers dependent upon the payment of a fare. The evidence with regard to the payment of fares by the captain's wife and father-in-law was so contradictory that the Court could come to no other conclusion than that nothing was said about the fares until after the collision. From the moment of the collision the "York Town" had a lien on the "Lion," and no subsequent act could remove it. The Court must, therefore, pronounce for the damage, and that the owners of the "Lion" were not exempt in consequence of a pilot being on board under the circumstances. Decree accordingly.

Correspondence.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Will you, or some of your readers, favour me with answers to the following questions:—1. Is the peroxide of manganese battery likely to prove superior to Daniell's battery in electro-plating, gilding, and casting?

2. Would a metal rod extending to nearly the bottom of the porous cell, or metal turnings with a shorter rod of the same metal, answer instead of the carbon? And, if so, what metal or metals would be a good substitute for the carbon in M. Leclanche's battery?

3. Why has M. Leclanche chosen zinc as the negative element?—I am, Sir, yours, &c.,

J. H. WILLIAMSON.

95, Cross-lane, Salford, Manchester.

April 23, 1868.

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[The peroxide of manganese battery in its present form is not likely to supersede Daniell's battery for plating, gilding, and electro-casting. For durability and constancy Daniell's is unrivalled. For plating and electro-casting on a large scale, perhaps Wolaston's is the best. It is the form of battery that Messrs. Elkington use, and for gilding they use Smee's. At the present moment we cannot call to mind the exact arrangement of M. Leclanche's battery; but whatever that arrangement may be, in a carbon-zinc pair, zinc can never be the negative element. If the carbon-fluid be nitric acid, platinum only can be substituted; if nitro-hydrochloric acid, silver.—ED. M. M.]

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

ERRATA.—The cork cutting machine, illustrated at page 297 of our issue for the 17th ult., is by Mr. Dudley, and not Mr. Drummond, as by a typographical error it is made to appear.

MESSRS. SNOW and Co., BOSTON, U.S.—We thank you for your letter; a description of the new process of manufacture of oil of vitriol, to which you refer, will shortly appear in our pages.

RECEIVED.—W. R.—H. C.—S. G. C.—F. J.—I. H. W.—A. B. B.—W. H. H.—T. M.—C. W.—R. D.—J. S.—R. P.—Messrs. A. W. and Co.—H. D. R.—J. M.—E. J. B.—R. S.—Messrs T. and C.—A. A.—G. W. H.—S. R.—W. T. C.—R. B.—W. H.—S. E.—F. S.—T. R.—H. W. H.—R. S.—W. L.—J. B. T.—W. L. W.—W. E.—J. N.—J. T.—I. H. B.—R. T.—G. W. H.—W. W.—W. T. F.—A. R. W.—T. C.

Meetings for the Week.

MON.—Royal United Service Institution.—James Mackay, Esq., on "The Mackay Gun and Projectiles," at 8.30 p.m. Commander P. H. Colomb, R.N., and Captain Bolton, will exhibit their new signal lights.

Society of Engineers.—M. de Merritens on "The Marseilles Docks," at 7.30 p.m.

Royal Institution.—General Monthly Meeting, at 2 p.m.

TUES.—The Institution of Civil Engineers.—Continued discussion on "Irrigation in India and in Spain," at 8 p.m.

Royal Institution.—Dr. M. Foster on "The Development of Animals," at 3 p.m.

THURS. — Royal Institution. — Professor Bain on "Popular Errors," at 3 p.m.

Royal United Service Institution.—The adjourned discussion on Major Leahy's and Major Bevan-Edwards' papers on "Army Organization," at 8.30 p.m.

FRI.—Royal Institution.—Mr. C. Greville Williams on "The Artificial Formation of Organic Bodies," at 8 p.m.

Royal United Service Institution.—Hyde Clarke, D.C.L., on "The Military Value of a Continuous Railway Communication between England and India," at 3 p.m.

SAT.—Royal Institution.—Professor Bain on "Popular Errors," at 3 p.m.

Naval, Military, and Gunnery Items.

THE "Diana," 42, in Chatham harbour, is ordered to be brought forward for service in the Tyne, where she is to be stationed for the purposes of a training ship at the Tyne ports.

THE "Wellesley," 72, until recently the flag ship in Chatham harbour, has been removed round to the Thames, there to be stationed as a receiving ship for the training of homeless and destitute boys for the Royal navy and mercantile marine.

IT is stated that the protracted question of the terms on which the Spanish Government is to deliver up the "Tornado" has at length been amicably adjusted. The exact conditions of the surrender have not transpired.

AS an earnest of the honours which await the successful exploit of Sir R. Napier in Abyssinia, her Majesty has given orders that the gallant general (who is already a K.C.B.), shall be promoted to the military division of the first class of the Order of the Bath, or a Knight Grand Cross.

GREAT preparations are being made in Prussia for naval manœuvres, which are to take place in the course of the summer. For that purpose a considerable number of ships of war will be brought together in the Baltic, under the command of Rear-Admiral Kuhn.

IT is reported that a grand naval display will be made off Cherbourg, in the presence of the Emperor Napoleon, about the 19th inst., and that the British Channel fleet, under the commander of Rear-Admiral J. Warden, C.B., will be present in Cherbourg roads to do honour to the occasion.

BY a return issued on Saturday it appears that the actual strength of the naval reserve on the last day of 1867 was 15,091 enrolled members. During the year 12,890 men presented themselves for drill, 929 were absent with leave, 674 from unknown causes, and 528 were discharged, abroad, deserted, &c.

A NEW port has just been opened in the Adriatic—that of Monopoli, a very populous and wealthy town in the province of Bari. The ecclesiastical authorities took part in the inauguration by blessing the first stone. In commemoration of the time at which this ceremony has occurred, the name of Princess Margherita has been given by the municipality to the port.

IN consequence of the death of the Duke de Valencia, there remain only four marshals in the Spanish Army, namely, the Duke de la Vittoria, the Marquis de Duero, the Duke de la Torre, and Count de Cheste. The most ancient lieutenants-general are Baron de Meer, the Dukes de Bailen, Rivero, Sanz, Iriarte, Sora, and the Marquises de Novaliches, de la Havane, and de Maestrazzo.

THE "Journal du Havre" says:—The American ship "Mercury," known as the fastest sailer that visits this port, has just accomplished the quickest passage ever made by a sailing vessel between America and Europe. She left New York on the evening of April 9, and arrived at Havre on the morning of the 22d, the passage thus occupying some hours over twelve days. The quickest generally extend to sixteen days.

OUR leading ship-builders, engineers, and others, are likely to be well represented at the Havre Maritime Exhibition. Messrs. R. Napier and Sons, of Glasgow, who carried off the Grand Prix at Paris last year, are again exhibitors. Messrs. Randolph and Elder, who have a dozen new vessels nearly completed in their extensive building-yards on the Clyde; Messrs. Gourlay Brothers, of Dundee; Mr. James Laing, of Sunderland; Palmer's Shipbuilding and Iron Company, Jarrow; Mr. G. Farrans, North Shields; Messrs. Earl and Brownlow, and Lumsden and Co., of Hull, send models; whilst anchors, chains, cables, ropes, sail-making, fishing tackle, preserved provisions, and other industries, will have numerous exhibitors.

WE have to record the death of Lieutenant-General Geo. Jno. Belson, of the Royal Artillery, which occurred at Woolwich on Wednesday week, at the age of eighty years. The gallant officer entered the army as ensign September 29, 1804, and served in the Peninsular and south of France from July, 1809, to the end of the war in 1814, including the retreat from Talavera, the action in front of Almeida, and the action of the Coa. He was present at the battle of Busaco, the actions at Pompal, Redinha, Cazel Fova, Foz d'Arouce, and Sabugal; took part in the battle of Fuentes d'Onor, actions on the heights of the Agueda; also the sieges of Ciudad Rodrigo and Badajoz, and the actions at Castrajon (where he was severely wounded), San Munos, San Milan, and Osma. He was also present at the battle of Vittoria, and the action with the French, June 28, 1813, in the morning before they entered Pampeluna, when he captured their last gun from Vittoria. He took part in the actions in the Pyrenees, also the passage of the Nivelle, Nive and Gave, d'Oleron, and the battle of Orhes, besides various minor affairs and skirmishes.

Miscellanea.

THE annual dinner of the Institution of Civil Engineers is to be held at Willis's Rooms on Wednesday next, May 6, when the chair will be occupied by Mr. Charles Hutton Gregory, the president.

THE Right Hon. Benjamin Disraeli is announced to take the chair at the anniversary festival of the Royal Literary Fund, which will take place on May 6, in the New Hall, Freemasons' Tavern.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending April 25, was 3,392; total number since the opening of the museum, free daily (May 12, 1858), 1,289,978.

IT is stated that MM. de Dorlodot, of Acoz, have secured a contract for 25,000 tons of rails for the Helsingfors and St. Petersburg Railway, the contract price being £6 17s. 6d. per ton, and that a small contract for rails has been concluded in the Moselle district at £7 8s. per ton.

IT is stated that goldfields of great richnees exist between the Zambesi and the Transvaal in the Mekonos county. These fields are described as only sixty miles in length and twenty in breadth. From specimens which have been obtained from the quartz it is considered that the yield of gold will exceed the Australian and Californian averages.

WE understand that Mr. E. J. Reed (Chief Constructor of the Navy) has consented to read a paper before the members of the London Association of Foremen Engineers to-morrow, April 2, at 8.30 p.m. Subject: the means of testing iron. Mr. Newton, of the Mint, will preside, the place of meeting being the George Hotel, Aldermanbury, City.

AT three o'clock this afternoon a trial run is to be made from Charing-cross to the Bank with an improved omnibus which has been invented by Mr. W. Harvey. We certainly want some improvement in these vehicles, and as the Omnibus Company did their best to throw out the Tramways Bill, we trust they will be made to give the public decent vehicles to ride in.

PRINCE NAPOLEON, who, not long since, presented a very fine collection of gold Ottoman coins to the Bibliotheque Imperiale of Paris, has now given to the same establishment a collection of American bank-notes, consisting of seventy-five specimens of various kinds, and twenty-five proofs on India paper of engraved portraits and vignettes employed in the ornamentation of these notes.

THE "Kingston (Jamaica) Morning Journal" of March 26 says:—The Government received by last packet, from the royal gardens at Kew, a case of healthy tea plants, which are to be sent to the Chinchona Nursery in St. Andrew, and placed under the care of Mr. Thompson, the island botanist. The idea has been formed, we believe, on good scientific authority, that our soil and climate are so well adapted that the tea plant will flourish here.

A TERRIFIC thunder storm broke over North Lincolnshire on Monday, doing immense damage to the large orchards between Barton and Grimsby. At East Halton the lightning struck a young man named Elm, employed by Mr. Slight, miller. The unfortunate youth, who was only twenty years of age, was attending to the brake of the mill when the electric fluid struck him on the face under the left ear. Death was immediate.

THE visitors to the South Kensington Museum during the week ending April 25, 1868, were—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 10,322; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 2,037. National Portrait Exhibition, by payment, 2,712; Total—15,071. Average of corresponding week in former years, 11,188; total from the opening of the museum, 7,344,945.

BY last mail from India it is announced that the iron girder work of the Beas Bridge on the Delhi Railway for the first span was hoisted into place on the 25th of March, in the presence of Sir Donald M'Leod, lieutenant governor of the Punjaub, his staff, and the chief officers of the railway. This intelligence is highly satisfactory, as the engineering difficulties which had to be overcome in constructing the foundations of this bridge were very considerable.

FROM the report of the Zoological Society it appears that the balance-sheet shows receipts during the past year to the amount of £25,000, of which sum so much as £12,000 is from admissions to the gardens and over £6,000 from subscribers—a very large proportion for the sake of securing a Sunday promenade. The receipts for 1867 exhibit a considerable increase over those of the previous year, which is the more satisfactory as most institutions have had to suffer a falling off.

A SAD accident occurred at Chicago on Good Friday. The Roman Catholic Cathedral of St. Mary was filled with worshippers and the weight of the multitude caused a portion of the floor to give way, which raising a great dust led some one to cry "fire." A terrible panic ensued, and in the rush that was made for the doors four women were crushed to death, and twenty or more persons were seriously injured, three of them having since died.

AN Industrial and Fine Arts Institution, intended solely for instruction in science and art, was opened on Tuesday at Wakefield, The inaugural meeting took place in the evening, and was addressed by Mr. W. H. Leatham, M.P., Mr. Mundella, of Nottingham, and Mr. Cole and Mr. Redgrave, of the South Kensington Museum. The Institution has been formed out of a surplus of £3,000 obtained from an exhibition held in Wakefield three years ago.

A MEETING of the fellows of the Royal Botanic Society, Regent's Park, was held on Saturday, C. R. Turner, Esq., in the chair. The names of the following candidates for the fellowship were read:—Earl of Sefton, H. G. Sturt, Esq., M.P., Mrs. Hyam, Lieut.-Colonel Robert Unwin, H. F. Underwood, Esq., Mrs. Alcock, Peter H. Berthon, Esq., Richard Hodson, Esq., Mrs. James Lyall, H. H. Robertson

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Aikman, Esq., Mrs. J. Gerstenberg, Mrs. Morrison, Rev. Henry Smith, J. E. Taylor, Esq., Mrs. Drake, Le Commandeur J. de Selles, in addition to eight elected on the same day.

WE take pleasure in announcing that the captain and crew of the "Rob Roy" yawl (J. Macgregor, Esq.), will "make a voyage alone" from the log of the above vessel at St. George's Hall, Langham-place, on Thursday evening, the 7th inst. Apart from the interest of the voyage, we are sure that the narrator will not be "alone," as the proceeds are to be devoted to the benevolent purpose of building the shoeblacks of London a new house, a step rendered necessary by the demolition of their old one for the Law Courts. The Earl of Shaftesbury will preside. Tickets at 24, New-street, Spring-gardens.

ON the evening of April 9, the advocates of an international copyright held a meeting in New York, and formed an association to support the project and urge it upon the attention of Congress. William Cullen Bryant presided. It appears that in 1853, Edward Everett, then Secretary of State, negotiated an International Copyright Treaty with John F. Crampton, then the British Minister, providing that any citizen of either country obtaining a copyright should by that Act obtain a copyright in the other country. This treaty was never ratified by the United States' Senate, however, and lost its vitality twelve months after negotiation.

BY the Clerkenwell outrage six persons were killed outright, six more died from its effects, according to the coroner's inquests, five, in addition, owe their deaths indirectly to this means, one young woman is in a madhouse, forty mothers were prematurely confined, and twenty of their babes died from the effects of the explosion on the women; others of the children are dwarfed and unhealthy. One mother is now a raving maniac; 120 persons were wounded; fifty went into St. Bartholomew's, Gray's-inn-lane, and King's College Hospitals; fifteen are permanently injured, with loss of eyes, legs, arms, &c.; besides £20,000 worth of damage to person and property.

THE "British Medical Journal," continuing its reports on the Preventible Diseases of the Industrial Classes, says that workers among dust are either so ignorant of the dangers to which they are exposed by inhaling dust for a long period, or so careless of their health, and so regardless of all warnings, that measures are seldom taken to prevent the inhalation of dust until lung-disease is firmly established. Minute particles of metal or stone being driven into the eye, cause pain, and, as they endanger sight, some of the men who are subject to such peril wear large spectacles lest blindness should come, and work have to be given up for a time, or altogether. But, as no immediate pain is felt when dust is breathed, means are seldom taken to protect the lungs.

MEASURES are about to be taken for the protection and preservation of the State forests of the colony of Victoria. A commission, appointed by the Government to inquire into the means to be adopted for this purpose, has recently made a report upon the subject. As illustrating the natural growth of timber in the more favourable districts, it is mentioned in the report that Mr. Percy Hodgkinson recently measured, near the source of the western branch of the Wori Yallock Creek, a tree (Eucalyptus amygdalina) that had been felled for splitting; its diameter, 1ft. above the ground, was 19ft., and at 70ft. from the butt-end 9ft.; its length in a straight line was 330ft. Many of the adjacent standing trees were, however, evidently of much greater height than this. A grove of the same kind of timber, at the head of the creek, contained on an acre of ground twenty large trees, of an apparent average height of about 350ft., and thirty-eight saplings of a height of 50ft., the whole being surrounded by a dense undergrowth of large fern-trees, musk, dogwood, &c.

A handsome testimonial, consisting of a service of plate, was presented on Saturday evening, by the workmen of the Millwall Iron Works, to their esteemed manager, Mr. John Hughes, and a gold watch to Mrs. Hughes. Mr. Hughes will be known to many of our readers as the inventor of the iron stringer backing for armour plates. Mr. J. L. O'Beirne, M.P., presided, in the large dining-hall attached to the works, and on the platform were Sir W. Wiseman, Bart., R.A., Captain Eardley Wilmot, R.N., Messrs. J. V. Gooch, C.E., J. Boyd, &c. The chairman observed that the works owed their creation to Mr. Hughes, and warmly testified to his personal worth. In himself he was a noble example of self-help, and had effected in one branch of industry the highest development of modern science and labour. Mr. Waring, in presenting the testimonial and address (which was tastefully illuminated) testified to Mr. Hughes' indefatigable energy and to his tact and kindly consideration, which had prevented his ever having had, in the long course of his management of this and other large works, a single strike amongst his workmen.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—2857, 2861, 2868, 2871, 2880, 2920, 2929
BUILDINGS AND BUILDING MATERIALS—2878, 2919
CHEMISTRY AND PHOTOGRAPHY—2852, 2874, 2893
CULTIVATION OF THE SOIL, including agricultural implements and machines—2905, 2916, 2930
ELECTRICAL APPARATUS—2879, 2909
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2885, 2914, 2926, 2928
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—None.
GENERAL MACHINERY—2854, 2855, 2856, 2862, 2863, 2867, 2872, 2877, 2881, 2883, 2887, 2890, 2891, 2895, 2899, 2901, 2903, 2906
LIGHTING, HEATING, AND VENTILATING—2853
METALS, including apparatus for their manufacture—2865, 2866
MISCELLANEOUS—2851, 2858, 2859, 2860, 2864, 2869, 2870, 2873, 2876, 2882, 2892, 2894, 2898, 2900, 2902, 2904, 2910, 2911, 2912, 2915, 2917, 2918, 2921, 2922, 2924, 2925, 2927
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2884, 2886, 2889, 2896, 2897, 2908
SHIPS AND BOATS, including their fittings—None.
STEAM ENGINES—2875, 2907, 2913
WARFARE—2888, 2923

2851 G. TWIGG. *Improvements in corkscrews.* Dated October 10, 1867.

This invention is not described apart from the drawings.—Patent completed.

2852 A. M. CLARK. *Improvements in the preparation or treatment of extracts of madder for dyeing and printing purposes, and in apparatus used in such treatment.* (A communication.) Dated October 11, 1867.

The details of this invention are too voluminous to be produced here at sufficient length for an intelligible abstract.—Patent completed.

2853 R. GEORGE. *Improvements in apparatus for warming and ventilating apartments or buildings.* Dated October 11, 1867.

This invention consists in forming a portable heating and ventilating apparatus with a chamber of thin sheet iron enclosing a grate or fireplace, the chamber being of such dimensions that the products of combustion will circulate within it for a sufficient time to part with a large proportion of their heat, and in arranging within such chamber a pipe or other contrivance of thin sheet iron through which a current of air passes from the exterior to the interior of the chamber or building to be warmed or ventilated, and, further, in so arranging the chamber or case and the pipe or contrivance through which the air is admitted that the burning fuel does not come in contact with them, but only the heated products of combustion arising from the combustion of such fuel, substantially as described.—Patent completed.

2854 J. WITHINSHAW and J. E. BAKER. *Improvements in steam pumps and blowing engines.* Dated October 11, 1867.

The patentees claim working or actuating the said slide valves by means of a lever worked from the piston rod of the pump or blowing engine, substantially as described and illustrated.—Patent completed.

2855 E. HAIGH. *Improved machinery or apparatus for planking the bodies of hats.* Dated October 11, 1867.

The patentee claims the production of the beating action upon the hat bodies from a number of beaters playing in pairs, such action being caused by the internal conical formation of the wheels, such formation causing the beaters gradually to approach nearer and nearer as the bodies become planked. He does not, however, confine himself to the precise details shown for effecting such beating action. Second, he claims the method of ejecting the bodies when planked; and, last, he claims the whole combined apparatus whereby hat bodies are planked by a beating action, and afterwards ejected from the machine, all substantially as described.—Patent completed.

2856 J. C. WILSON. *An improved rice unhusking mill.* Dated October 11, 1867.

This mill is constructed with two rollers, one of which is made of or covered with a hard substance, such as a metal, hard wood, stone, ebonite, &c., roughened on its periphery or external surface; the other is formed of (or with) a soft material, such as india-rubber, the periphery of the latter rubbing or squeezing, or both, the rice with the husk on it against the periphery of the former, whereby it is immediately unshelled.—Patent abandoned.

2857 J. C. WILSON. *Improvements in steam boilers.* Dated October 11, 1867.

This invention consists, first, in constructing the flues of steam boilers with a conical or bell-shaped mouth at one end, sufficiently large to permit of the withdrawal or insertion of the flues through that end of the boiler. Second, in the addition of small water tubes to boilers so as to increase their power, one end of the said tubes being open to the water space, and the other to the steam space of the boiler. This invention is not fully described apart from the drawings.—Patent completed.

2858 G. DAVIES. *Improvements in the manufacture of corsets, and in apparatus for taking measurements for the same.* (A communication.) Dated October 11, 1867.

This invention consists, first, of a very simple combination of "patternometer" for taking the measurements necessary for making a corset; and, second, of a new kind of corset made in two pieces united by one seam only; plaits or gathers, as well as the gussets for the skirt and top of the corset, are entirely dispensed with, which allows the corset to set well to the figure without distorting it in any way.—Patent abandoned.

2859 J. BRONNER. *An improvement in the construction of gas burners.* Dated October 11, 1867.

This invention relates to the construction of gas burners having any application by which the entrance of the gas into the burner is regulated. It has reference to a former patent, dated October 17, 1866 (No. 2679). The patentee gives to the lower hole-burner, instead of only two orifices as heretofore, a greater number of orifices—say, three, four, five, six, or more—which are distributed around the centre, whereby the gas is spread more completely than by two holes only, and it is forced to enter more equally and more regularly into the hollow body of the burner. This object is more perfectly attained by piercing the holes in an inclined direction, and by giving a concave convex form to the piece which is inserted in the burner and contains the holes. The larger the intended consumption of the burner the greater will be the number of orifices.—Patent completed.

2860 W. H. MAY and P. GRAHAM. *Improvements in stoppers for bottles and other vessels.* Dated October 11, 1867.

This invention is applicable to wooden stoppers, such as are described in the specification of a patent granted to M. Thompson, dated January 1, 1866 (No. 3). In order to make such stoppers more perfectly gas-tight, the patentees adapt short corks to them. They form an annular groove in the cork of a size to receive into it the hollow cylindrical end of the wooden stopper, also a coating or covering closing its exterior for some distance up, and a plug entering into the interior hollow. The central plug of cork may be also omitted, but this is not advantageous.—Patent completed.

2861 A. HELWIG. *An improved feed-water apparatus for maintaining a proper water level in steam boilers and other vessels.* Dated October 11, 1867.

This invention relates more especially to the means for supplying steam engine boilers and other similar vessels with water, and for preventing variations in the level of the water, and consequent injury to the boilers or other vessels. The apparatus is constructed with a chest or casing divided by a partition having two apertures somewhat similar to the ports of an ordinary steam engine. One of these apertures communicates with a cistern or other vessel containing water, and the other aperture communicates with the boiler, tank, or other vessel into which the water is to be forced. The partition of the chest or casing through which the two ports or apertures are formed is planed or otherwise made perfectly true on one side to form a face or bearing for a side valve, which is fitted to work thereon. The said valve is similar to the ordinary D-valve of a steam engine, and is provided with a rod or spindle which works through a packing box at one end of the chest or casing. The end of this rod or spindle may be connected with an eccentric, or other equivalent device, by means of which the required motion is communicated to the valve from a steam engine or other motive power. The D portion or cavity of the valve is made about the same width as the ports or apertures in the chest or casing, the valve being extended on one side of the chamber by a flange. This flange is of such a length that, when the cavity of the valve covers one of the ports, the other part or aperture is closed by the flange. The cistern or other reservoir from which the water is drawn must be placed at a higher level than the boiler or other vessel into which the water is to be forced. When, therefore, the valve lies with its cavity over the port or aperture communicating with the system, the water will fill the said cavity; the valve is then moved endwise till the cavity comes over the outlet port, when the water will pass therefrom through the said port into the boiler or other vessel being filled. When, therefore, the water in the boiler or other vessel has risen to the level of the top of the said casing, it will obviously not vary therefrom, so long as the working of the valve is continued. The cavity of the valve being brought alternately in communication with the inlet and outlet ports or apertures will keep up a continuous supply of water from the cistern to the boiler or other vessel being filled, and thus prevent the falling of the water therein below its proper level, while the arrangement of the valve to work inside the chest or casing prevents the rising of the water above the top thereof.—Patent completed.

2862 R. A. WRIGHT. *Improvements in the method of, and apparatus for, heating.* Dated October 11, 1867.

Here the inventor employs a solution of glycerine (which may be more or less concentrated), and which he uses in circulation pipes coiled where required. Also the heat may be applied to the solution of glycerine, or to other heating liquid, by means of friction, for the purpose of heating railway carriages.—Patent abandoned.

2863 E. LEITENBERGER. *Improvements in apparatus for separating soluble from insoluble matters, filtering the solutions, and, if wished, distilling these latter, or parts of them.* Dated October 11, 1867.

The apparatus for performing this invention cannot be described without reference to the drawings.—Patent abandoned.

2864 G. ANGELL. *Improvements in portable fountains.* Dated October 11, 1867.

This invention relates to improvements in portable fountains suitable for placing in rooms, conservatories, or in other positions, by means of which a continuous jet of water may be produced. The apparatus consists of a chamber of triangular or other form, on each face of which the inventor arranges a pump in such manner that, in all cases, one shall be forcing out water from the chamber while the others are taking in a supply, in order to produce a continuous jet of water. The chamber is divided into two compartments, the upper one of which communicates with the supply pipe and basin of the fountain, and the lower one with the fountain jet pipe. Each compartment also communicates with the several pumps by means of valves of india-rubber, or otherwise, arranged in such manner that the water passes continuously from the supply pipe and basin into the upper chamber, thence through the upper valves to the several pumps, upon the return strokes of which it is forced through the lower valves into the lower chamber, and up through the discharge pipe to form the jet, the water falling again into the basin to be again forced upwards, and so on.—Patent abandoned.

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2865 W. E. NEWTON. *An improved mode of preparing iron for the manufacture of various articles where great strength and capability of resistance to tensile strain or torsion is required.* (A communication.) Dated October 11, 1867.

This invention relates to the manufacture of iron of great tenacity which will only break when subjected to very violent strain. This object is effected by the following means:—A number of iron rods, all of the same thickness (which must be in proportion to the size of the article to be manufactured) are to be worked cold, and then welded or brazed together to give the requisite size for the article required. All these rods should be straightened and united together with a faggot or pile, which is to be brought to a red heat until it has become sufficiently pliable to enable it to be twisted like a cord. Care should be taken at the same time to re-adjust such of the rods as had become displaced, and to preserve the regular form of the faggot or pile. When the faggot or pile has been twisted from one end to the other, it should be submitted to the ordinary welding and forging process until the rods (already firmly united by the twisting) form one compact and solid mass.—Patent completed.

2866 W. BUTLER. *An improvement in the rolling of hoop or strip iron for brewers' or other hoops.* Dated October 11, 1867.

It is a common defect in the use of ordinary iron barrel hoops that they have a tendency to slip, from the grip or bite being more in the middle than at the edges of the hoop. This defect the inventor obviates by rolling hoop or strip iron thinner in the middle, which may be done by a regular curve, or flattening the middle portion and raising the edges, so as to show a slight fillet or projection of the desired width on each side.—Patent abandoned.

2867 H. B. BARLOW. *Improvements in sewing machines.* (A communication.) Dated October 12, 1867.

This invention consists in certain improved parts and combinations of parts for producing an improved "whip stitch" or "point de feston," and they may be applied to all or most sewing machines in which shuttles are used. In this machine the needle is moved to and fro either horizontally or vertically, and the shuttle moves segmentally or horizontally. The principal novelty consists in the application of a swivel arm or bar, actuated by cam, tappet, or lever, and made with a spiral groove to unwind the thread off the shuttle, to hold it while the needle passes through the loop, and to tighten it again. Another part of this invention consists in giving the feed by means of a pair of spring nippers which vibrate on a fulcrum, and are opened and closed alternately by suitable levers and cams, or other equivalents, instead of giving the feed by the ordinary toothed feeder or propeller. The machinery above described is particularly adapted to sewing kid gloves, but it may be employed for sewing woven fabrics and other materials.—Patent completed.

2868 J. BUCKINGHAM and J. S. BLOCKEY. *Improvements in apparatus for regulating the feed of steam boilers.* Dated October 12, 1867.

This invention consists in the construction of an apparatus (substantially of the form described, and of the same principle) which shall, by the fall of the level of the water in the boiler, cause the pressure in the boiler to move a piston, which, connected with suitable mechanical contrivances, may be made to actuate the feed pump, or injector, or donkey engine.—Patent completed.

2869 C. H. COLLETTE. *Improvements in the construction of flights of stairs commonly called staircases.* (A communication.) Dated October 12, 1867.

This invention is carried out in the following manner:—The plan of a flight of stairs being given, the inventor takes a piece of sheet iron, or other metal of a sufficient thickness to resist the weight it may have to bear, and which serves for a string-board. He cuts in the iron plate the number of angles sufficient for the steps of the stairs, and, if of great height, as sheet iron is not made usually in great lengths, he adds to the length of the slips of sheet iron or iron plate other bands of iron plate, united end to end by joint plates screwed or riveted in the inside, sufficient for the height of the staircase. He then bends the plate according to the curves or squares necessary for the site or place of the flight of stairs. Each angle in the plate-iron string-board is cut rather deeper than would be necessary if in wood, to receive the back or heel of the tread, whether wood, iron, or stone. He cuts in each tread two longitudinal grooves, one at the heel of the tread above, and one in front of the tread below, into which the riser (which is of sheet iron, or other suitable metal, and which is of the same thickness as the string-board) can enter, and thus give greater rigidity. He makes use of the pieces of sheet iron cut out in forming the string-board, bending them into form of angle irons and supports, and the other pieces necessary for making the flight of stairs; thus no iron is wasted. These pieces serve in putting up the flight of stairs. The end of each riser he cuts at the end next the wall a little depth into the length of the riser, which is made rather longer than the width of the flight of stairs, and he bends one part forward and the other backward, so as to form a cramp or fastening in the wall, thus giving great solidity to each step, and, in case of fire, preventing the fall of the staircase. He fixes the balusters to the iron plate of the string-board instead of into the tread. To carry the plastering underneath the stairs he proceeds in the same manner as in other stairs, except that, instead of laths of wood, he fixes to the risers small pieces of iron cut from the string-board, which are riveted to and project below the tread, and carry strong iron wires longitudinally for the support of the plaster.—Patent abandoned.

2870 R. F. BARE and J. THOMSON. *Improvements in the conduction or transmission of fluids, and in the means, apparatus, or mechanism, employed therefor.* Dated October 12, 1867.

This invention is not described apart from the drawings. —Patent completed.

2871 J. B. P. A. THIERRY. *Improvements in smoke-consuming apparatus for steam boiler and other furnaces, and in machinery for manufacturing parts of the same.* Dated October 12, 1867.

This invention is not described apart from the drawings. —Patent completed.

2872 H. A. DUFRENE. *Improvements in apparatus for decorticating rice and other grain.* (A communication.) Dated October 12, 1867.

This invention relates to a former patent granted to the present patentee, dated June 11, 1866, and consists in forming the two friction surfaces of the decorticating apparatus, first, with vulcanized india-rubber and a hard rough biting body, such as emery, formed into an agglomerate, as described. Second, with vulcanized india-rubber and india-rubber covered with emery and vulcanized, or of two surfaces of the latter. Third, with india-rubber only.—Patent completed.

2873 R. CANHAM and J. THOMSON. *Improvements in stoves for consuming gas and other fuel, and in ovens to be used therewith.* Dated October 12, 1867.

This invention relates, first, to a novel combination and arrangement of parts of a stove for burning a mixture of gas and atmospheric air. For this purpose the patentees make the stove by preference of a cylindrical form. In the centre of the stove are fixed two cylinders concentric with each other, and having a small space left between them; these cylinders extend from the bottom to a short distance from the top of the stove, and are surmounted by a conical cover having a hole through it. The inner cylinder is closed at top and bottom by wire gauze, or perforated metal, and has a pipe therein through perforations in which the gas issues into such cylinder, and there mixes with atmospheric air, such mixture of air and gas being burnt on the top of the wire gauze, or perforated metal cover of the cylinder, the flame thereof being contracted by passing through the hole in the conical cover; atmospheric air is supplied to the flame by its passing up the space between the two inner cylinders, and is caused to impinge thereon by the conical cover. The products of combustion pass away by a pipe, one end of which is near the bottom of the stove, and open thereto, whilst the upper end passes out at or near the top of the stove.—Patent completed.

2874 E. LEITENBERGER. *Improvements in treating madder for the purpose of obtaining purpurine or alizarine from the same, and in apparatus to be made use of thereby.* Dated October 12, 1867.

This invention relates to new methods for obtaining the purpurine and the alizarine separately from madder, and consists, first, in certain new modes of preparing either madder, or what is called madder charcoal, viz., the results from the treatment of madder, by concentrated sulphuric acid, in such manner that, instead of containing both purpurine and alizarine, the same after the said preparation, contain only one of the said colouring principles. Second, in new modes of and apparatus for extracting from madder or from madder charcoal, prepared as above stated, the colouring principle left behind in the same, or existing in the wash waters.—Patent abandoned.

2875 H. FORMAN. *Improvements in the wheels of traction engines.* Dated October 12, 1867.

This invention consists in constructing the tyres or peripheries of the wheels of traction engines so as to cause them to grip or adhere to the ground. For this purpose the inventor makes on the tyres or peripheries of the said wheels a series of projecting bands or plates of iron or steel, the bands or plates being situated, by preference, equidistant from each other. The bands or plates pass in an inclined or oblique direction from side to side of the tyre or periphery, the bands or plates somewhat resembling in configuration, but broader than, the threads of a quick-threaded screw, or the threads of a worm wheel. The bands or plates on one wheel are disposed so as to run from right to left, and those on the opposite wheel to run from left to right. By these means the engine is made to travel in a straight line, the tendency of one wheel to move out of a straight line being neutralized by the other wheel.—Patent abandoned.

2876 J. DRABBLE. *Improvements in the mode of securing handles and scales to every description of cutlery.* Dated October 12, 1867.

Here, the handle is to be bored or pierced vertically to receive the tang, but the side and depth of the bore must be greater than the tang, and a hole must be pierced on the upper and lower surface of the handle (or on each side) communicating with the bore in which the tang is to be set; the handle is bevelled off, or cut out with a tool at that part where the bolster is to be formed, and the tang is perforated with one or more holes. The handle being fixed in a vertical position, the blade and tang are placed in position, and a mould is placed round the upper part of the handle, leaving spaces at the upper portion, where the handle is bevelled off or cut away. The openings at the side, or top and bottom, of the knife are then to be stopped by placing paper, or other porous substance, against them, which will yet permit of the escape of air. Then the soft metal is to be poured from a ladle down one side of the vertical hole in the handle; the metal will fall to the bottom, and eject the air from the cross holes, filling them up, and return afterwards, surrounding the tang, and filling the hole or holes therein, and, rising, fills up every cavity until it becomes flush with the upper line of bolster mould.—Patent abandoned.

2877 J. H. JOHNSON. *Improvements in knitting machines.* (A communication.) Dated October 12, 1867.

This invention is not described apart from the drawings. —Patent completed.

2878 B. NICOLL. *Improvements in the economical construction of buildings, also in rendering them more secure from fire and damp, and in preserving them from decay.* Dated October 12, 1867.

This invention is not described apart from the drawings. —Patent completed.

2879 W. R. LAKE. *Improvements in electric telegraph apparatus.* (A communication.) Dated October 12, 1867.

This invention is not described apart from the drawings. —Patent completed.

2880 J. C. PEARCE. *Improvements in furnaces and fire-grates.* Dated October 14, 1867.

Here the grate bars are connected together alternately, so as to form two or more lots, which, by way of distinction, are termed lifting bars and traversing bars; the former work up and down edgewise, and the latter backward and forward lengthwise. In a convenient situation, about the front of the furnace, is fixed a revolving shaft provided with cranks or eccentries, from which the required motions are communicated through suitable rods and levers to the grate bars. A hopper or other receptacle for the fuel is formed at the front of the grate, above the bars, and is fitted with an adjustable plate for regulating or stopping the supply of fuel to the furnace.—Patent abandoned.

2881 D. E. BLACKE. *Improvements in apparatus for spinning and twisting yarns.* Dated October 14, 1867.

This invention consists in the application of a friction plate or cone to the spool or bobbin in the process of spinning or twisting flax, tow, and other fibrous materials into yarn, the object being to drive the bobbin and contents by means of the above-mentioned plate or cone, and not solely by the yarn or thread, as is the case at present. This the inventor effects by causing the friction plate or cone which acts on the bobbin or spool to revolve with the spindle, the latter passing through the friction plate or cone, which has a feather, or other like contrivance, inside the hole, which feather fits into a corresponding slot in the spindle which is prepared to receive it. By this means the friction plate is carried round with the spindle at the same time that the bobbin works up and down in building.—Patent abandoned.

2882 E. WARD. *Improvements in hats and other similar coverings for the head.* Dated October 14, 1867.

This invention consists of a novel method of attaching the linings to the hat body, by means of which the hat more perfectly fits the head of the wearer, and at the same time the ventilation of the interior of the hat is promoted. In carrying the invention into effect the patentee makes the portion of the lining of the hat which comes into contact with the head, and which is usually made of leather, a suitable degree smaller in circumference than the inner circumference of the hat body to which it has to be attached, so that, when placed in its position, a space will be left between the lining and the said hat body. The connection between the said lining and the hat body is effected by attaching strips of leather, or other suitable material, to the lining and the hat body in such a manner as that one end of each strip shall be attached to the lining, and the other end to the hat body, it being preferred that a portion of the strips be reversed as regards the other portion, that is to say, that supposing the hat to be in a vertical position, as in wear, the lower ends of one portion of the strips which are now vertical will be attached to the lining, the corresponding ends of the other portion being attached to the hat body.—Patent completed.

2883 W. GADD and B. WALKER. *Improvements in means or apparatus for the manufacture of narrow fabrics.* Dated October 14, 1867.

This invention relates to means for producing upon the lace machine, or a modification thereof, narrow fabrics such as are usually produced in the loom, thereby obtaining much greater speed and an increased quantity of breadths at the same time. In carrying out the invention the warp of the fabric is supported in the lower part of the machine, but instead of all the threads being upon one beam, they are divided into sets, each set being wound upon a separate reel or spool. A number of these reels or spools are placed either in a continuous line upon a shaft running lengthways in the machine, or otherwise. Upon each spool or reel may be wound threads of warp sufficient for one breadth of fabric, which threads for each fabric are carried upwards through a sley in a line stretching from back to front of the machine, thence these threads pass through bars, which may be of the ordinary kind. If they are put in what are termed "top bars," such bars may be divided to their proper distances by means of points of the character of ordinary leads of points, or by sleys, or other suitable means. If bottom bars are used, the threads may be drawn through (in addition) a stationary reed, or a many-wired stump bar placed close underneath the carriage bottoms. By means of such bars a shed is opened in all the breadths through being actuated by jacquard, cam, or any suitable means for the passage of the bobbins and carriages which act as the shuttles, and thus form the fabrics with their edges towards the operator. The invention includes other features.—Patent completed.

2884 M. FITZPATRICK. *Improvements applicable to railway trains for the prevention of accidents arising from collisions or other casualties on railways.* Dated October 14, 1867.

This invention consists of an elastic cushion to be attached to the locomotive and carriages of a train in place of buffers. This elastic cushion will yield to any compulsory force, and deaden the effects of a collision. It is constructed exteriorly of leather, gutta-percha, or similar materials of the size, say, of 5ft. by 3ft., and 2½ft. in depth. Interiorly it is divided into three or more compartments, which are filled with blankets and wool, and is fitted with springs and with valves to admit of the entrance and exit of air. The invention further consists in retaining the break suspended when it is desired to reverse the engine, and this the inventor effects by means of a double-notched lever which grasps the cushion frame and raises the break legs from the rails.—Patent abandoned.

2885 W. REDGATE and T. MARRIOTT. *Improvements in the manufacture of lace in twist-lace machines.* Dated October 14, 1867.

Here the inventors obtain, on the edge of a band of lace, a purl like that of hand-made lace, or what is ordinarily called a twisted purl, in which the two sides of the purl loop across each other by the following means:—The purl loop is formed from a warp thread (or it may be from two warp threads for the time working together as one), and in the edge of the lace on which the purl is to be made they provide, to aid in producing the purl, two warp threads which they call closing threads, and two bobbin threads which they call edge bobbins. Immediately before commencing to produce the purl, one of the closing warp threads comes from a distance sideways and crosses one of the edge bobbin threads, then the purl warp, in going to make the purl, passes the same edge bobbin on the other side, and the purl warp and closing warp threads are then snared together by the edge bobbin thread. The closing warp then remains for a time without twisting, so that, as the work rises above the points, it becomes gradually drawn down or tightened, and it brings with it the root of the purl, sliding it down the edge bobbin; the bottom of the purl top is raised in a similar manner to that in which the top is depressed by means of the other edge bobbin; the purl warp thread is snared with the other closing warp thread, which previously had been standing for some time, and which immediately after is thrown a distance sideways; then, as the work rises above the points, the tension on this closing warp thread tends to raise the root of the purl, sliding it up its edge bobbin. As the top and the bottom roots of the purl are caught by separate closing warp threads, and separate edge bobbins, they are free to slide past each other on their edge bobbins, and so the purl loop is brought to the form desired.—Patent abandoned.

2886 H. N. MAYNARD. *Improvements in bridges, piers, and landing stages.* Dated October 14, 1867.

This invention consists in so connecting the pieces or

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supports to hydraulic rams fixed in the bed of the river that, on working these by means of pipes from the shore, the piers or supports are either raised to the requisite height for supporting the roadway of the bridge or other structure, or they are lowered down level, or nearly so, with the bed of the river, when it is desired to make a free roadway for the navigation. When the pier or support has been raised to its full height, it is supported either by suitable locking bolts made to project therefrom into recesses in the foundation, or it may be supported in any other suitable manner.—Patent abandoned.

2887 W. R. LAKE. *Improvements in apparatus or machinery for loading heavy ordnance with balls, shells, or other projectiles.* (A communication.) Dated October 14, 1867.

The object here is to raise and place in the bore of the gun heavy shot, shell, or other projectiles by mechanical means, with the assistance of very little manual labour. The invention relates to the employment of a platform on which a bed is fitted to receive the shot, the platform being so arranged and combined with a steam cylinder or cylinders, or with other machinery operated either by steam or by hand, or by any other power that may be made applicable to the purpose, that the said platform may be raised or lowered to lift the projectile to the muzzle of the piece when the projectile is placed on the platform, and then introduce the said projectile into the bore. Two cylinders may be used, one being placed on either side of the carriage, and directly below the trunnions, with the piston rods extending forward in a horizontal plane, and attached to the lower ends of the vertical arms of two bent levers. One of these levers is placed on either side of the piece with its fulcrum located in about the same horizontal plane as the trunnions, and its horizontal arms extending as far forward as the muzzle, where it is attached to the aforesaid shot platform. As the said vertical arms are moved forward or backward by means of the steam applied to pistons within the cylinders, it follows that the forward ends of the horizontal arms of the said levers, and with them the shot platform and the shot itself, will be with ease elevated to such a plane that it may readily be rolled, if round, or caused to slide if elongated, into the muzzle of the piece. One cylinder might be placed beneath the piece, and made to serve the purpose of two by coupling its piston rod with both levers. Another device consists of a series of telescopic cylinders with their axes in a vertical or nearly vertical plane, and placed directly beneath the shot platform. As steam is introduced into these cylinders, they are raised up one out of another until the shot platform is of the proper height to introduce the ball into the piece. By having the shot platform hinged at its back end or side to the top of the upper cylinder of the series, and a guard connected therewith so as to extend under the gun, when the platform shall have been raised so as to cause the said guard to come in contact with the gun, and a little more steam is applied, the front end of the platform will be raised up while the said guard and hinge holds the back end of it down on a level with the bore of the gun, thus tipping the platform so as to allow the shot to roll off into the piece (if it is a round shot, or be pushed off if it is an elongated one) as soon as a spring catch which has hitherto retained it on the platform shall have been released.—Patent completed.

2888 W. R. LAKE. *Improvements in revolving batteries, and in the means for working the same.* (A communication.) Dated October 14, 1867.

Here, instead of surrounding the guns with armour which revolves with the battery, the inventor arranges the armour as fixed or stationary, or secured to the vessel bearing the same, and only movable therewith; and he arranges the battery within the said fixed armour movable in such wise that the battery may command all points of horizontal and vertical range which it may be necessary or useful to command. This he accomplishes by piercing the casemate or armour with the necessary number of embrasures or port holes, each being of such form as to permit the horizontal and vertical ranges aforesaid, and by arranging the battery on a platform which may, by proper mechanism, be rotated, thus rotating the battery thereon, and by arranging the guns or other weapons forming the said battery to move, with the carriages whereon they are placed, on proper slides, thereby admitting a motion of the said guns and their slides independently of the platform; and, last, by arranging to manœuvre the said guns or weapons on the said slides to run the same by means of proper mechanism into the positions for firing or loading. All the operations of manœuvring the battery may be effected either solely by the power of the operator's acting upon proper mechanical devices, or by the aid of steam, or similar power, controlled by operators. This invention is not fully described apart from the drawings.—Patent completed.

2889 M. A. F. MENNONS. *Improvements in apparatus for transmitting alarm signals and applying brake power in railway trains.* (A communication.) Dated October 14, 1867.

This invention consists in the application of the vacuum to railway alarm and brake working apparatus as a means of actuating a bell or other signal, or of transmitting motion to the brakes when required for the stoppage of the train.—Patent completed.

2890 H. A. BONNEVILLE. *Improvements in apparatus for superheating steam and other vapours.* (A communication.) Dated October 15, 1867.

This invention consists, first, in a novel construction and arrangement of pipes or tubes for the introduction and passage of steam or other vapours for the purpose of superheating the same, the main principles of which construction consist, first, in providing barriers to the passage of the steam or other vapour, and in so running or locating the pipes or tubes that the steam or other vapour will be made at points of its passage through the tubes to strike against the sides or surfaces thereof, and thus have its particles, as it were, so broken or separated as the more fully and perfectly to be subjected to the action of the heated currents circulating about or around the tubes of the superheater either more or less as the case may be; and, second, in so constructing the pipes composing the superheater that at the points thereof where the steam or other vapour impinges or strikes against the sides of the pipes and becomes broken up into particles as above stated, such steam or other vapour will then be allowed to expand when being again contracted in its further passage onward, a new column of steam or other vapour, as it were, is formed and exposed to the action of the heated currents until it is again broken up as before when again expanding and becoming contracted it passes. Third, in so constructing the superheater for heating the steam or other vapour with the boiler or boilers from which such steam or other vapour is being and has been previously generated that the superheated steam or other vapour can be conducted back into the boiler and there made to act upon and diffuse itself entirely or thoroughly. —Patent abandoned.

2891 H. A. BONNEVILLE. *Improvements in apparatus for threading needles.* (A communication.) Dated October 15, 1867.

This apparatus is composed of two little plates of metal, or some such analagous hard material, one of which is rigid, and of a certain thickness, whilst the other is much thinner, of a smaller size, and possesses a certain amount of flexibility when it is connected at one of its extremities to the larger plate by means of a screw. A slot proportioned to the thickness of the needle or needles for which the apparatus is intended is made in the rigid plate, starting from its outer edge, and extending to a little hole running right through the said plate, which hole is proportioned to the dimensions of the eye of the needle, and corresponding with the extremity of a conical hole made in an appendix fixed on the adverse side of the rigid plate. In order to thread a needle it is run down the slot between the two metal plates until its eye comes in front of the hole in the rigid plate, then the thread—the end of which tapered off, as usual—is inserted into the conical hold of the appendix, which assists its entrance, traverses the hole existing in the rigid plate and the eye of the needle, which is then drawn from the slot, carrying away the thread with it.—Patent completed.

2892 M. VOGL and H. V. DYK. *Improvements in articles consisting of muffs combined with bags or similar receptacles, and in the frames of such receptacles.* Dated October 15, 1867.

The main object here is to combine a bag or other receptacle with a muff in such a manner that the muff shall be of the ordinary round shape. The improvements consist, first, in the construction and employment of a frame for the bag or other receptacle constructed as hereafter described; and, second, in providing an arrangement for opening the bag or other receptacle from the inside of the muff. The frame consists of an arrangement for opening the bag or other receptacle from the inside of the muff, and comprises an upper and under part. The ends of these parts are curved to correspond to the circular form of the muff, and the upper part, when the bag is closed, comes upon the lower part. The upper part is pivoted to the under at one side of the frame, while the other side is provided with a depending catch or lock which locks into a corresponding appliance on the under part. To release the catch or lock, the patentees carry down from its under side a rod or projection extending to the inside of the muff; by pushing or moving this rod or projection by the hand inside the muff the catch or lock is released, and springs fitted between the two parts of the frame then raise the upper part.—Patent completed.

2893 A. AITCHISON. *Improvements in the treatment of hydrocarbons for the production of gas sufficiently permanent to be stored for lighting and heating purposes, and especially in the treatment of the hydrocarbons obtained by distilling or carbonizing coal, wood, and other carbonaceous materials.* Dated October 15, 1867.

This invention consists in first heating the hydrocarbons and other products obtained from the distillation or carbonization of coal, wood, and other combustibles, as also other hydrocarbons, so as to convert the volatile constituents thereof into the form of vapour, and in then causing such vapours to pass in a more or less finely divided state against highly heated surfaces, whereby such vapours are converted into gases sufficiently permanent to be stored for lighting and heating purposes—Patent abandoned.

2894 T. H. BAKER and T. WOODROFFE. *Improvements in treating sewage so as to purify the more fluid portions thereof, and recover some of the contained matters for re-use in manufacturing processes.* Dated October 15, 1867.

Here the sewage (or other liquid matters from towns or other places, or from works where manufacturing or other processes are carried on with a tendency to render impure the sewage or other liquid matters passing therefrom) is allowed to flow into wells or receivers, of which there may be several, to be filled in succession, if desired, better to meet the requirements or occasions of violent storms, or to obtain greater purification, or for other purposes. The matters passing into each of these wells or receivers rises upwards through filtering materials supported in a frame at the upper part of each of such wells or receivers, by which the watery or more fluid portion is separated therefrom, and as it rises above the filtering matter such more fluid portion may flow away by suitable conduits to a river or other watercourse; or it may be collected, if desired, for irrigation or other purposes. The invention also includes other features.—Patent abandoned.

2895 M. SAMUELSON. *Improvements in sewing machines.* Dated October 15, 1867.

This invention relates to that class of sewing machines wherein a reciprocating shuttle is employed in conjunction with a vibrating eye-pointed needle for producing what is known as the lock-stitch. According to one mode of carrying out this invention, the patentee proposes to actuate the shuttle by means of a rotary crank-pin in a disc on the end of the main shaft of the machine; this pin works in a vertical differential slot in an upright lever constituting the shuttle carrier, which vibrates on a fixed centre at its lower end. In order to give a quick motion to the shuttle whilst passing the needle at a point where there is the least stress upon the crank-pin or lever, he curves the upper portion of the slot, and with a view to further facilitate the quick passage of the shuttle case or holder on the top of the lever at a slight angle. In the arrangements above described the shuttle will reciprocate in the arc of a circle, but if it be required that the shuttle should have a rectilinear reciprocating motion, then he substitutes the vibrating slotted lever above described for a plate sliding along two horizontal guide rods, such plate having a vertical differential or curved slot formed therein in which works the crank, and being further provided with a shuttle case or holder at the upper end thereof. On rotating the said crank a to-and-fro horizontal motion will be imparted to the plate or shuttle carrier and shuttle along the guide rods above referred to.—Patent completed.

2896 W. R. LAKE. *Improvements in the construction of railways and railway carriages, and in the means for propelling the said carriages.* (A communication.) Dated October 15, 1867.

This invention is not fully described apart from the drawings.—Patent completed.

2897 H. A. LEVESON. *Improvements in pack saddles.* Dated October 15, 1867.

The object here is to construct pack saddles in such manner that they may be readily accommodated to fit any sized animal—a mule, a bullock, or a camel. The inventor constructs the tree of the saddle of one or more (by preference, two) pairs of bars of iron, or other suitable material, the two bars of each pair being pivoted to each other in a similar manner to the two halves of a pair of scissors; they are kept open at an angle to suit the sized back to which the saddle is to be applied by a bar fitted to their upper part, and formed with holes, through one or other of which a bolt or pin is passed to hold the tree bars in place; or instead of this fixing bar any other convenient appliance may be applied to keep the tree bars apart. The lower ends of the tree bars carry the ordinary pads, while their upper ends vary in shape according to the description of load or baggage they are intended to carry; for supporting a cannon lengthwise the two of each pair should form a curve or hollow, thus ⌣. —Patent abandoned.

2898 B. LATHAM. *Improvements in the means and apparatus employed for distributing sewage over land.* Dated October 16, 1867.

The patentee claims, first, distributing sewage upon the surface of land by means of closed passages, pipes, or conduits, the upper parts of which are uncovered by the soil, and in which uncovered portions apertures are formed for the escape of the sewage on to the land, substantially as set forth. Second, constructing closed pipes or conduits for conveying sewage on to the surface of land, arranged and operating substantially as described.—Patent completed.

2899 A. M. CLARK. *Improvements in apparatus for producing motive power by means of compressed air, water, or other liquid.* (A communication.) Dated October 16, 1867.

The chief feature of this improved motor is that it is worked by compressed air acting on a piston in a cylinder, which, during its motion, at same time stores and compresses a fresh quantity of air in a reservoir for feeding the working cylinder and acting on the piston.—Patent abandoned.

2900 A. and A. C. M. PRINCE. *Improvements in telegraphic communication by pneumatic means.* Dated October 16, 1867.

The documents relating to this invention are with the law officers, "under objection," and cannot at present be seen.

2901 F. D. FROST. *Improvements in rollers used in frames for drawing and spinning fibrous materials.* Dated October 16, 1867.

This invention consists in forming the front rollers used in frames for drawing and spinning or preparing fibrous materials with a groove of ⌣ shape in its periphery, and in placing in the bottom of this groove leather or other suitable yielding material. The ordinary lower roller or boss works in the groove, and draws the fibrous material through.—Patent completed.

2902 C. TINET. *Improvements in the construction of chairs.* Dated October 16, 1867.

Into the back of the chair, and in a line with the back legs thereof, the inventor screws four rings in a horizontal position, two rings being at one side, and two at the other, the top rings being fixed near the top of the back, and the lower rings to the rail carrying the seat. The rings at one side are intended to receive and hold an umbrella, and the other rings a stick. Each pair of rings carries a horizontal cross bar or rail hinged and hooked thereto, one bar being behind the top rail of the back of the chair, and the other bar behind the rail of the seat, and the use of these rails is to receive a coat or other pliable article. The coat being first folded is laid over or across the top bar or rail which is unhooked to receive it, and the bottom bar holds the lowermost part, and by these means the coat is compactly held. He proposes to affix bars or rails between the legs of the chair at the sides and back thereof, and a shelf of cane or other open work a few inches from the bottom of the legs to receive a hat or other small article, the space between the front legs being left open for that purpose.—Patent abandoned.

2903 E. GESSNER. *Improvements in the construction of fulling stocks or fulling machines.* Dated October 16, 1867.

This invention consists, first, in the employment of a trough, the position of which is capable of being changed relatively to the beaters, in such a way that it may either be brought nearer to or removed further from them, according to the thickness of the stuff that is to be operated upon, and which would naturally vary considerably. Second, in the arrangement and disposition of this trough by means of springs or weights, so as to render it movable and make it act elastically against the beaters, that is to say, to make it give more or less, according to the quantity of stuff that is placed between the beaters and the trough, and which often varies unequally during the operation. By arranging the apparatus in this manner, this variation in the position of the trough will be neither prejudicial to the stuff nor to the trough. Third, in the trough in which several beaters work side by side, being of the same width as the cloth to be fulled, the latter may be fulled not only throughout its entire length, but also its entire width. The double advantage of this is that it entirely does away with the false longitudinal folds which are so very prejudicial to the stuff; this process also accelerates the operation of fulling. Fourth, this invention consists in using two beaters placed opposite one another, attached together and united by a single eccentric, and acting alternately and each in an opposite trough. This arrangement constitutes a double fulling action, which, besides the advantages offered by the single fulling stock, offers several others that are peculiar to it. Fifth, the cover of the trough can be either opened or shut, like a valve or trap. This cover or lid, when it is closed, tends to keep the material warm and to effect a more complete and uniform fulling, but when it is open it admits of the cloth being introduced in and withdrawn from the trough easily and regularly.—Patent completed.

2904 W. E. NEWTON. *An improvement in the preparation of wood for increasing the sonorous quality of a piano, or other musical instrument to which the wood is to be applied in its construction.* (A communication.) Dated October 16, 1867.

Here the sounding boards, or other parts of pianofortes and other musical instruments, after they have been

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reduced nearly or quite to the required shape and thickness, are submerged in a tank of chamber lye or urine, in which they are allowed to remain undisturbed for a month or longer, until they are thoroughly soaked and impregnated with the salts in the urine, after which the boards are to be taken out, and slowly dried at a low temperature in a kiln or oven, until every particle of moisture is dispelled.—Patent completed.

2905 D. PIDGEON and W. MANWARING. *Improvements in reaping and mowing machines.* Dated October 17, 1867.

This invention relates to improvements in harvesting machines known as self-acting side delivery reapers fitted with one driving wheel, and in which the cut grain is discharged in sheaves clear of the track of the horses by means of a rotating rake or rakes, the object being to simplify the construction of such machines. To this end the whole of the gearing, both that which drives the cutting apparatus, and that which operates the rotating rake or rakes, is contained in two frames, the first, termed the draught frame, having fitted to it the main axle, and the first motion shaft and the second, termed the gear frame, carrying the crank shaft and the rotating rake or rakes, together with the cutter bar and grain platform. The gear frame is pivoted to the draught frame in such a manner that the first motion shaft forms the centre of motion on which the gear frame (together with the raking and cutting apparatus and the grain platform) is free to move for the purpose of adjustment with respect to the ground.—Patent completed.

2906 J. OXLEY and G. WILSON. *Improvements in machinery or apparatus for cleansing casks.* Dated October 17, 1867.

The patentees claim, first, the combination of parts consisting of revolving frames and driving gear adapted for turning them with cages or carriers for the several casks, and driving gear adapted for turning each cage or carrier with its cask on its own axis, as described. Second, the combination of supporting rollers and a brush roller working in a trough containing water, with gearing adapted to impart to the supporting rollers and the brush roller their relative directions of motion and speeds, in order to cleanse the outsides of casks, in the manner described.—Patent completed.

2907 W. B. ADAMS. *Improvements in locomotive engines and appliances for better and safer working on railways, tramways, and common roads, parts being applicable to like purposes.* Dated October 17, 1867.

This invention is not described apart from the drawings. —Patent completed.

2908 M. WILKIN and J. CLARK. *Improvements in the means or mode of signalling upon railways.* Dated October 17, 1867.

This invention comprises, first, certain apparatus for depositing on the rails fog or similar detonating signals from the last carriage or van of a train whilst the train is in motion. Second, the erecting and working of signal posts or indicators along the line, so that, when a train has passed the first signal post, the line will remain blocked till the train shall have arrived at the second signal post, when automatic apparatus shall clear the first section of line, and the second section be in turn blocked, and so on to the end of the journey. Third, means for effecting the same object as the preceding, but by an interval of time, instead of distance. Fourth, arrangements for depositing and removing fog or signal detonating signals at a certain distance from a station when the usual distance signal is temporarily obscured. The details are too voluminous to be quoted here.—Patent completed.

2909 W. R. LAKE. *Improvements in electric telegraph apparatus.* (A communication.) Dated October 17, 1867.

We cannot here give space to the details of this invention.—Patent abandoned.

2910 E. SHAW. *Certain improvements in hoods for perambulators and Bath chairs.* Dated October 17, 1867.

This invention consists in the application of rods secured to the front framework of the hood of perambulators that are caused to project a short length below the bottom of the hood on each side of the carriage; on this projecting rod a small pulley secured to a connecting link is allowed freely to act, the said link being attached by means of an india-rubber or other spring to a hook or catch placed and secured near the back of the carriage in the mean or central position corresponding with the length of the projecting rod upon which the connecting link slides. Thus, when the bowl of the link is at the bottom of the projecting rod, the spring will retain the hood in its highest or open condition, and when the hood is closed, the pulley and rod will have slipped to the top of such rod, which retains or keeps the hood in its closed condition; by this means the hood is retained in whatever position it is placed, whether open or closed.—Patent completed.

2911 R. C. ROSS. *Certain improvements in mechanism for cutting paper and similar substances.* Dated October 17, 1867.

This invention consists in mounting the circular disc knife in bearings that are arranged so as to allow such knife to revolve in a fixed position; or the said bearings are arranged so as to cause such circular knife to advance whilst revolving. The material to be cut is fixed by clamps or otherwise, so as to rise in a direct line against the cutting cage of the knife, having thereby their edges clearly severed or cut; or, in case the knife is movable, whilst revolving the goods are fixed whilst being cut. At the opposite end of the knife from its cutting cage a hone or sharpener is adjusted, so as to keep the knife, whilst cutting and revolving, in a sharp and keen condition.—Patent abandoned.

2912 J. RIVES. *Improvements in casting metals, glass and other materials, and in apparatus employed for this purpose.* Dated October 17, 1867.

This invention has for its object the applying pressure to castings of molten metal, glass, and other fluid substances whilst they are solidifying, in order to render them dense and homogeneous. For this purpose the patentee places the mould in which the casting is to be made in a strong vessel which can be closed air-tight, and after the molten metal, glass, or other substance of which the casting is to be formed has been poured into the mould, he closes up the vessel and forces into it compressed air, by which a very high degree of pressure may be placed upon the metal or other substance during the time it is solidifying.—Patent completed.

2914 L. HAMEL. *Improvements in machinery for clipping figured net and similar fabrics.* Dated October 17, 1867.

In order to clip off from a figured net or similar fabric the loops of the ornamenting thread which passes from figure to figure, the patentee distends the fabric, and over the face thereof he mounts a frame or bar to which a motion to and fro is given endwise as respects the frame or bar, and transverse to the length of the fabric. The frame or bar has a number of cutters upon it, and instruments which take up the loops of the ornamenting threads and present them to the cutters to be clipped. Any convenient number of cutters may be used, and the more numerous the cutters the shorter will be the to and fro movement of the frame or bar.—Patent completed.

2916 T. BELL and J. RICHARDSON. *Improvements in machinery for decorticating or hulling rice and other grain.* Dated October 17, 1867.

Here the patentees employ a drum or cylinder of metal or steel hung on a horizontal revolving shaft, and a stationary but adjustable concave, also of metal or steel. The periphery or face of the drum or cylinder, and also the face of the concave, are formed with small round buttons or knobs, cast with the surface, such buttons or knobs being placed in vertical and horizontal lines, and so disposed that, as the face of the drum or cylinder rotates towards or against the concave, each vertical row of buttons or knobs is carried between two similar rows on the face of the concave.—Patent completed.

2917 G. M. WELLS. *Improvements in apparatus to be employed in the manufacture of boots and shoes.* Dated October 17, 1867.

This invention relates to the sockets or holders for the standards or supports employed for holding the lasts during the process of making and finishing boots and shoes, and has for its object the affording facility for placing or adjusting the last in any convenient position required by the workman. It is proposed to mount the standard which carries the last in a revolving socket, whereby the last is free to be rotated horizontally or angularly, so as to bring any side in front of the workman. This revolving or rotating socket may be used either in conjunction with the ordinary standard, or with a standard cast in one piece with a portion of the last. The revolving or rotating socket may be made in various ways. According to one mode of construction the patentee casts the outer ring or surrounding metal forming the fixed part or holder of the socket round the revolving block containing the socket hole, such block being, by preference, of a slightly spherical shape, in order to increase its strength, and to keep it in its place in the outer ring. There are modifications given in the specification.—Patent completed.

2918 J. BANNEHR. *Improvements in apparatus for supplying deodorizing matter to dry or earth closets, and in processes of, and apparatus for, treating the liquid portion of human or animal excreta after removal from such closets.* Dated October 17, 1867.

This invention is not described apart from the drawings. —Patent completed.

2919 J. CUBITT. *The preservation from decay of stone, metal, and other substances, and for hardening or glazing their surfaces, so as to prevent smoke or dirt from adhering to them.* Dated October 17, 1867.

Here the inventor applies to the surface to be preserved or hardened a liquid composition which has the property of hardening on the application of heat, and he afterwards heats the surface so prepared by means of a blast or current of hot air, vapour, gas, or flame forcibly impelled against it, or by means of a jet of superheated steam. The ingredients of the liquid composition or glaze will vary according to the nature of the substance to which it is to be applied. A composition of two parts of alumina, two parts of hydrofluoric acid, and one of caustic potash, afterwards rubbed up with ten parts of saturated solution of silicate of soda or potash, forms a good glazing liquid for several kinds of stone and brick.—Patent abandoned.

2920 W. TREDGOLD and J. M'NEIL. *Improvements in steam boilers and furnaces.* Dated October 17, 1867.

This invention relates to improvements in the construction of steam boilers and furnaces with a view to obtain largely increased heating surface, economy in fuel, and an almost entire consumption of smoke. To effect this the patentees provide the furnace with hollow firebars which pass under and beyond the bridge, and are firmly fixed at their rear ends, where they communicate with the water space of the boiler; these firebars incline downwards towards the front, where they terminate in a hollow chamber resting simply against the sides of the furnace, and free to move sufficiently to allow for the expansion and contraction of the firebars. The water supplied to the boiler first passes into a water head situate within the smokebox, where it becomes heated preparatory to entering the boiler. The water passes from the water head through a suitable pipe into the chamber supporting the front ends of the hollow firebars before mentioned, through which latter it is forced in the form of jets by the pressure of the supply by means of nozzles placed in the end of each hollow firebar, the inclination of the firebars facilitating the passage of the water and steam contained therein into the boiler. Air is admitted to the fuel at the front of the furnace above the firebars, the ashpit being completely closed at all times except for the removal of cinders. By this arrangement, the products of combustion are first caused to pass down through the firebars, and then up again between them behind the bridge, returning through the smoke tubes of the boiler into the smokebox at the front of the same, in which is the water head for heating the water contained as above mentioned before it enters the boiler, thereby effecting a saving of fuel. The heat and flame passing twice through between the hollow firebars and through the smoke tubes of the boiler afford an increased heating surface, at the same time that the smoke is consumed by passing downwards through the incandescent part of the fire.—Patent completed.

2921 J. HALE. *An entwining pocket gaiter or spiral legging.* Dated October 18, 1867.

Here the garter or legging is cut out of nearly a straight material, varying in length and breadth according to the size of the person they fit; one end of the bottom part is placed near the instep; the remainder is passed round the heel and brought to the front, where it is secured to that end with a button or other fastening; the shape then swerves, so that in continuing the coil the body of the portion already fastened is only partially covered at the top, the remainder as it is entwined rises and covers the leg; each coil is secured with a button or other fastening to the one it covers. When off the leg, it can be made into a small parcel and conveniently carried in the pocket. —Patent abandoned.

2922 F. PRUDENCIO, F. COOPER, and J. F. COTTERELL. *Improvements in stoppers for bottles, which improvements are also applicable to cocks for casks.* Dated October 18, 1867.

This invention relates to that class of stoppers for bottles and other like receptacles which are self-closing, and in which the valve or stopper itself is contained inside the bottle or other receptacle. The same arrangement may be used as a self-acting cock for casks and similar vessels. According to this invention the patentees construct a self-closing stopper, which does not necessitate any special form of neck, but may be applied to other suitable material which is free to slide through a metal or other collar, which rests on the top of the neck of the bottle or end of the cock, an india-rubber or other packing ring serving to keep the tube in a central position as well as to prevent any breakage at that part. The inner end of this sliding tube carries a disc valve of india-rubber, or other suitable material, which closes against the inner shoulder of the neck of the bottle, or against the inside of the aperture in the case of a cock. A helical spring surrounding the outer portion of the tube, and confined between the collar and a cap or dome on the extreme outer end of the sliding tube, serve, in conjunction with the internal pressure, to keep the valve perfectly tight. When it is required to draw off the contents of the bottle or vessel, it is simply necessary to depress or force inwards the dome or cap, whereupon the valve is opened, and the liquid passes through the tube and is discharged at the outer end thereof.—Patent completed.

2923 H. W. GARRETT and G. HOLCROFT. *Improvements in firearms and ordnance, and in cartridges for the same.* Dated October 18, 1867.

This invention is applicable to breech-loading firearms and ordnance, and consists in connecting the barrel to the breech-piece by means of spiral projections on the one fitting into a spiral groove or grooves in the other, by which contrivance, when the barrel is drawn forward, or the breech-piece is pulled back, the chamber to admit the cartridge is opened, and when the barrel is pressed back, or the breech-piece is pushed forward, the firearm or piece of ordnance is ready to be discharged. The improvement in cartridges may be applied to cartridges for every description of firearms and ordnance, and it consists in introducing a small thread or portion of gun cotton or fulminate into or through the gunpowder of the cartridge for the purpose of producing instantaneous combustion thereof.—Patent completed.

2924 H. SHARP and F. W. WEBB. *Improvements in the manufacture of smiths' anvils.* Dated October 18, 1867.

Smiths' anvils now in use are generally forged of iron and faced with steel, the horn or horns being welded to the body of the anvil. Now this invention consists in casting anvils either wholly or partially of Bessemer or other cast steel.—Patent completed.

2925 E. CASPER. *An improved mode of, and means for, preventing the bursting of the tubes in steam and water pressure gauges, and other tubes or pipes, from the effects of cold.* (A communication.) Dated October 18, 1867.

The patentee claims preventing injury to the tubes of pressure gauges, and to other tubes and vessels when water freezes in the same, by placing within such tube or vessel an elastic or compressible body, substantially as set forth.—Patent completed.

2926 J. HILL and S. SHELLEY. *Improvements in the method of preparing weft that will enable the plain loom to weave checks or stripe goods.* Dated October 18, 1867.

The patentees claim, first, the method or process described of preparing weft whereby checks and striped fabrics can be woven in an ordinary single shuttle loom. Second, the machinery described, or any modification or arrangement of machinery, for winding or reeling yarn, and dividing each hank into two or more portions. Third, dyeing or printing the different portions of the hank so divided of different colours, or dyeing or printing one or more portions and leaving other portions without colour, so that the yarn is partly coloured in alternate lengths.—Patent completed.

2927 E. T. HUGHES. *Improvements in the manufacture of hats and bonnets, and in the apparatus employed therein.* (A communication.) Dated October 18, 1867.

This invention relates to hats and bonnets made of cloth, and consists in forming on the outside of the hat or bonnet a design or pattern similar to the plaits of the straw or grass hats and bonnets at present in use.—Patent completed.

2928 W. H. TASKER. *An improved shuttle eye.* Dated October 18, 1867.

This invention relates to shuttles employed in looms for weaving, and consists in the construction and application thereto of glass eyes instead of the pot or metallic eyes heretofore applied, which, by the constant friction or rubbing of the weft yarn in its passage therethrough, the said yarn is chafed and frequently broken thereby.—Patent abandoned.

2929 J. SEWARD and H. SMITH. *Improvements in steam boilers.* Dated October 18, 1867.

This invention has for its object the prevention of deposit in the flues of boilers of particles of incombustible matter. This the patentees effect by means of a series of plates fixed at intervals along the flues, the particles of incombustible matter being carried along the return flues and deposited in a pit prepared at the front of the boiler, or other convenient place, to receive the same.—Patent completed.

2930 T. KITCHEN. *Certain improvements to be applied to the grinding of wheat and other grain.* Dated October 18, 1867.

The object here is the carrying off and discharging the dust or particles of grain in suspension arising from wheat or other grain when undergoing the operation of grinding, without the aid of exhaust pumps, fans, or blasts, as heretofore employed, and the invention consists in the use of pipes, tubes, or trunks connected with an exhausting power to induce a current of air between the millstones, of sufficient power to carry off and discharge the dust or particles of grain in suspension.—Patent abandoned.

PROVISIONAL PROTECTIONS.

Dated February 15, 1868.

504 J. A. Hogg, Montague-street, Edinburgh. Improvements in the method of, and means for, increasing the combustion and illuminating power of gas.

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Dated January 27, 1868.

656 R. A. Hope, Brelade House, St. Clement's, Island of Jersey. A machine for adding sweetening and other ingredients to aerated, mineral, and other beverages.

Dated March 17, 1868.

904 H. H. Hazard, New Cross-road, Deptford, Kent, engineer. Improvements in coiling or revolving shutters.

Dated March 24, 1868.

998 F. W. Crohn, Cullum-street, Fenchurch-street, City. Improvements in turbine apparatus for obtaining power from a fall of water.

Dated March 27, 1868.

1048 A. Scott, Blomfield-crescent, Paddington. The production of an alcoholic fermented dry sweet, or effervescent drink, of which tea or coffee or theine or caffeine is an essential ingredient.

1059 W. W. Hughes, Porchester-terrace, Middlesex. Improvements in apparatus for propelling and steering vessels, and in forcing water.

Dated April 2, 1868.

1112 J. Saxby, Kilburn, W., railway signal engineer. Improvements in apparatus for actuating, locking, and regulating railway switches, points, and signals.

1115 A. Jackson, braid manufacturer, and J. Hartley, foreman mechanic, Manchester. Improvements in braiding machines.

1117 J. G. Dale and E. Milner, Warrington, Lancashire. An improved method of producing white pigments from lead.

1119 J. Napier, Glasgow, engineer and shipbuilder. Improvements in apparatus for steering ships and vessels.

Dated April 3, 1868.

1121 J. and T. Walmsley, Little Harwood, Lancashire. Certain improvements in apparatus to be employed for warping and beaming yarns or threads.

1123 J. S. Crosland, Manchester, engineer. Improvements in, or applicable to, steam engines.

1125 J. Wallace, Glasgow, agricultural implement maker. Improvements in apparatus for digging potatoes.

1127 J. Harwood, Blackburn, Lancashire, sewing machine maker. Improvements in sewing machines.

1129 A. Martin, Middle-street, Clothfair, Middlesex, bonnet shape manufacturer. Improvements in bonnet shapes.

1131 J. V. Jones and G. J. Williams, Birmingham, manufacturers. Improvements in the manufacture of ornamental metallic tubes.

1133 W. Williams, Tividale, Staffordshire, tin plate manufacturer. Improvements in the manufacture of tin and terne plates.

1135 T. Row, Old Ford, Bow, Middlesex, and S. Scott, paper stainer, Chelsea, Middlesex. Improvements in the manufacture of paper hangings.

Dated April 4, 1868.

1137 H. Cochrane, Middlesborough-on-Tees, Yorkshire. Improvements in blast furnaces.

1141 A. and H. Illingworth, Bradford, Yorkshire, worsted spinners. Improvements in means or apparatus employed in folding worsted or other yarns.

1143 F. H. Greenstreet, Pattingham, near Wolverhampton. Improvements in targets, arrows, darts, and other projectiles more especially adapted for indoor use and amusement.

1147 D. C. M'Ivor, Asknish, Loch Gair House, Argyll. Improvements in propelling ships, and in the means or apparatus employed therefor.

Dated April 6, 1868.

1149 H. and J. Bryceson and T. H. Morten, Stanhope-street, Euston-road, Middlesex. Improvements in the construction of organs, and in the application of electricity thereto.

1150 D. Crichton, machinist, W. Donbavand, scale beam and weighing machine manufacturer, and D. Crichton, engineer, Manchester. Improvements in looms for weaving.

1151 E. Hay, Lombard-street, City. Improvements in means or apparatus for measuring and indicating the passage or flow of liquids. (A communication.)

1153 R. Morcland, jun., and D. Thomson, Old-street, St. Luke's, Middlesex. Improvements in pumping engines and steam boilers therefor, which steam boilers are also applicable to other purposes.

1154 C. H. Gardner, West Harding-street, City, printing machine manufacturer, and J. Bickerton, Oldham, Lancashire, engineer. Improvements in lithographic, zincographic, and typographic printing machines.

1156 J. M. Plessner, Rue de la Chausee d'Antin, Paris. Improvements in the mode of, and apparatus for, obtaining motive power.

1157 J. Radcliffe, Consett Iron Works, Durham. Improvements in processes and means employed in the manufacture of iron and steel.

1160 T. Holt and H. Spencer, Rochdale, Lancashire, agents. Improvements in machinery for spinning and doubling cotton and other fibrous substances.

1161 A. V. Newton, Chancery-lane. Improvements in bathing shoes. (A communication.)

1162 A. V. Newton, Chancery-lane. Improvements in anchors. (A communication.)

1163 J. Casson, St. James's-street, Sheffield, Yorkshire. Improvements in machinery for planing wood.

Dated April 7, 1868.

1164 E. Watteau, Vulcan Works, Middlesborough-on-Tees, Yorkshire. Improvements in screw taps, and in the mode of fixing the same.

1165 R. Holiday, High-street, Poplar, Middlesex. Improved means or apparatus for the prevention of accidents at facing points on railways.

1166 H. J. Ditmars, Pancras-lane, City. Improvements in apparatus for the consumption of smoke. (A communication.)

1168 W. Nall, Leicestershire. An improved apparatus for holding and igniting matches.

1169 E. H. Newby, King William-street, City. An improved boat-detaching apparatus. (A communication.)

1170 H. Fisher, Sheffield, Yorkshire, manufacturer. Improvements in constructing the handles of tea-pots, coffee-pots, or other vessels intended to contain heated liquids.

1171 F. Simpson, machine fitter, and S. Hardwick, metal roller, Handsworth, Staffordshire. Improvements in machinery for rolling sheets or plates of iron for the manufacture of tin and terne plates, which improvements may also be used for rolling sheets of iron for other purposes.

1172 C. W. Siemens, Great George-street, Westminster. Improvements in the application of gas furnaces to evaporating, smelting, puddling, and other manufacturing purposes.

1173 I. Sherwood, Birmingham, lamp manufacturer. Improvements in lamps for burning hydrocarbon oils and spirits.

1174 R. G. Lowndes, bleacher and finisher, Auldhousefield, Renfrewshire. Improvements in finishing textile and other fabrics, and in the machinery or apparatus employed therefor.

1175 J. Armstrong, Clifton, Westmoreland, agricultural implement maker. Improvements in harrows.

1177 D. Lane, Cork, Ireland, secretary to the Cork Gas Consumers' Company, Limited. Improvements in the manufacture of floor and other cloth or coverings for floors, and in covering floors.

Dated April 8, 1868.

1179 J. Bedford, Leeds, engineer. Improved means and apparatus for washing and drying grain.

1180 J. J. Chaudun and J. J. Dexant, Rueil Village, near Paris, manufacturers. Improvements in cartridges for breech-loading firearms.

1181 J. James, Ebbw Vale, manager, and T. Jones, Govilon, forge and mill manager, Monmouthshire. Improvements in the manufacture of iron into semi-steel or steel.

1183 W. R. Lake, Southampton-buildings, Chancery-lane, Middlesex. Improvements in machinery for cutting and working rocks. (A communication.)

1184 W. E. Newton, Chancery-lane. Improvements in the manufacture of salts of soda. (A communication.)

1186 C. G. Hill, Alfred-street, Nottingham. Improvements in the manufacture of fringes and purl.

1187 V. Gallet, Lavausseau de Berassais, department of the Vienne, France. Improvements in the manufacture of steel.

1188 E. Brasier, New Cross, Surrey, and J. E. Hodgkin, Liverpool. Improvements in machinery and processes for scutching, dressing, cleaning, treating, and preparing flax and hemp.

1189 T. Hunt, Godolphin-road, New-road, Hammersmith. Improvements in ordnance, and in the mode of working the same.

1190 C. Douglas, Edinburgh. Improvements in cutting the teeth of wheels, and in apparatus employed therein.

Dated April 9, 1868.

1191 W. Chapman, Kennington Park-road, Surrey, leather seller. Improved machinery or apparatus for skiving or chamfering leather and other materials.

1194 J. Rae, Sydenham, Kent, engineer, and G. Miller, Glasgow, rivet manufacturer. Improvements in the construction of railway wheels, and in the axles and bearings for the same.

1195 A. H. Still, Rockboro' House, and D. Lane, South Mall, Cork. Improvements in the manufacture of gas.

1196 W. B. Robins, South Moulton-street, Oxford-street. Improvements in garden engines and other similar hand pumps for throwing jets of water.

1198 G. T. Bousfield, Loughborough Park, Brixton, Surrey. Improvements in dies and in machinery for cutting dies and taps. (A communication.)

1200 W. E. Newton, Chancery-lane. Improvements in firearms and in cartridges for the same. (A communication.)

Dated April 11, 1868.

1204 J. Marsden, Bolton, Lancashire, builder. Improvements in the construction of beams or girders, floors, and roofs for fireproof buildings.

1206 C. E. Brooman, Fleet-street, City, patent agent. Improvements in photography. (A communication.)

1214 M. A. F. Mennons, Rue de la Chaussee d'Antin, Paris. Improvements in apparatus for the preparation of carbonated or effervescent beverages. (A communication.)

Dated April 13, 1868.

1218 B. J. B. Mills, Southampton-buildings. Improvements in bleaching, reviving, and tinting white and coloured feathers and silk fabrics and goods. (A communication.)

1222 T. Forster, Streatham, Surrey. Improvements in the manufacture of compounds of india-rubber, gutta-percha, balata, parkesine, solid paraffin or vegetable oils, and vegetable fibre.

1224 E. Richardson, Castle-street, Falcon-square. Improvements in stays or corsets.

Dated April 14, 1868.

1228 E. Foden, Sandbach, Chester. Certain improvements in apparatus to be employed for mowing and reaping.

1230 E. P. H. Vaughan, Chancery-lane. Improvements in the manufacture of ceramic tesserae and in the employment thereof for mural and other decorative purposes. (A communication.)

1232 H. Hughes, Homerton, engineer. Improvements in the manufacture of pipings and folds or plis of satin or other material.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," April 28, 1868.

3548 L. A. Damm. Means for conveying salt water fish through fresh water, and overland, and on land. (A communication.)
3560 R. Tinkler. Churns.
3569 L. A. W. Lund. Studs.
3580 J. Standfield. Apparatus for applying hydrogen gas to the furnaces of steam engines.
3583 T. V. Mackintosh. Machines for making drains.
3599 J. Hall. Furnace grates. (A communication.)
3603 O. A. Hebert. Musical boxes.
3608 J. S. Gisborne. Electric telegraphic apparatus.
3609 L. M. Becker. Arrangement of electric telegraph wires.
3618 W. B. Pullar. Manufacture of fabrics.
3627 J. Kenyon. Apparatus for boiling size.
3635 C. G. Wilson. Machinery for pressing cotton.
3640 J. Rowe. Miners' safety lamps.
3641 W. Dixon and W. Brown. Elastic coupling for the prevention of sudden strains upon ropes.
3642 C. W. Lancaster. Construction of cannons.
3643 W. W. Urquhart and J. Lindsay. Machinery for softening jute.
3652 F. A. Abel. Production of explosive compounds.
3663 J. Addie and F. Kohn. Blast furnaces.
3666 W. Hewitt. Holders for holding reins.
3708 M. A. F. Mennons. Accelerating the induration of certain descriptions of concrete. (A communication.)
3716 W. Wilson. Hats. (Partly a communication.)
2 W. R. Lake. Fireproof safes. (A communication.)
7 A. M. Clark. Breech-loading ordnance. (A communication.)
8 H. Milward. Needle-cases. (A communication.)
14 T. B. Daft. Construction of iron ships.
17 D. Foster. Anvils for smiths.
44 F. Chamberlain. Steam boiler furnaces.
89 R. Winder. Folding machine for folding sheep.
112 T. Whitwell. Furnaces.
158 R. Heathfield. Machinery for the manufacture of nails. (A communication.)
320 B. Dobson, W. Slater, and R. Halliwell. Machines for spinning and doubling.
634 G. T. Bousfield. Apparatus for raising and forcing water. (A communication.)
684 T. Trotman. Doubling-up or folding carriages.
887 H. A. Bonneville. Permanent way of railroads. (A communication.)
970 V. A. Deaubeuf. Machinery for the manufacture of compressed fuel.
1028 J. T. King. Apparatus for dressing millstones.
1065 J. Macintosh and W. Boggett. Boots and shoes.
1121 J. and T. Walmsley. Apparatus for warping yarns.
1137 H. Cochrane. Blast furnaces.
1186 C. G. Hill. Manufacture of fringes.
1222 T. Forster. Manufacture of compounds of india-rubber, &c.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed April 24, 1868.

3000 W. and D. Fisken	3034 A. J., W. B., and S. H. Waterlow
3010 P. Love	3030 H. A. Bonneville
3011 B. Cooper	3036 M. Henry
3014 G. and E. Dorsett and J. B. Blythe	3037 T. Bennett
3015 W. E. Wiley	3055 J. B. Fenby
3020 J. J. Perry	3057 F. Piercy
3023 W. Kendall	3061 C. and J. Jobson
3027 W. Payne and A. B. Fraser	3070 I. Kendrick
3028 J. de Silva	3086 W. E. Gedge
3029 G. Smith	3117 C. E. Brooman
	818 W. R. Lake

Sealed April 28, 1868.

3045 E. T. Hughes	3112 T. Wingate
3049 W. P. Savage	3119 A. M. Clark
3050 L. Perkins	3124 A. M'Dougall
3052 W. H. A. Bowhay	3127 E. C. Prentice
3056 T. E. Symonds	3131 R. Newton
3060 A. V. Newton	3137 A. M. Clark
3062 R. Clegg	3140 T. J. Baker
3065 E. Donner	3208 A. F. Gaidan
3075 R. B. Roden	3258 W. R. Lake
3076 J. Sturgeon	3368 W. Palmer
3080 S. Parr and A. Strong	3563 E. H. Bentall
3081 J. Wright and M. B. Nairn	3647 C. J. Adams
3085 A. G. Avenell	224 C. R. Broadbent
3089 J. J. Hicks	726 J. Dewar
3101 H. Hebden	808 C. D. Abel
	865 C. R. Broadbent

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1113 E. Wilson	1178 H. W. Wood
1122 R. Canham	1213 J. C. Davis
1127 J. H. Wilson	1239 W. Clark
1143 J. J. Parkes	1251 J. Lilley
1150 T. Walker	1277 P. Welch
1155 J. Wilkinson	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1085 F. J. Bramwell and W. Owen	1041 J. S. Templeton
	1106 P. Wright

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending April 25, 1867.

No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.
2381	1	2	2551	3	4	2610	0	6	2627	0	4	2645	0	10	2658	0	4			
2485	0	8	2555	0	8	2611	0	8	2629	0	4	2646	0	4	2660	0	4			
2504	2	6	2567	0	6	2612	0	8	2631	0	4	2647	0	4	2661	0	4			
2507	1	4	2572	0	8	2613	0	4	2632	0	4	2648	0	4	2663	0	4			
2513	1	2	2580	1	0	2614	0	4	2633	0	4	2649	0	8	2664	0	4			
2520	1	4	2588	2	0	2616	0	4	2634	0	4	2651	0	4	2666	0	4			
2533	1	4	2595	0	10	2617	0	4	2635	0	4	2653	0	4	2669	0	6			
2534	1	2	2596	0	6	2618	0	4	2637	0	4	2654	0	4	2670	0	4			
2537	1	10	2600	0	10	2619	0	4	2638	0	4	2655	0	4	2671	0	4			
2541	1	4	2605	0	4	2620	0	4	2642	0	4	2656	0	4	2683	1	0			
2542	0	6	2606	0	4	2625	0	10	2643	0	8	2657	0	4	2685	0	4			
2546	0	4	2608	0	4	2626	0	4	2644	0	4									

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, MAY 8, 1868.

THE GOVERNMENT AND THE TELEGRAPH COMPANIES.

IT would have been matter of great surprise if the Government bill for obtaining the electric telegraphs had not met with opposition from the various telegraph companies. The bill, as it stood, was capable of great improvement, and opposition usually has the salutary effect of detecting the weak points, and consequently necessitating certain amendments. On this account we are glad to see the pamphlet lately published as a "Statement of the Case of the Electric and International Telegraph Company against the Government Bill." This is generally credited as the work of their chairman, Mr. Grimston; and as we have seen similar matter in a more condensed form under his signature, we may be fairly permitted to accord to him the credit of the work. We cannot enter into its consideration without expressing our admiration of the bold and plucky way the attack is made. No opposition has appeared from any of the other telegraph companies—unless we can call the petitions presented to Parliament against the bill by individual shareholders, by that name—so we may take the pamphlet as expressing the views of all, especially when we find it remarked that they "for their own part, as well as for that of the other companies, deny, &c." Almost simultaneously with the above, was published by the House of Commons, a "Return relating to Electric Telegraphs," giving the various reports made to the Postmaster-General, and which we must take as the foundation of the bill itself. It is somewhat unfortunate that the return did not make its appearance earlier, for it would then have saved the company from several inaccuracies and mis-statements. The return contains the original and exhaustive report of Mr. Frank Ives Scudamore, and his second report, the latter giving answers to many points brought before us in Mr. Grimston's pamphlet. We may mention, before proceeding further, that the pamphlet attributes the origin of this scheme jointly to Mr. Scudamore and Mr. Chadwick, the latter of whom read an independent paper on the subject at the Society of Arts, in the discussion of which Mr. Scudamore joined. The scheme was really exciting the attention of the Government prior to that event, and we think we are correct in stating that their attention was originally drawn to it, strange to say, by a letter from the late Mr. Ricardo, who was one of the promoters of the Electric Telegraph Company, and was for many years their chairman. The letter being written after his official connection with the company had ceased, may account somewhat for their ignorance of it; but the many proposals on the subject by Mr. Thomas Allan, the well-known telegraph engineer, remarked so freely on in the press at the time of their appearance, ought to have been known to them.

The pamphlet reviews the Government bill, what it proposes, what the Electric and International Telegraph Company has effected, the great question of the Belgian and Swiss telegraphs, the plans of the Post-Office, and, finally, the Government control, showing its disastrous effects. It would have been far better if the latter section had been left out, for its want of taste mars the effect of the arguments entirely. In discussing the bill they dispute "the truth of the preamble, and take issue on it boldly, that the means of communication by electric telegraph are insufficient." In spite of the boldness of their statement, we certainly do not think they have satisfactorily contradicted it, neither have they made any attempt to refute the petition presented to the House of Commons by the Association of the Chamber of Commerce of the United Kingdom, complaining not only of the high rates, but of frequent and vexatious delays, and of inaccuracy, &c.; and also a special report of the Edinburgh Chamber of Commerce with similar complaints. It is not so much on their own account that the Government have worded their preamble in such a manner, but almost entirely upon the representations made to them. We do not expect for a moment that the Telegraph Company would admit any of these allegations, just as we should not imagine that a tradesman would run down the wares he was about to offer for your purchase.

The reports upon which the Government drew up their bill not having been before the Company until after their pamphlet had appeared, this part of their statement is not so complete as it otherwise would be, but the statistics of the Swiss and Belgian telegraph systems are fairly used by them, and they make a strong case, by taking these statistics, that our system is not inferior to theirs. Certain statistics brought forward by them show this result, whilst others brought forward by Mr. Scudamore show a different result, proving how statistics may be taken for or against. One point the company bring against the Belgian Government is, that "no matter how long a message has taken in delivery, or whatever may be the errors in it, they will make no compensation to the sender or receiver, except under very exceptional circumstances." Of the value of this argument in favour of the Company, we make the following extract from the Electric and International Telegraph Company's forwarding form. "The Company will not be responsible for *inaccuracy* in the transmission of any message along the Company's lines, unless the message be an insured message. The Company will not be responsible to any extent whatsoever for any delay in the transmission or delivery of *any message, whether the message be insured or not.*" The italics are not our own.

The Company make out a very good case of what they have effected. Too much praise cannot be awarded them for what they have done towards improving telegraphy in the United Kingdom. Personally, we do not consider our system inferior to that of other countries, and we do not question, neither to our knowledge has it ever been questioned, but that we owe much to the various telegraph companies, and principally to the Electric and International Telegraph Company, for what they have done; but it must be acknowledged that, being compelled to look after the profits of the concern, so as to return a good dividend to their shareholders, prevents them from giving the public more extended and cheaper communication. It is a great commercial undertaking with them, necessitating a good return for the capital expended; the dividends the shareholders annually receive proves that the directors have not been unmindful of their trust. The Company have done what they can, but we contend that an amalgamation of the various systems under the Government would infallibly bring about the result of a cheaper system of telegraphy, which could only be effected by the companies at the cost of dividends. We have already expressed our opinions on the subject, with which our readers are doubtless familiar. We will only state here our conviction that the Government would be able, under a general and a more economic system, to work the telegraph at greatly reduced rates, and still with a profit.

An argument was made use of by Mr. Grimston, in his former pamphlet, which we see repeated in the one before us, relative to the value of telegraph stations in a pecuniary sense. "The following simple statement will suffice to dispel the illusion" that "a cheap system of working the telegraph in connection with the Post-Office would enable them to reduce the rates in the general system." "The great bulk of the stations of the Electric and International Telegraph Company only collect 9 per cent. of its gross receipts. In 1867, of the gross receipts of the Company, 76 per cent. was received at eighteen stations, 15 per cent. at eighty-one stations, and only 9 per cent. at the remaining stations." "It is obvious, therefore, that it is not the small stations that pay." It is sufficiently obvious to us (a point also Mr. Scudamore has not been slow to make use of) that the Company places a value purely one-sided on their traffic. It simply amounts to this, that the value of a station does not depend at all upon its received messages. In fact, that it only exists for forwarded messages. If these small stations, therefore, had no existence, would the larger stations send those messages? The argument is certainly a weak one, and damages the case of the Company. The value of any station—telegraphic, railway, or postal—can only be fairly estimated by taking into consideration the traffic received at it as well as that forwarded from it.

The Company enter largely into the confusion that would arise relative to the contracts they have in hand, agreements between them and the various railway companies, and want to know what the Government intend doing as regards them. One clause in the bill specially provides for this point—that all matters undertaken by the Company will be carried on by them, "as if the Postmaster-General had been named" "instead of the Company." As regards press messages and other extraordinary traffic, we cannot think so badly of the Government as to imagine they would exercise *espionage* or any undue influence politically with regard to such telegrams. We should have been ashamed to bring forward such a suspicion. What would be the opinion of the directors were we to hint such a thing against them? The chapter on Government control is one we are sorry to see in the pamphlet, and one which must leave an unfavourable impression against the authors of the pamphlet in the minds of those who read it.

There are many points in the pamphlets which call for attention, but our space will not allow us to discuss it more. The opposition that the Company has brought to bear will, no doubt, be beneficial; but for all the arguments they have brought forward, we cannot agree with them that "it is undesirable that the telegraphic system of the country should be placed in any way under Government control;" and, on the contrary, we are still firmly of opinion that under the change we should have an equally, if not more, expeditious, and decidedly a cheaper system of electric communication.

IMPROVEMENTS IN OUR PUBLIC CONVEYANCES.

THE question of the improvement of our public conveyances is one which has been much discussed of late. That there is room for improvement no one will deny who is acquainted with the tightly-packed, unwholesome-aired, noisy, jolting omnibus of the present day. In his tramway system Mr. Train set us an example of what might be done towards enabling the public to travel in comfort. But he used a rail which interfered with the general traffic, and so the system fell into disrepute. More recently we have had Messrs. Noble and Co. endeavouring to revive the tramway system, under Parliamentary sanction. Vested interests, how-

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ever, and a powerful carrying company, have, we regret to say, been the cause of the bill being thrown out. So for a time, at least, we must rest contented with our present miserable system. We hope, however, that next year Messrs. Noble will be more successful with their bill, and that, with certain necessary exceptions, we shall see our thoroughfares laid with a judicious system of street tramway. The mechanical arrangements proposed by Messrs. Noble are simply unobjectionable, and cannot in any way interfere with existing traffic. In the meantime, however, and pending better things, it should be the duty of Government to insist upon the public being provided with a decent class of conveyance, which, we are sorry to say, the present ordinary omnibus is not. Several improvements have been made from time to time, and most of our great exhibitions have included examples of convenient and comfortable omnibuses. But improvement has rarely gone beyond that, and the designers and builders of these vehicles have, for the most part, had their trouble for their pains. We have now another enterprising gentleman who has worked out with great care, and at considerable cost, a novel system of omnibus, which promises well for the public convenience and comfort, if only the powers that be will back the inventor's exertions to obtain its general adoption. This gentleman is Mr. William Harvey, who is well known to our readers by his recent letters upon the quadrature of the circle, and other mathematical subjects.

We last week briefly announced that a trial trip was to be made with Mr. Harvey's omnibus. Pursuant to notice, and punctual to time, on Friday last, at 3 p.m., it left Charing-cross for a run to the Bank and back. This trial was made by direction of the Home Secretary, who specially appointed Mr. George Lane Fox to superintend it. A number of scientific gentlemen and others interested in the question of improving our public vehicles were among the passengers, Sir Richard Mayne directing the operations from the roof. The chief peculiarity of this omnibus consists in its having only two wheels, and being drawn by three horses. The horses are attached to the vehicle by means of four shafts, so that, as the back and belly bands of the horses traverse freely from the near side of the near horse to the off side of the off horse through swivel holes in the centre shafts, and as there are only two wheels to the omnibus, the three horses act together as one horse in a gig or Hansom cab. For the purpose of preventing noise, the shafting and framework of the running frame are put together as one piece, and are composed entirely of angle and bar iron. This framework rests by strong and long grasshopper steel springs on the single cranked axle, the arms of which are 3¼in. in diameter, and the wheels have a run of nearly 8ft. The carriage body rests on the top of the iron frame on four india-rubber cylindrical buffer springs, and swings entirely free of the axle. This completely prevents the ordinary sharp rattle experienced in omnibuses, and enables the passengers to speak freely to one another. There is a comfortable separate seat to each inside passenger, and much more than the ordinary accommodation for the outside passengers, with ample leg room, and abundance of space to pass. The omnibus, from its peculiar construction, is hung so low that even feeble persons can enter and leave it with the greatest possible ease. The passage room in the centre inside is 6½ft. high, and being 22in. wide between the knees of the passengers on either side, the utmost facility of ingress and egress is presented; and vacant seats can be at once seen for occupation. In plan, the seats are arranged like the teeth of a saw, each presenting a corner to the one on the opposite side. The passengers thus sit at an angle of about 60deg. with the side of the omnibus, and thus obtain a view of outside scenes, instead of gazing into vacancy and each other's faces all the journey.

The steps to the outside are sloping, and very convenient. A screw drag, which is under the command of the driver, enables him to apply it without stopping the vehicle. By its means all weight is taken off the horses in going down a hill. Mr. Harvey's omnibus is somewhat wider, and, in other respects, larger than the ordinary omnibuses, the principal dimensions being as follows:—Extreme length over all from point of shafts to tip of hind step, 21ft. 4½in. Inside measurements of carriage body—length, 14ft. 2½in.; height, 6ft. 5½in; width, 5ft. This omnibus is constructed to carry sixteen passengers inside, and twenty outside, and we understand that three-horse omnibuses under Mr. Harvey's patent, to hold thirty-six or thirty-eight passengers, can be built as light and stronger than the present two-horse omnibuses which carry only twenty-six or twenty-seven passengers.

The trial run with Mr. Harvey's omnibus was accomplished with the most satisfactory results, turning corners of narrow streets and turning round in main thoroughfares with the greatest ease and facility. With regard to the vehicle itself, as a public carriage, we think it superior in every respect to those at present in use. Our experience on the trip was one of comfort and convenience from first to last. There is ample sitting and passage room; each passenger has a seat to himself, and enjoys a look out without twisting his neck—those who sit near the upper end have a clear look out a-head. The noise and rattle are muffled and subdued, so that conversation is conveniently kept up without strain or exertion. There is, however, a slight buzz, which had a singular effect on the tympanum. Our opinion is that this effect is due to the glass—of which there is a considerable amount in the sides of the vehicle—is slightly too thin; a thicker glass would be more rigid, and this sensation, which is slightly unpleasant, would doubtless be removed. With this, and one or two other matters of minor detail attended to, Mr. Harvey's omnibus will be second to none as a public conveyance. With regard to the horses—a point of importance in the working economy—we may observe that they worked excellently well, appearing in no way distressed at the end of the journey. This is highly satisfactory, considering the crowded state of the thoroughfares passed through, and the fact that the omnibus was put through some extraordinary evolutions in the narrow lanes of the City. Of course, there will be an official report, to which we look forward with interest. In the meantime, we wish Mr. Harvey success, and thank him, on behalf of the public, for his practical endeavours to improve that highly useful but highly inefficient institution the omnibus.

THE INSTITUTE OF NAVAL ARCHITECTS.

IF length and multiplicity of matter, with a reasonable clearness of explanation, be sufficient, then Admiral Halstead's paper on the turret and tripod system is second to none. This paper gives the substance of the Admiral's examination, spread over the lengthened period of seven weeks, by the French Imperial Commissioners at Paris. There is no doubt a certain propriety in this local sequence, as with the French "La Gloire" began the race, so hotly contested since, of ironclad ships of war. What we have said in reviewing Sir E. Belcher's paper, we might repeat with emphasis on reading Admiral Halstead's. Ships against guns: guns against ships, is the simple alternation, and may go on, as far as we can see, *ad infinitum*. There is no end to the contest, save the bottom of the purse. The Admiral puts it thus:—

> These necessities gradually resolved themselves into these four propositions, which, it is submitted, must equally apply to any other attempt practically to solve, on a reasonable system, the still pending controversy between armour ships and guns:—1. As in all past battles between ships of wood, so in future fights between ironclads, the respective hostile projectiles must decide, *ceteris paribus*, the issue of victory or defeat. 2. The armour-plate projectiles of the future will decide this issue according to their relative excellence in material, proportions, form, range, accuracy, penetration, and explosive force. 3. These requisite conditions of excellence for the projectiles must rule the conditions for the gun which fires them. 4. These requisite conditions for the guns must rule the mode of turret and turret-ship best able to carry and to fight them.

Here, then, we think we see a gap of sufficient magnitude to swallow £100,000,000 sterling, demanding twenty years, at least, to do it in. Surely, this ought to satisfy any number of hungry expectants of the crumbs that fall from the Admiralty's table. In the combination of seven turrets carrying fourteen guns, commanding nearly the whole sweep of the horizon, no doubt the Admiral has planned a ship most formidable in its character, and probably destructive of any of inferior armament and build. The testimony of such names as those of Coles, Napier, Watts, Lang, &c., leaves no room for doubt on these points. In the proposed combination of turret and broadside guns, the comparative clearness of the upper deck, the gain of a high and dry spar deck, the full equipment for sailing, &c., we see points of surpassing importance proposed. But we quite agree with the Chief Constructor, and Mr. Scott Russell, and others who took part in the discussion, that many of these plans which look well on paper, and perhaps violate no principle theoretically true, may be found unworkable, or even self-destructive; for on both points doubts were expressed by those competent to judge, in the discussion that followed the reading of the paper.

In this discussion we see what a glorious state of confusion we are at present in respecting our navy. No one point seems yet to be fixed as to construction or constructors. Captain Symonds is for fixed central batteries and broadsides; Captain Coles for distributed turrets; and Admiral Halstead for a combination of both. "Let us have long ships," we hear on one side; "Short ships are more handy" meets us on the other. Heavy armour amidships, *a la* "Warrior," is now recommended; now stem and stern and broadside alike, as the "Achilles." By some, rams are said to be most destructive under water; by others, above. Again, it is a question whether our future navy should be designed by sailors or shipbuilders. "Let sailors tell us what they want, and we will let them have it," says Mr. Scott Russell, "but unfortunately we cannot get a sailor to tell us what he wants." Just so; and for the best of all reasons: he does not himself know. For ourselves, we agree with what was said by Sir F. Gray, "that the uncertainty that had hung over the question—What the ships of the future were to be?—since 1856, had not been dispelled. We, therefore, should be careful not to go too fast in building these enormous ships, for we might find ourselves ten years hence with another set of obsolete ships on hand." "Nothing like leather," is the maxim of fools—the warning of the wise. Iron is to do all now-a-days, in defence as in attack, which idea has been so hastily acted upon that now it is a question if our ships will float. Yet the cry is for more iron. If the "plunging" fire is to be adopted (when the ends and sides of ships are no longer pervious to shot) and the decks and bottoms are to be attempted, what remains but that these also must have their 8in. or 10in. of iron plating? The armour can no longer stop at 11deg. of heeling. Now that its weight seems to be bringing our armouring to a dead lock, we

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hope that more caution and economy will be manifested in the use of public money. We feel confident that in ten years we shall see, as we have said before, that the great models of our ships of war will be the Cunard or the P. and O. packets, the seaworthiness of which would not be very injuriously interfered with by a moderate amount of broadside armouring.

A description of new double expansive engines for H.M.S. "Spartan" was read by Mr. E. E. Allen. Now that steam of such high pressure is coming into general use, the great desideratum for engines is some method of using that steam so as to obtain an approximately uniform motive power. If steam of high pressure is admitted into a cylinder, and there allowed to expand, the work is greatly in excess at the beginning of the stroke, and in defect at the end. This produces great and irregular strains on all parts of the engine, and consequent expense in repairs. The means proposed to remedy this is to allow the steam to expand only partially in the first cylinder it is admitted into, and then to admit it into a second cylinder much larger than the first, where it again expands more fully. The "Spartan's" engines are very ingeniously contrived. The cylinder has an annular projection on its inner surface, through which a hollow trunk works; the extremities of the trunk form pistons which fit the cylinder. The one cylinder in this way is practically divided into four portions, two being annular, and being between the projection on the inner surface of the cylinder and the pistons, the other two being of the ordinary shape, and lying between the pistons and the extremities of the cylinder proper. The steam is first admitted into one of these annular spaces, which are comparatively small, and afterwards into one of the larger spaces outside the double trunk-piston. A very fair uniform motion is thus obtained, and as the steam passages are short, there is little loss of steam in charging them. The use of high pressure steam, and double, or, perhaps, treble or quadruple expansion, combined with the use of liquid fuel, will, we think, soon enable vessels to take a run to Australia or New Zealand, which can now with difficulty reach Gibraltar under steam.

When poor Paddy was commiserated by his mate on the injury sustained by a fall from an elevation, "Oh! sure," says Pat, "it wasn't the fall that hurt me at all, at all, but the sudden stoppage at th'ind." Now, laugh as we may, there was the truest philosophy in the Irishman's answer. The whole difference between the ordinary stoppage of a train, and a railway accident by collision, is accurately measured by the difference of time consumed in the two operations. A fatal and destructive accident is, in this case, wholly caused by the absence of sufficient time to take off the momentum of the train gradually. The buffers of carriages which abut on springs capable of sustaining a pressure of six or seven tons each, afford this gradual diminution of speed, and consequent reduction of momentum, so that we scarcely feel the stoppage of the train. To any one riding in a luggage train, where the trucks are generally without buffers, the difference is not only plainly perceptible, but also inconvenient, and even dangerous. To remedy a similar collision between the consecutive links of chain cables is the object of Mr. Sanders, by whom a paper was read on the application of portable buffers or springs to the cables of ships riding at anchor. Though the case of a railway smash by collision, and the snapping of a cable, may seem different, in fact their causes are identical. In the case of the train, we understand how the catastrophe is caused without further explanation; in the case of the cable, the collision is between the inside parts of any two consecutive links at the points where they touch. The sudden jerk in both cases causes the fracture and its consequences. Now, in a train, we have buffers between each consecutive pair of carriages, and, to make the cases parallel, we ought to have a spring between each pair of touching links in the cable. Could this be introduced, a very small one would suffice for safety. This, however, is impossible, and in this case, the next best provision is made, viz., one large and strong pair of buffers or springs is so applied to the cable as to give the whole and every part thereof the needful relief in case of a sudden strain or jerk by wind or wave. As, according to Mr. Saunders, the spring can be introduced without breaking the continuity of the cable, so that, in case the buffer gives way, the holding is the same as if no application of the sort had been made, we do not see what possible objection can be offered to its use. "The proof of the pudding" in this matter, lies in repeated trials, and, as no evil ensues even on failure, by all means let us so satisfy ourselves of its worthlessness or utility, though the printed testimonials from captains who have used the buffer seem to leave no doubt as to its being able to render very good service.

At the last meeting, on Saturday morning, under the presidency of Dr. Woolley, Mr Merrifield, the indefatigable secretary of the Institution, read an abstract, made by himself, of Admiral Paris's paper on a sea-going turret-ship. It is interesting to receive such contributions of ideas on shipbuilding from "our hereditary foes," and we trust that such fraternal interchanges will go far ere long to change foes into friends in phrase and fact. The French Admiral's object has been so to arrange a monitor as to improve her sea-going qualities, and make her a safe and worthy ocean ship. To effect this, he virtually builds two ships, the one inside the other. The outer ship is very much of the type of the monitor class, broad and low, with its deck little above the water-line. On this deck, at some 9ft. in from the sides, there runs, as it were, the upper part of the sides of another narrower vessel. This construction is intended to secure the decks from being swept, as is the wont of monitors, and also to obtain the more valuable quality of them, viz., the almost entire absence of rolling. This construction also would clearly secure a shallower draught of water for the vessel, which, being fitted with twin screws, would be most valuable for operations near the shore. The lower hull alone is intended to be heavily plated as well as the decks, the upper hull being chiefly appropriated to berthing; the boilers, engines, &c., would all be below. The Admiral would place his guns in a very elevated central battery, to avoid the risks attendant on low ports open in bad weather, and to carry out his idea of the advantage of a plunging fire against ironclads, which are not protected far below the water-line, and not at all on their decks. Unprotected works in a vessel of this construction run fore and aft her whole length, from the central battery, which weak point seems well compensated for in the snugness of the ship, all her weight being concentrated amidships, and her ends quite free from encumbrances of any sort. Given, moreover, a balanced rudder and a ram, and you have the Admiral's idea complete. But the value and risk of the latter is well educed,—the first, by the sinking of the "Rè d'Italia" by the "Ferdinand Max," when the former was at rest and the latter could choose her opportunity; and the second, by the double destruction of the "Osprey" and the "Amazon." The loss of the latter in a couple of hours after its contact with the "Osprey," a mere "cockle shell" in comparison, strongly confirms what we have ventured to express in regard to rams in our comments on Sir Edward Belcher's paper. Notwithstanding that the "Amazon" was a large and strong ship, her bow was by the collision twisted into a position at right angles to her keel. Had the "Osprey" been an armour-plated vessel, what can we suppose but that both would have instantaneously disappeared, proving, if it needs more proof, that the ram is likely to be as injurious to its owner as to her adversary, and that the use of such an armament is much the same as that of knocking one's head against a stone wall. We are very much inclined to believe that after the present mad rush—now to bigger guns and missiles, now to thicker plates to resist them—we shall return, in the main, to the old lines of speed and beauty. Monitors and heavy ironclads may do very well for harbour defence, but the necessity of speed and seaworthiness, which are qualities whereof they are in any great degree innocent, will ultimately drive them out of the market. The contest between our gun and target authorities, each in the heated rivalry crying with the leech, "Give, give," reminds us of the difficulty experienced by the young man from the country in finding an equilibrium between his bread and meat in the cookshop. First, he begged a small piece of bread to balance the surplus meat, and then a bit of meat to equal the surplus bread, till the late-convinced caterer at length kicked the impostor out of the shop. John Bull, the tale has a moral for thee!

The only papers which now remain to be noticed are one by Mr. Mackrow, on the position of the centre of gravity of the Greek armour-clad gunboat "King George," and one by Professor Rankine, on waves which travel along with ships. We will only say a few words on these. Mr. Mackrow's paper included a great deal of arithmetic, which can only be printed in detail. The only point of interest to which we will allude is the experimental method of testing the correctness of the result of the arithmetic which Mr. Mackrow adopted. The gunboat was moored alongside the wharf in Bow Creek, at the top of the tide on a still evening. It was then heeled by means of a couple of armour-plates weighing about five tons each, the angle of heel observed for different positions of the armour-plates, and the position of the centre of gravity deduced from each of the observations so made. The mean of these results was taken, and the result coincided very nearly with the result obtained by the ordinary method. Observation gave 4·373ft. below L. W. L.; calculation, 4·279ft.; the difference being about 1in. Dr. Woolley, who was chairman at the time, hoped that Mr Mackrow's example would be largely followed, and that the time would come when no ship, whether for mercantile or war purposes, would leave a yard without being so experimented on. With this we heartily concur.

The object of Professor Rankine's paper was to show how a certain relation between the depth to which the disturbance of the water extends, and the speed of the wave bears upon the form and motion of waves which travel along with ships. It is not an easy matter to condense this paper, which is one of many able papers which have come from the same pen. The subject, however, is one of interest, and, no doubt, of practical utility. Anyone who has travelled on a steamboat on a broad sheet of smooth water—on the Rhine, or on one of the Scottish lochs, for example—cannot have failed to notice the waves the ship causes, and to observe the curves formed by them. These are the waves discussed in this paper. The Professor thinks it desirable that careful observations should be made of the size, position, and curvature of these waves when raised by vessels of different builds driven at different speeds, to facilitate investigation as to the depth of the original disturbance caused by a ship in still water, and the rate at which the disturbance is transmitted to greater depths. It would be presumption on our part to differ from this opinion.

AERIAL LOCOMOTION.

PHAETON, who, we are told, was so unfortunate a "whip" as to be thrown out of the chariot of the Sun, of which he

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was allowed to be the Jehu for a single day, and whose sad fate his sisters so deeply bewailed that they were turned into poplars, was evidently a predecessor of the celebrated confraternity of Montgolfier, Godard, Green, and Co., the latter of whom, in one of his excursions, came to grief by being driven—balloon and all—against "tall" trees! and Icarus, who, according to tradition, was able to fly admirably until he got so near the sun that the wax, by which he had attached wings to his body, became melted (so that he, too, met with an untimely death) was evidently the inventor of some primitive parachute. We deem it necessary, therefore, to put scientific men upon their guard, and to point out what appears to us the sensible course to take so as to avoid, on the one hand, foolish attempts to fly, or waste time in floating through the air at the mercy of the winds in a balloon, which, by its shape, is not calculated to navigate the atmosphere; and, on the other hand, to go the right way to work so as to obtain useful and successful results, based on scientific researches, aided and confirmed by calculation and experiment.

To resume and recapitulate our suggestions, then, we propose that a model wind-ship be constructed in the shape of a plover's egg—somewhat elongated fore and aft—either consisting of several inflated bladders, bound together in the manner that we usually suppose the molecules of matter to be united, by which a solid body is formed by a congeries of globular ultimate atoms; or else that a regular wind-ship be built with a light framework, having double sides of leather or gutta-percha, or any other light substance capable of being made air-tight, between whose double skins hydrogen, or any other suitable gas, should be stored; the space in the interior to be of sufficient capacity for experimental requirements, and the whole machine to have sufficient buoyancy to float at any convenient height above the ground. This model air-vessel to be fitted with a sort of horizontal vane, or a kind of continuous float surfaces or fins, by which it would be sustained in the air without losing its horizontality. It might likewise be attached by cables having rings at their extremities, furnished with antifriction rollers, or wheels, so that it might be more or less guided by two parallel ropes, one on each side, in order that it should neither fall entirely to the ground, nor rise a great deal beyond some determined altitude. Such a model air-ship might be worked by hand with a crank in the first instance, or with a spring, for the purpose of trying experiments by which we should obtain data for future operations. But they should be made on some uniform basis—this is most important—for information on such subjects can only be really useful if procured in such a way as that the results of different experiments may be compared one with another. General Morin and the late George Rennie made many interesting enquiries to ascertain the effects or the amounts of friction among different substances, under various circumstances, but, unfortunately, no two experiments have been made with the same units, and comparison between them is therefore extremely difficult, and, in some cases, quite impossible; the consequence is, they are oftentimes entirely valueless.

By following out the plan which we propose, a variety of useful facts could be ascertained, such as the velocities at which a wind-vessel could be forced through the air in certain states of the atmosphere, and against certain currents of air, and also the form or section it should have, so that its "wind-lines" may be most advantageous. Again, how the "float-vane," if we may be allowed the expression, ought to be fixed—whether higher or lower; whether in the form of a spiral, or cycloidal, or parabolical, or segmental curve; whether inclined to the air-vessel upwards or downwards; whether continuous or intermittent; whether horizontally attached or obliquely placed, &c. And, generally, by means of such a model air-ship, many useful preliminary problems might be solved. Again, as to the power best adapted to set the wind traction-engine in motion, experiments might also be tried with such an aerial pontoon and "ropeway." Our idea is, however, as we said before, to make use of some chemical means for compressing air immensely, and then to liberate it, so as to force a piston rapidly through several feet of space, thus driving it against the surrounding atmosphere with great force; in fact, making the air-ship travel on the very principle of the recoil of a gun. In other words, the wind-ship to be moved by a series of recoils or departures from any point, in any direction, with the whole force of immensely and rapidly expanded—not exploded—air, and it would thus shoot itself through space. The motive power would then work in the inverse manner to that of a wind-gauge; instead of the wind acting on it, it should act on the wind. In our opinion, all that is wanted now is enormous power contained in a small space and of very light weight, and to have experiments made in the manner we have described, in order to arrive at the best shape for the wind-ship, the best position for fixing the vane or fins, and the best means of utilizing some of the many chemical combinations we have at our disposal for generating power and compressing air into a very small space, and for suddenly liberating it, so that by the force exerted upon the circumambient air, the aerial locomotive might work its way through the atmosphere. By following up this theory in practice, aerial navigation may become a reality, and many a future Gay-Lussac may make experiments to master meteorological mysteries, without rashly risking life or limb in an unmanageable balloon.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

WAY OF TESTING THE DURABILITY OF COMPOUND METAL SHEATHING—MODE OF FREEZING DECANTERS OF WATER—USES OF NAPHTHALINE—METHOD OF MAKING FLUORIDE OF SODIUM AND PHOSPHATE OF SODA—A NEW MANURE—THE DUKE OF EDINBURGH'S WOUND.

THE compound metal sheathing (mixtures of zinc and copper) applied to ships in place of pure copper is liable to some ill-understood variations. One specimen stands well, while another apparently the same in composition and appearance is so much affected by sea-water that a ship may require stripping after one voyage. Some mode, therefore, of testing the durability of the sheating was desirable, and this has been recently supplied. The inventor takes a sheet of copper and a sheet of the compound metal of an equal size, and places them in a solution of sulphate of copper—the copper plate connected with the negative, and the brass with the positive pole of a battery. Here, it is said, the metal will be exposed to the same conditions as it will be at sea, and if the brass stands well it may be depended upon when applied to a ship. A very feeble galvanic current we fancy should be used.

Every Englishman who has been in Paris brings away with him a recollection of the Carafes Frappées—decanters of frozen water—supplied in such profusion at the cafés and restaurants, and probably often wishes that London was as liberally supplied. A new establishment for supplying them to the cafés has recently been opened in Paris, and the mode in which the water is frozen is said to be as follows:—The decanters, two-thirds filled with water which has been twice filtered, are placed in shallow tanks in which salt water is made to circulate. Each tank contains a copper reservoir with a receiver containing ether. Large air pumps, worked in this establishment by a 16-horse power engine, exhaust the air from the reservoirs, the ether in the receiver boils and passes rapidly away in the state of vapour and the temperature of the salt water, and the water in the decanters is soon reduced to 20deg. below the freezing point. At this temperature, however, the water in the bottle remains liquid; but now a workman goes round and with a glass rod stirs the water in each decanter, and in an instant, "as if by enchantment," it is changed to a mass of ice. At the establishment we notice 6,250 carafes are frozen daily, at what expense is not stated, but it need only be very small.

Naphthaline in a state of fusion dissolves sulphur, phosphorus, the sulphides of arsenic and antimony, and indigo, and deposits them again in a crystalline form as it cools. The crystals may be obtained by dissolving away the naphthaline by means of alcohol. At this time of the year, too, it may be worth mentioning that naphthaline is said to be very useful in driving insects away from plants.

With reference to the fluoride of sodium we spoke of a week or two ago, as an important agent in the treatment of refractory minerals, we find an easy method of producing it at a cheap rate, which may be worth the attention of chemical manufacturers. The inventor of this process, M. Jeannel, roasts fluorspar with sulphate of soda, and carbon (charcoal or coal dust). In this operation fluoride of sodium and oxysulphide of calcium are produced. The former can be dissolved out by lixiviation, but as it is not very soluble, a large quantity of water will be necessary.

In a similar way the same inventor proposes to change phosphate of lime into phosphate of soda. He roasts one part of phosphate of lime with six parts of sulphate of soda, and an excess of charcoal or coal dust. In this case the results are phosphate of soda and oxysulphide of calcium, Phosphate of soda produced cheaply in this way will, the inventor thinks, supersede phosphate of lime as a manure, the solubility of the former being regarded as an advantage. Soda salts, however, are not readily assimilated by plants, and, in some soils, the solubility might be a positive disadvantage. We are inclined to think that the roasted mixture would be employed best without the separation of the phosphate of soda. Oxysulphide of calcium, in the form of "soda waste," has been employed alone as manure with great success. Spread over the ground exposed to air, it is slowly changed into gypsum, which absorbs atmospheric ammonia, the porosity of any residual charcoal contributing to the same effect. On the whole, we are disposed to believe that a compound like the above would be an improvement on "superphosphate."

The dastardly attempt on the life of the Duke of Edinburgh, so happily frustrated by Providence, affords another illustration of the eccentric course taken by balls when reflected from their direct line. In this case, the ball—which was fired, no doubt, obliquely—followed the course of the rib nearly half round the body of the Prince, and rested under the skin. In a similar way a bullet has been known to strike a man in the forehead, and being reflected upwards has passed over the skull and under the scalp, and made its exit at the back of the head. Another still more remarkable case happened in the Crimea, when a grapeshot struck a man in the lower part of the belly and passed out under his knee. In both these cases the patient recovered from the injury, as everyone hopes our illustrious Prince has.

PARLIAMENTARY NOTES.

PARLIAMENTARY proceedings have of late been confined to such purely political discussions as to have left us little or nothing to place on record in our pages. Having, however, during the past week, found various matters of interest to our readers, we have, in pursuance of Captain Cuttle's excellent plan, made notes thereon. And the first thing we noted was, that in the House of Commons, towards the close of last week, the question of coal for the navy was discussed. It may be premised that in the form of tender issued by the Admiralty, for coals to be supplied to her Majesty's dockyards, for the year commencing with the present month, for the use of the steam vessels in the navy, the only coals named are the Welch steam coals. The appropriateness of these coals to

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the purpose ought to have been sufficient to have vindicated the step. This does not, however, appear to have satisfied Mr. Headlam, or some of his constituents; so he asked why, after the reports made at Devonport, and the recommendations contained therein, as to the use of north country coals in her Majesty's ships of war, these had been excluded.

Lord H. Lennox told the hon. member that the Admiralty had this year reverted to the policy of supplying nothing but smokeless coal to steam vessels in the navy. This decision was arrived at in consequence of the strong representations received by them from the commanders-in-chief of the foreign squadrons, setting forth the great advantages possessed by the smokeless coals for all purposes of steam navigation. He, however, added that bituminous coal was still on the Admiralty list, and was largely used for dockyard purposes. This, we trust, will satisfy the minds of those who can appreciate the step taken in adopting the smokeless coal for steam purposes in the navy, and, at the same time, will not be unsatisfactory to those who were excluded from tendering, by assuring them that they can still hope for a contract for dockyard use.

None who have traversed the "silent highway," or have crossed the Thames either by Westminster or Hungerford-bridges, on the one hand, or by the Victoria-bridge, at Chelsea, or Battersea-bridge, on the other, can fail to have noticed two decided eyesores in the shape of groups of timber piling in the river at either of those points. The first of these nuisances was the subject of a question from Mr. Hardcastle, who asked the Vice-President of the Board of Trade whether there was any probability that the unsightly groups of piling which obstruct the river between Westminster-bridge and Hungerford would be removed; and, if so, when; and whether he could state with whom the responsibility rested. The second gave Lord Otho Fitzgerald an opportunity for asking the same official whether he would reply to the same query with reference to a much more formidable obstruction of the same nature that reached full half-way across the river opposite Battersea-park, and had existed there for a much longer period.

Mr. Cave, in reply to the first question, said the piles were erected by the Waterloo and Whitehall Railway Company under their Act of 1865. The works had been at a standstill since October, 1866, and the directors had stated at general meetings that they were without funds. Their powers expired in July, 1870. They had brought in a bill for extension of time this session, which the Thames Conservators had opposed, and the company had agreed to a provision that all the works on the river should be completed by July, 1870, after which date the Board of Trade or the Conservators might remove the obstructions. With regard to the second question, the obstruction off Battersea-park was the temporary staging of the Albert-bridge. The Act was passed in 1864, and the powers expire in 1869, when the obstruction might be removed in a similar manner. He was afraid the responsibility rested in both instances with the committee which passed the bills. If this be so, the responsibility rests with very irresponsible parties. But the fact of the matter is, that, in both the above instances, the badness of the times has to answer for the non-completion of these works, and, we fear, of many others. The Waterloo and Whitehall Railway works, which were described at page 375 of our issue for June 16, 1865, were begun and continued in good faith, but ended in a collapse for want of funds. This is to be regretted, not only on account of its having left an unsightly row of piling to obstruct the navigation of the river, but because it is an opportunity lost of carrying out a railway upon the pneumatic principle, the details of which have been perfected by Mr. C. W. Rammell, the engineer to the works.

The same remarks hold good with regard to the staging of the proposed Albert Bridge, at Battersea. This bill was only passed after two hard fights in the Houses of Lords and Commons, and the bridge was about to be constructed, when the prevailing disease—impecuniosity—attacked the company or the contractor, or both, and compelled them to stop. It has been stated that the level of the Thames Embankment works not having been fixed at that point was the cause of the stoppage, but we beg leave to doubt that this reason can exist for so long. As in the last case, so in the present, the piling is not the only cause for regret, inasmuch as the new bridge was to have been constructed upon the principle of rigid suspension, invented by Mr. Ordish, the engineer to the works. The designs for this bridge were illustrated and described by us in our issue for January 13, 1865, page 25, and in its non-erection we lose the opportunity of a practical illustration of a sound engineering principle. It is gratifying, however, to know that Mr. Ordish has nearly completed a bridge of large span on the same principle over the River Moldau, at Prague, and which we believe is to be opened during the present month.

Turning from works of peace to those of war, we find next on our notes the old vexed question of fortifications. It relates, however, to that phase of the question which promises either to settle the matter, or to plunge it in still further confusion. We refer to the nomination by Sir John Pakington, as Secretary of State for War, of a committee to enquire into the character and construction of our coast defences, whether of iron, masonry, or earthwork, as recommended by the Royal Commission on National Defences. The committee is to consist of the following officers and gentlemen:—Admiral the Hon. Sir F. G. Grey, G.C.B., chairman; Major-General Collingwood Dickson, C.B., Royal Artillery; Major-General Simmons, C.B., Royal Engineers; Major-General Harness, C.B., Royal Engineers; and Mr. Hawshaw, civil engineer. In the present instance, Mr. O'Beirne asked the Secretary of State for War whether the statement announcing these nominations was correct, and, if so, whether he would state to the House the nature and extent of the instructions under which the members of that commission were to act, what powers had been given to them, whether they were authorized to examine witnesses, and whether he would place a copy of the commission and of the instructions upon the table for the information of the House.

Sir. J. Pakington, in reply, without committing himself to the correctness of the details, stated that he had appointed a committee of the character described. Allegations had been frequently made in the House that the large expenditure on our fortifications and arsenal defences had been to a great extent thrown away. It had been stated that the foundations were in some cases giving way, that in others the walls were cracked, and in others the roofs were falling in, and when he asked on what authority such allegations were made, it proved to be newspaper articles and anonymous letters. It therefore appeared to him desirable to get some authentic information on the subject, and he accordingly appointed the commission. He selected Sir F. Grey to preside over it, because of his known ability and high character, and also because he held the office of President of the Fortifications Committee, and because he had nothing to do with either the designing or construction of the works he would survey. He had associated with Sir F. Grey the officers whose names the hon. member had read, and every one would agree that it was impossible to nominate a commission of higher reputation. He had no objection to lay the instructions given to the commission on the table; they were of the simplest kind; both in them and in his private communications with Sir F. Grey the only point he had insisted on was that in the report of this body of gentlemen, whose honour and competence were above all suspicion, the whole truth should be made known for the information of the House and the country. We trust that the report of this commmission will enable us to reconcile conflicting and contradictory statements, and to set at rest the cavillings and bickerings which have of late been so rife with regard to our fortifications.

A very pregnant question was put by Mr. Whalley when he asked the First Lord of the Admiralty, with reference to the sale of such of Her Majesty's ships as were not now required for the service, whether the use of such ships might be obtained for schools or other public purposes, subject to such conditions for their preservation, and their return when required, as the Admiralty might prescribe.

Lord H. Lennox said the Admiralty had already in many instances given ships for the purposes specified by the hon. gentleman, and would be glad to do so where this was possible and compatible with the public service. At the same time, he must point out that in many cases the societies not only asked for the loan of ships, but required that these should be refitted, caulked, and otherwise repaired at very large cost, for which no provision was made in the Naval Estimates. We do not think that the Government ought to go so far as this. Those who obtain ships for this purpose receive great aid from the State in the loan of the vessel. Therefore, notwithstanding the benefit training ships are to the State, and, notwithstanding also that the object in view is highly charitable, we think the borrowers should be content with the ship, and look after her repairs themselves. Our Navy Estimates are quite heavy enough without the addition of items which properly fall within the province of public philanthropy to meet.

THE WHITWORTH SCHOLARSHIPS.

WE have been requested to give insertion to the following letter and resolutions relative to Mr. Whitworth's recent munificent benefaction, which we recorded in our impression for the 9th ult.:—

THE INSTITUTION OF CIVIL ENGINEERS,
25, Great George-street, Westminster, S.W.,
May 2, 1868.

SIR,—At the moment when it is considered by many, that more systematized methods of instruction are necessary for those intended to follow industrial and scientific pursuits, you, sir, come forward with the best practical help that could possibly be devised. In the learned professions numerous forms of endowment already exist; but for all those occupations which are intimately associated with the applications of pure science to the affairs of every-day life, hitherto there has been no such encouragement.

I have the greatest pleasure in being the medium of conveying to you the accompanying extract from the Minutes of the Institution of Civil Engineers; and I am sure that the general feeling of your brother members is, that any words very inadequately express the sense of their indebtedness for your princely liberality.

I am, Sir,
Your obedient humble servant,
JAMES FORREST,
Secretary.

To JOSEPH WHITWORTH, ESQ., F.R.S.,
M. Inst. C.E., &c., &c., &c.

At the Ordinary General Meeeting of the Institution of Civil Engineers, held on Tuesday, the 28th of April, 1868, Mr. Charles Hutton Gregory, the President, being in the chair, the following communication from the Council was brought forward, was adopted by acclamation, and a copy ordered to be sent to Mr. Whitworth:—

"Attention having been called to the foundation in perpetuity, by Mr. Joseph Whitworth, M. Inst. C.E., of Thirty Scholarships, of the annual value of £100 each, for the instruction of young men, natives of the United Kingdom, to be selected by open competition for their intelligence and proficiency in the theory and practice of mechanics and the cognate sciences, with a view to the promotion of engineering and mechanical industry in this country, it was

"Resolved unanimously,—That this meeting desires to record, on its own behalf, and on that of the members of all classes of the Institution of Civil Engineers, its grateful recognition of this act of munificence, and its high appreciation of the services which have thereby been rendered to the cause of technical education and national advancement, and of the advantages that may be expected to accrue, alike to the profession and to the community generally."

Signed on behalf of the Institution of Civil Engineers. JAMES FORREST,
Secretary.

SOCIETY OF ENGINEERS.

AT the meeting of the Society of Engineers, held on Monday the 4th inst., Baldwin Latham, Esq., President, in the chair, it was unanimously resolved, "That the thanks of the Society be conveyed to Mr. Whitworth for his munificent endowment of thirty free scholarships for the engineering profession." The following candidates for election were balloted for, and duly elected as members:—Messrs. E. D. Latham, Borough engineer, Bideford, Devon; G. B. Ritchie, resident engineer, London and North-Western Railway, Leighton Buzzard. As Associate—R. J. Cheeswright, Clerk to the Croydon Board of Health, Town Hall, Croydon. It was announced that the council had made arrangements for the members to visit various public works during the coming vacation. The meeting was adjourned to Monday, October 5.

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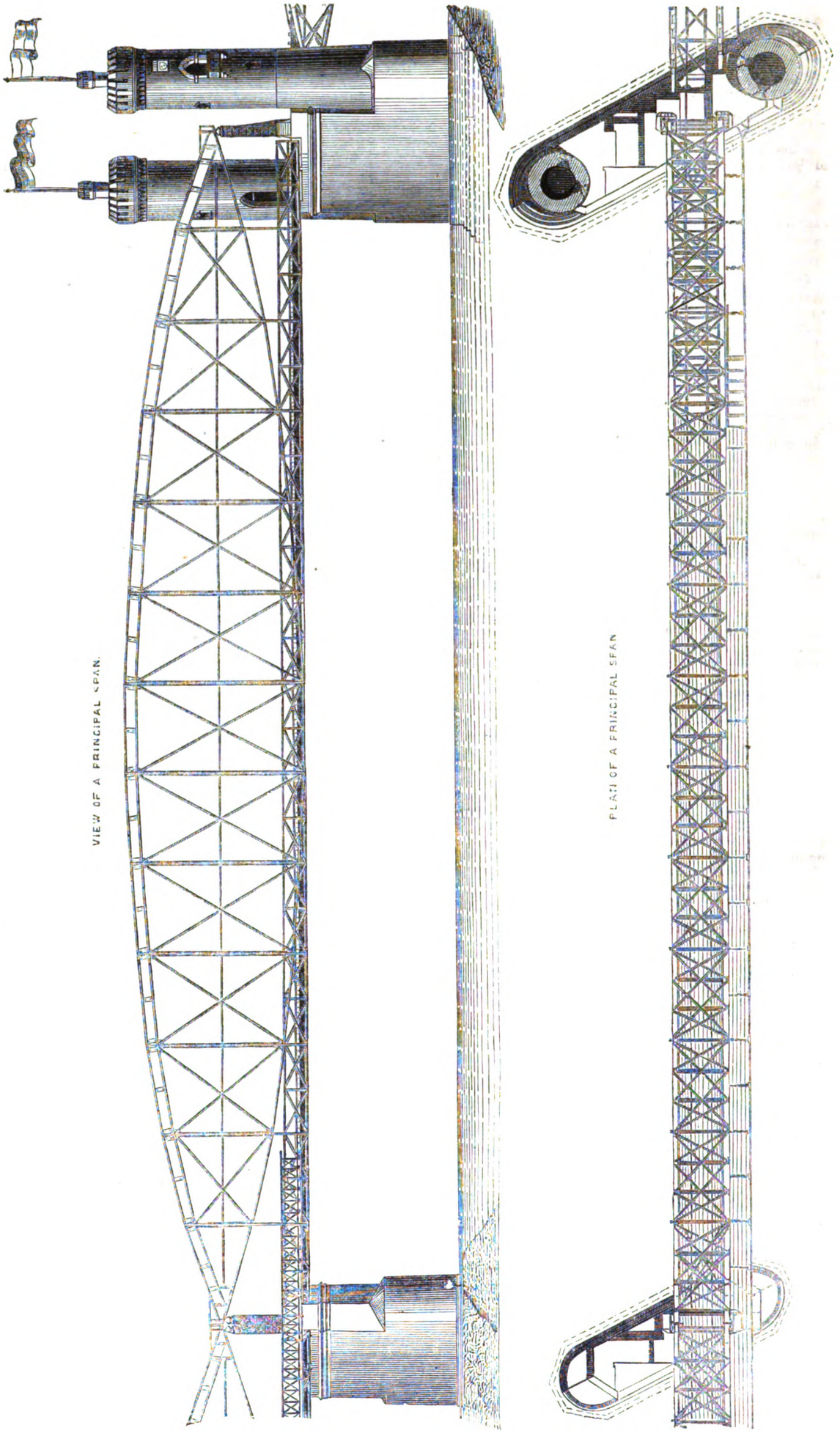
BRIDGE OVER THE RHINE, AT MAINZ.



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BRIDGE OVER THE RHINE, AT MAINZ.

TWO lines of railway leave the station at Mainz; one crosses the Rhine, and so forms the junction at Mainz of the Gustarsburg-Darmstadt line with the other line which runs from Mainz to Worms. The communication across the Rhine is effected by means of a bridge of different spans, of a total length, width of intermediate piers included, between end piers of 1028·645m. In order not to hinder the navigation on the Rhine, and to interfere with the laws agreed upon for its protection by the Rhine States—Baden, Bavaria, Hesse, and Prussia—the bridge was to be built 14·10m., or about 48ft., above low-water mark, thus rendering the height of the platform 15·1m., or over 49ft., above low-water. Owing to these circumstances the line on one side from the station at Mainz rises by a gradient of 1 in 80 for a length of about 708m. The bridge crosses the river in an oblique line, making an angle with the stream of 27deg. The requisite width of the Rhine, as fixed by commissioners of the Rhine States, for the navigation is 360m., thus requiring four spans of 90m. each, measured at right angles to the current; but as the bridge crosses the river in an oblique line the width of the spans was increased to 101·29m., or about 326ft. each, not including the thickness of the piers.

On the right side of the river the line descends again on an incline of 1 in 74, in order to reach the ordinary height of the embankment. The length of this incline to the embankment is taken up by six flood openings of 33·5m., and thirteen openings of 15m. each; two openings of 25m. each; and, lastly, seven openings of 15m. each, thus giving a clear width of the bridge of 956·56m., or, including the thickness of the intermediate piers, a length of 1028·645m. from abutment to abutment. Our engraving shows one of the principal spans, and a portion of one of the flood openings of this bridge. The principal piers are 4·25m. thick at the top, and increase towards the bottom at the rate of 1 in 30. The next, on the right side of the river, is 5·9m. wide, and is ornamented with two towers corresponding with those on the Brackenkyof at the opposite side. The piers of the flood openings are each 2·35m. thick, and those on the thirteen following openings 1·75m. each, and the remaining six 1·25m. each. The foundations in the water are made of beton, and are 10in. wide, and guarded by timber piling of 1ft. in thickness, and secured further by large stones thrown around them. The piers themselves are built of sandstone blocks. The foundations or piers are made for two lines of rails, but only one is executed as yet.

All the upper construction is made of wrought iron, on the principle known as the *systeme Pauli*. The iron construction of each span consists of two main girders of the (lextil) shape peculiar to the system. To these main girders the strains are transmitted from the roadway by means of a system of longitudinal cross girders, tie bars, &c., and from them are taken up by the piers. Each main girder consists of an arched top flange, which is subjected to compression, and of the lower flange of a shape corresponding with the top flange, but bent in the reverse direction. This flange has to resist tensile strain. These two flanges are connected by vertical columns and crossed tie bars. With the columns the parts forming the platform are united, and consequently only at these joints the transmission of the strains to the main girders is effected. All the joints are arranged in such a manner that the transmission of the strains only takes place, so that the material is disposed only in the direction of the strain; no part, therefore, is subjected to bending force. For this reason the cross tie bars of the main girders have been made very thin as compared with their breadth, so that they are quite unable to act as struts.

There are two such cross tie bars between every two vertical columns, so that by any eccentric load the one of them is exposed to tension, whilst the other, on account of its being unable to resist compression, is bent by the displacement which is caused by the load. The top and bottom flanges of this system, as by any other girder of one opening only, are subjected to compression or tension only respectively. The girders rest on shoes at each end, provided with steel plates; the shoes on the one side of the girder are fixed, whereas those of the other side are provided with rollers in order to allow for movements caused by the change of the temperature. The rails rest on wooden sleepers supported by longitudinal plate girders, which repose on lattice cross girders, through which the load is transmitted at the connecting points with the vertical columns to the main girders. The cross girders are at right angles with the main girders, which, therefore, had to be made 105·2m. long from support to support.

SCIENTIFIC RATCATCHING.

ACCORDING to the French "Moniteur" there are in France upwards of two thousand millions of rats and other rodents. Supposing each of these little quadrupeds to commit the damage of only one centime per annum, this loss would amount in the aggregate to twenty millions of francs annually. Hence it is most desirable to find some means of destroying this vermin in large numbers as expeditiously as possible. Nux-vomica, arsenic, phosphorus, and traps have been successively tried, but with no very decided success, and certainly not equal to the rate of increase of these prolific creatures. Recent experiments, however, show that squills (Scylla maritima), the enormous bulbous root of which is much used in medicine, is not only a powerful poison for rodents but also one they are very fond of. The way of preparing it for the desired purpose is as follows:—One of the bulbs is cut into slices, hashed and bruised, then done in the pan with fat, which is afterwards strained through a cloth and poured into broken plates and saucers to be placed in the cellars and other places infested with rats, mice, &c. To prevent dogs and poultry from eating of this poisonous compound in stables, pigeon-houses, or farmyards, it may be put into a wooden box about 1½ft. long, and having a hole at each end. The rat gets in at one end and goes out at the other, after partaking of the noxious food, which soon kills it. Squills may also be reduced to powder for the same purpose by bruising them in a mortar to a pulp, which is afterwards incorporated with as much flour as it will hold. This paste is then rolled out, as they do for a pudding, then cut into shreds, which are left to dry on hurdles or on sheets of pasteboard, and are afterwards pounded in a mortar. The powder thus obtained will keep for years, and may be put into boxes or barrels. If manufactured on a large scale it may become a profitable article of exportation. In Algeria squills cost nothing, the country being absolutely overrun with them. They have a different notion of dealing with the question in America, where a correspondent of the "Scientific American" recommends the following method of catching rats in a cheap and effectual manner:—Cover a common barrel with stiff, stout paper, tying the edge around the barrel; place a board so that the rats may have easy access to the top; sprinkle cheese parings or other food for the rats on the paper for several days, until they begin to believe they have a right to their daily rations from this source. Then place in the bottom of the barrel a piece of rock about six or seven inches high, filling with water until only enough of it projects above the water for one rat to lodge upon. Now replace the paper, first cutting a cross in the middle, and the first rat that comes on the barrel top goes through into the water and climbs on the rock. The paper comes back to place and the second rat follows the first. Then begins a fight for the possession of the dry place on the stone, the noise of which attracts the rest, who share the same fate.

THE GUNBOAT "STAUNCH."

WE this week devote a good deal of space to illustrations of a very small craft; and we have good reason for doing so, for, insignificant as the little "Staunch" may seem, she is the first practical embodiment of a very valuable principle. In all attempts which have hitherto been made to provide naval defences for our seaports the favourite idea has been to resort to the use of monitors, because they can carry excessively heavy guns and offer a very small mark for hostile shot. Now, both these advantages would be possessed by gunboats of small size mounting one gun each—floating carriages, in fact—but they are accompanied by drawbacks so great that gunboats enjoy small favour. Their defects are that if of little tonnage they cannot carry a heavy gun as deck load in bad weather or a rough sea, and therefore they cannot with any safety proceed from port to port when it blows hard. Thus, if an attack on Holyhead were threatened, gunboats of the ordinary construction could not proceed there from Liverpool for its defence. Even such gunboats as we have of the "Earnest" class, although of considerable size, and mounting only a 56cwt. gun, are of little or no value in a gale.

Fully convinced of the value of a seaworthy fleet of gunboats little larger than the launch of a line-of-battle ship, Mr. G. Rendel, of the firm of Sir W. Armstrong and Co., of Elswick, set about producing a model boat some time since which should be free from the defects of previous gunboats. The result of his labours is the "Staunch," which is in almost every respect perfectly novel. The "Staunch" is 79ft. long, 25ft. beam, and has a loaded displacement of 150 tons, and a mean draught of 6ft. She carries the largest gun ever put on board such a craft—an Armstrong 12½-ton rifle. This gun is supported on a platform carrying the slide. The platform is provided at each corner with a screw box working on one of four columnar screws rising from the floor of the forehold. All the screws are driven simultaneously in the same direction by a donkey engine through gearing, the construction of which will be understood by a glance at our engravings. When proceeding to sea, the screws are made to revolve and lower the gun into the forehold, where it is carried as cargo. When going into action the donkey engine is put in motion and the gun screwed up on deck in about eight minutes, the same time sufficing to lower it again. As the gun is in line with the keel, rolling on the part of the boat does not affect it. A screen of thin plates sufficient to keep out rifle shot is constructed across the bows of the little vessel, which is otherwise unarmoured. Side tackles are used for working the gun, but instead of the ropes being hauled on by a large gun's crew, a turn is taken with them by one man on each side of the gun round capstan heads revolved by the machinery below, each man tightening the rope's end. Friction is caused against the surface of the capstan head and the rope is drawn forward, and the gun run out or in, as the case may be. In the same manner the shells are run up out of the shell-room below, and other work done, tending greatly to reduce the number of the crew. On trial it has been found that even when rolling 11deg. the gun can be raised and lowered with ease. No provision is made for training the weapon, because all lateral movements are effected by the use of the rudder, the steersman standing, as will be seen, close to the rear of the gun. In order that the fullest effect may be given to this principle, the "Staunch" is fitted with twin-screws driven by engines of the collective nominal power of twenty-five horses.

There are two cylinders to each pair of engines, 14in. diameter and 14in. stroke. One air pump is fitted to each pair of engines, cast with the condenser and forming so far the framing of the engine. Each air pump is 12in. diameter and 7in. stroke, worked from the crank shaft by an eccentric placed in the centre. One feed and one bilge pump are provided for each pair of engines, each 3in. diameter and 4in. stroke, worked by back gear eccentrics. The propellers have three blades, are 5ft. diameter and 7ft. pitch. Steam is supplied by one boiler, shown in our engraving, with two furnaces and 138 brass tubes, and a heating surface of 700 square feet. The total area of the fire-grate is 27 square feet. The boiler also supplies the engine for working the gun. On trial the engines made 150 revolutions per minute, the working pressure in the boiler being 25lb. per square inch, and the vacuum 27in.; indicated horse-power 130. The engine and machinery for working the gun were designed by Mr. G. Rendel, and were manufactured at the Elswick Engine Works, Newcastle-on-Tyne. The screw engines were designed and manufactured by Messrs. Robert Stephenson and Co., and on the trial trip gave perfect satisfaction, working without heating. They are very favourable specimens of their kind. The hull was built by Messrs. Mitchell, of Low Walker.

It might be supposed that although a heavy gun can be carried in such a little craft, it cannot be worked with full charges, but the contrary is the fact. A very large number of rounds have been fired with full charges of 56·25lb. of powder and 285lb. shot. As regards the "Staunch's" power of making evolutions, it will suffice to say that during the recent trials with the engines driving reverse ways, the vessel made the full circle in her own length in 2¾min. With both engines going full ahead, she made by the helm a complete circle of 75yds. diameter in 2¼min. At a moderately close range the most powerful ironclad we have afloat, excepting perhaps the "Hercules," could be pierced at every round by the "Staunch's" gun, and as she would be very hard to hit in a fair sea—and could not well be run down because she is so lively—she would constitute, even alone, a formidable antagonist. But a fleet of thirty or forty "Staunches" would prove too much for any three or four ironclads in the world, and yet such a fleet would cost less than one large armoured war ship, and would be capable of manœuvring in shallow water where larger ships could not follow them. Let us hope that the principle will meet with all the consideration it so well deserves at the hands of the authorities who have now the "Staunch" placed at their disposal for trial.—"The Engineer."

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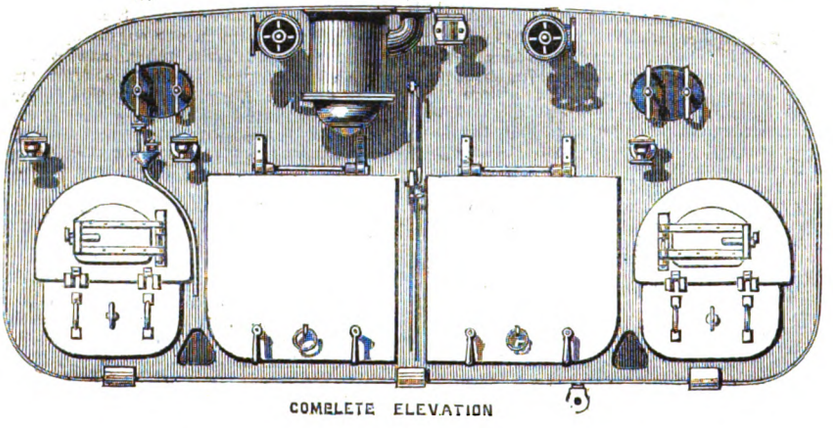
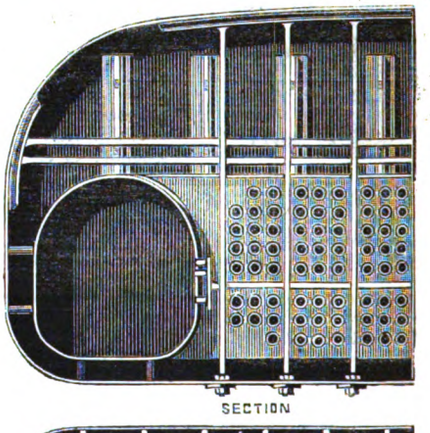
THE GUN BOAT "STAUNCH."

DESIGNED BY MR. G. RENDEL, ELSWICK; ENGINED BY MESSRS. ROBERT STEPHENSON AND CO., NEWCASTLE-ON-TYNE.

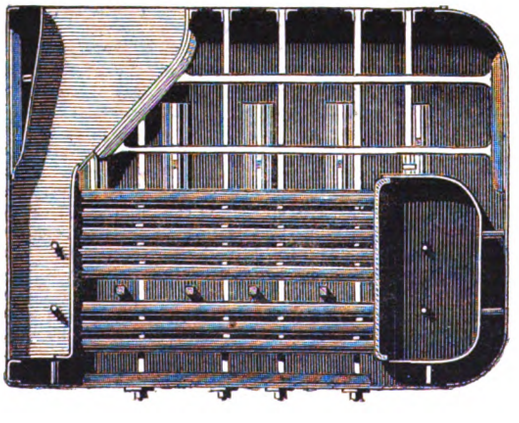


COMPLETE ELEVATION



SECTION

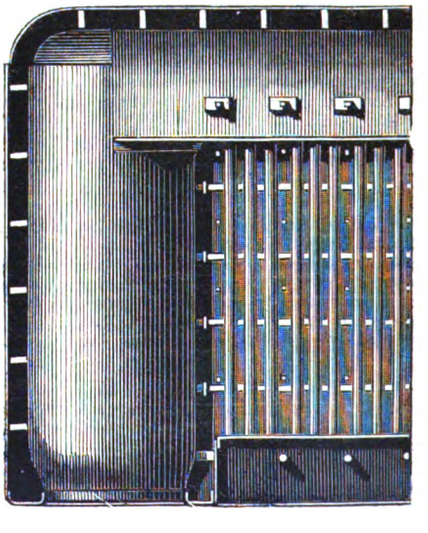
LONGITUDINAL SECTION



PLAN

HALF COMPLETE

HALF SECTION



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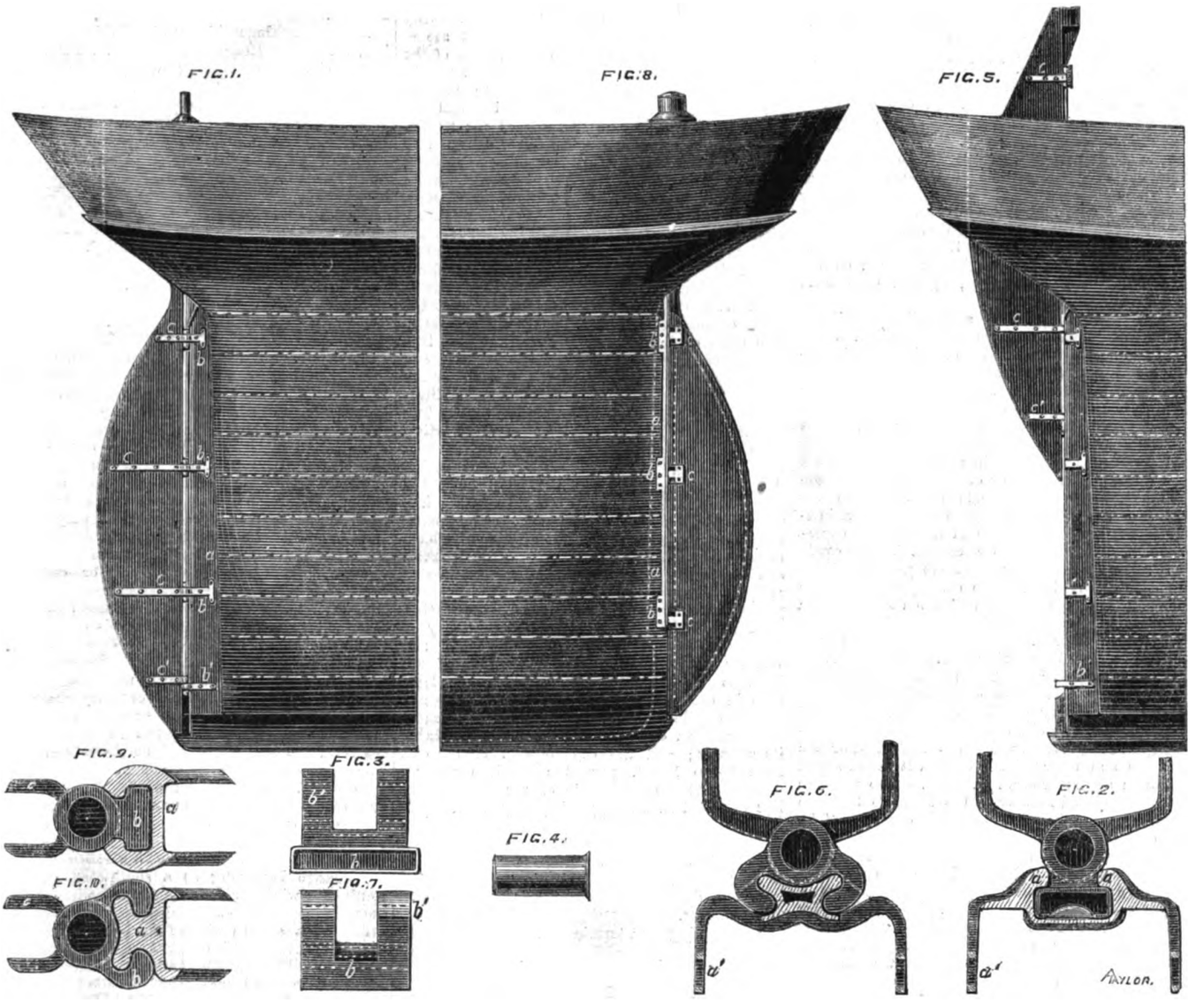
THE SLIDING RUDDER.

BY MR. J. MEDHURST.



THE SLIDING RUDDER.

SOME sure and safe mode whereby the rudders of ships may be unshipped and shipped for repairs when at sea is much needed, many disasters having occurred in consequence of ships' rudders breaking and becoming useless. We, therefore, have much pleasure in placing before our readers engravings and description of a sliding rudder, the patented invention of Mr. John Medhurst, of No. 70, Mark-lane, London. Mr. Medhurst fixes at the stern of the ship a rudder trunk of such a size that the rudder can be raised up on to the deck through it and afterwards again lowered into its place, and in place of fixing the braces or the sockets which receive the pintels of the rudder to the stern post, as is usual, he makes them capable of moving up and down a guide fixed on the stern post. This guide is a casting or forging fixed to the stern post and with a dovetailed or undercut groove in it, and the braces are formed so as to fit into this guide and be securely held by it. The pintels and braces are so arranged that they cannot escape the one from the other. They form with each other ordinary hinge joints. In our engraving, fig. 1 is a side elevation of the stern of a wooden ship fitted with a rudder in the manner we have described. *a a* is a metal casting which is accurately fitted to the stern post of the vessel and secured to it by bolts passed through the lugs a^1 a^1 of the casting. This casting has a dovetailed or undercut groove formed in it from end to end, as is seen in fig. 2, which shows to a larger scale a transverse section of the casting and parts connected therewith. The groove in the casting is very slightly tapered, increasing in size from the bottom upwards; *b b* are the movable braces—they fit the groove in the casting accurately each in its proper position, and from the groove of the casting being tapered when they are lifted from their seats they are held sufficiently loosely in the groove to move easily along it. A side view of one of the braces *b* is shown at fig. 3; it is made with two eyes b^1 b^1, which receive between them a corresponding eye with which each of the rudder pintels *c c c* is furnished. Fig. 4 is a side view of the pin which holds the braces and pintels together and forms with them a hinge joint; the pin has a small head at its upper end which prevents it falling through when it is put into its place. The braces *b b* and pintels *c c* are put together before the latter are secured to the rudder to which they are correctly fitted and firmly secured by bolts passing through the lugs or straps formed on them.

A dotted line in fig. 2 shows the form to which the woodwork of the rudder is fashioned; it is such as produces a nearly flush surface with the outside of the pintels and their eyes, so that the hinge pins cannot work up out of their places. The lowest brace b^1 is fixed to the stern post, as has heretofore been the custom, and the lowest pintal c^1 of the rudder is also of the ordinary form, so that the casting *a* may terminate immediately under the third pintel of the rudder when in position. The weight of the rudder is taken by the brace b^1 assisted by a dumb cleat fixed to the stern post on which the pintel c^1 of the rudder rests. When the rudder trunk is deep, as may be the case in a vessel having a full poop, the guide groove for the movable braces is continued above the casting *a*, it is best formed in the stern post, the wood being cut away, and the groove being lined with sheet metal.

Fig. 5 is a side elevation of the stern of a ship corresponding with fig. 1, but here the rudder is shown in process of being lowered into its place through the rudder trunk. In this operation the rudder is hauled by tackle into an upright position over the rudder trunk and carefully steadied by guy ropes. It is then gradually lowered, and the braces in succession entered into the guide groove in the stern post. In order to fill the guide groove in the casting *a* to keep it clean and prevent the adhesion of marine animals and vegetables, cakes of tallow and stearine, cast to form and cut off to the lengths required, are used. These cakes are entered into the guide groove between the braces as the rudder is lowered. These cakes, however, are unnecessary where the groove is not of iron. Fibre, such as coir or other cheap fibre, is mixed in with the tallow and stearine so that the cakes do not readily break or crumble. In order that the rudder may not rise when struck by a sea, a turned metal ring is shrunk upon its head at the level of the deck. Over this ring an exterior ring is fitted, which at the bottom has a flange on the outside by which it is bolted down to the deck, and at the top an internal flange overlapping the upper end of the ring on the rudder head; this flange ring is bolted down after the rudder has been shipped, and it is removed prior to unshipping it.

It is not essential that the guide fixed to the stern post, to lead the braces to their position, should be of groove form: it may be a projecting guide, and fig. 6 shows a transverse section of such an arrangement; in this case the braces *b b* are made with horns to embrace the guide. A side view of one of these braces is shown at fig. 7. Fig. 8 is a side elevation of the stern of an iron ship fitted according to Mr. Medhurst's invention. The guide *a* on the stern post is here made of iron, either a forging or a malleable casting, and it is riveted to the iron stern post. A transverse section through this piece *a* is shown at fig. 9, and the corresponding braces *b* and pintels *c* are also represented. In iron ships also the projecting guide may be substituted for the guide groove, as is shown in the transverse section fig. 10.

It will thus be seen that this invention is one of a highly practical character, and of great value to the shipping interest. We are glad to learn that they are appreciating it, for we are informed that Mr. Medhurst's rudder has been applied to vessels in the West India trade, to the great satisfaction of their owners. Messrs. Oswald and Co., of Sunderland, are, we understand, applying the principle to a large ship now in course of construction by them.

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INSTITUTION OF MECHANICAL ENGINEERS.

THE general meeting of the members of this Institution was held on Thursday, April 30, in the lecture theatre of the Midland Institute, Birmingham, Thomas Hawksley, Esq., Vice-President, in the chair.

The Secretary (Mr. W. P. Marshall) read the minutes of the previous meeting, and a number of new members were elected. A communication from the Patent-Office was read, requesting the nomination of gentlemen by the Institution, for the appointment to be made by Government of one out of three additional Commissioners of Patents; and Mr. Charles Edward Amos, of London, and Mr. Robert Charles May, of London, were nominated by the meeting for this purpose.

The adjourned discussion then took place upon the paper read at the previous meeting, on the Allen engine and governor, by Mr. Charles T. Porter, of Manchester.

The next paper was a description of the American dovetailing machine, by Mr. John Robinson, of Rochdale. This machine, the invention of Mr. T. S. Armstrong, of New York, was shown at work at the recent Paris Exhibition; and it is constructed so as to cut out the dovetail joints in woodwork by means of the continuous rotation of compound circular saws of peculiar form, which finish the joints completely, without the use of any chisels or cutters. The same machine cuts both the pins and the holes of the dovetails in succession, by a simple change of adjustment, so that their pitch and dimensions correspond exactly, and make a correct joint in every case. The two circular saws are placed inclined to each other at an angle corresponding to the inclination of the two sides of the dovetail pins; they are geared together by two bevelled toothed rings upon their inner faces, and the first saw is driven by bevelled gearing from the main driving shaft of the machine. The two inclined axes of the saws are themselves capable of being rotated simultaneously by gearing through a quarter of a revolution, whereby the direction of their inclination is changed from vertical to horizontal or the reverse, and their point of contact is rolled round through a quarter of a revolution. The wood to be cut is placed radially to the saws, so that the cuts are at right angles to the face of the wood in cutting the dovetail holes, but inclined towards each other, one saw cutting the right-hand side and the other the left-hand side of each hole. By then rotating the axes of the saws through a quarter of a circle, the dovetail pins are cut, with parallel sides on the face of the wood, but inclined on the edge of the wood; and by this means the pins and holes are formed at exactly the same inclination, by the simple expedient of cutting them at two different points of the circumference of the saws, at right angles to each other. Each saw cuts one-half of a pin or hole in a single revolution; the first three-quarters of the circumference of the saw blade is made plain, like an ordinary circular saw, but with a spiral outline gradually increasing in diameter, so as to increase the depth of cut until the bottom of the dovetail is reached; and then the last quarter circumference of the saw blade is made truly circular, but has the cutting edge bent over at right angles, so as to cut at the side, for cross-cutting the bottom of the dovetail; the lateral projection of the flanged blade gradually increases until it is equal to half the width of the bottom of the hole. The blade of each saw, instead of being at right angles to the axis upon which the saw revolves, is set inclined like a screw thread, with the pitch equal to the intended pitch of the dovetails; and the wood is traversed across the saws by a bed screw of the same pitch, so that each saw follows up its own cut correctly to the end of the revolution, and then begins a fresh cut at the proper distance for the next dovetail. In order to take up the slack that would be caused in the fit of the dovetails by the thickness of the saw-cuts themselves, each saw is turned upon its own axis through a small arc, at the time of changing from cutting pins to cutting holes, and is then secured in the position marked: the fit of the dovetails is thereby readily adjusted to any degree of tightness that is required. Also, by giving to the table on which the wood is fixed an inclination of 45deg. to its usual radial position, the same machine serves for cutting concealed dovetails, in which the two pieces of wood form a mitre at the outer angle. The saw blades are made in short segments, held by screws in a turned recess in the boss of the saw; and they are readily and quickly changed when it is required to set the machine for cutting a different size of dovetail. Specimens were exhibited of dovetails cut by the machine, together with one of the saws employed for the purpose.

The last paper was on an improved cupola for iron foundries, by Mr. J. Eichhorn, of London. In this cupola, which is the invention of Mr. Henry Krigar, of Hanover, the objects aimed at are to concentrate the heat in the lower part of the furnace, and render the action uniform throughout the operation of melting, and to prevent the blast from injuring the heated metal by oxidizing it. The vertical shaft of the cupola, which is made rectangular in form, opens into a lower chamber, the bottom of which forms the hearth to receive the melted metal. Round the bottom of the shaft runs an air passage, into which the blast is delivered from the air main; and the blast entering through this passage cools the brickwork of the cupola, and becomes heated itself; it then passes down into the melting chamber of the cupola through two long slots in the roof, one at the front and the other at the back, extending the whole breadth of the hearth. The front of the furnace is closed by an iron door on hinges, extending the whole breadth, and lined with clay and sand on the inside; and a smaller door is placed at the back, to facilitate the drawing of the furnace after each heat. The cupola is charged from the top of the vertical shaft in alternate layers of coke and iron, as usual, a filling of coke being first put in for starting, before closing up the front door. In the working of the cupola, the coke falling into the melting chamber from the vertical shaft stands there in a heap, upon which the blast rushes through the two transverse slots in the roof: and the heat from the burning fuel being radiated into the air passage, the blast becomes prepared for combining rapidly with the carbon of the fuel, before it has an opportunity of coming in contact with the melting metal and wasting it by oxidation; and the action of the blast is finished at a considerably lower level than in ordinary cupolas. The metal obtained in this cupola is found to be very fluid, more so than in an ordinary cupola, while retaining its softness; and the consumption of coke is from 1¼ to 1½cwt. per ton of iron melted, according to the magnitude of the charge, the loss of metal in melting being only from 2¼ to 3½ per cent.

It was announced that the annual meeting of the Institution in the ensuing summer would be held at Leeds, on Tuesday, July 28, and following days, during the time of the Art Exhibition in Leeds.

The meeting then terminated.

ROYAL INSTITUTION.

AT the annual meeting of the Royal Institution of Great Britain held on Friday, May 1, 1868, W. Pole, Esq., F.R.S., in the chair, the annual report of the committee of visitors for the year 1867 was read and adopted. The books and pamphlets presented in 1867 amounted to 131 volumes, making, with those purchased by the managers, a total of 319 volumes added to the library in the year, exclusive of periodicals. Forty new members were elected in 1867. Sixty-three lectures and twenty evening discourses were delivered during that year. Thanks were voted to the president, treasurer, and secretary, to the committees of managers and visitors, and to the professors, for their services to the Institution during the past year. The following gentlemen were unanimously elected as officers for the ensuing year:—President—Sir Henry Holland, Bart., M.D., D.C.L., F.R.S.; treasurer—William Spottiswoode, Esq., M.A., F.R.S.; secretary—Henry Bence Jones., M.A., M.D., F.R.S.

Managers:—Henry Wollaston Blake, Esq., M.A., F.R.S.; Charles Brooke, Esq., M.A., F.R.S.; Adm. Sir Henry John Codrington, K.C.B.; Captain Douglas Galton, C.B., F.R.S.; John Peter Gassiot, Esq., F.R.S.; William Robert Grove, Esq., M.A., Q.C., F.R.S.; Cæsar H. Hawkins, Esq., F.R.S.; Sir John Lubbock, Bart., F.R.S. Pres. Entom. Soc.; Sir Roderick I. Murchison, Bart., K.C.B., D.C.L., F.R.S.; William Pole, Esq., M.A., F.R.S.; William Frederick Pollock, Esq., M.A.; Robert P. Roupell, Esq., M.A., Q.C.; Lieut.-Gen. Edward Sabine, R.A., D.C.L., Pres. R. S.; Sir Charles Wheatstone, D.C.L., F.R.S.; Colonel Philip James Yorke, F.R.S.

Visitors:—Andrew Whyte Barclay, M.D.; Charles Beevor, Esq., F.R.C.S.; John Ashton Bostock, Esq.; John Charles Burgoyne, Esq.; Rev. Charles Fynes Clinton, M.A., F.R.G.S.; Alfred Davis, Esq.; William Dell, Esq.; Rev. G. Godwin Pownall Glossop, A.M.; Alfred Gutteres Henriques, Esq.; Edward Henry Moscrop, Esq.; William Newmarch, Esq., F.R.S.; Arthur Giles Puller, Esq., M.A., F.S.A.; Samuel Scott, Esq.; Edward Owen Tudor, Esq., F.S.A.; Robert Ballard Woodd, Esq., F.S.A., F.R.B.S.

At the general monthly meeting, held on Monday, last, Sir Henry Holland, Bart., F.R.S. President, in the chair, the following vice-presidents were nominated for the ensuing year:—W. R. Grove, Esq.; General Sabine; Sir Charles Wheatstone; William Spottiswoode, Esq., F.R.S., the treasurer; William Anderson, Esq., LL.D.; Captain N. D. C. F. Douglas; Frederick Green, Esq.; Swann Hurrell, Esq.: John Edward Taylor, Esq., were elected members. The following professors were re-elected:—John Tyndall, Esq., LL.D., F.R.S. as professor of Natural Philosophy; Edward Frankland, Esq., Ph.D. F.R.S. as Professor of Chemistry.

SIGNS OF STORMS.

THE following observations on storms, and instructions respecting them, have just been issued by the Meteorological Committee. The ordinary signs of coming atmospherical disturbance are sudden increase or decrease of atmospherical pressure, as shown by the rapid rise or fall of the mercury, or the hand of a barometer, great difference of pressure between adjacent stations, and sudden changes of temperature. If the weather, especially in winter, be very warm and damp for the season, there is danger of a storm; if the wind "backs" instead of "veering," the weather is likely to become or continue bad. N.B.—The wind generally changes with the sun, *i.e.*, a north wind changes to south through east, and so on; any change in this direction is called veering; a change in the direction from north towards south through west is called backing, and occurs when weather is unsettled.

A few remarks as to the ordinary character of winds and storms may be of use. The winds which are most commonly felt in these islands are from the south-west and north-east quarters. The south-westerly wind blows most frequently; it is called the equatorial current, and is warm and moist. While this current is blowing, the barometer is low, and the weather cloudy, and often wet. The barometer falls when a south-west wind is about to succeed a north-east wind; the change beginning as a south-east or south-south-east wind, which lasts for some hours with heavy rain. South-west gales are frequently preceded by a sudden rise of the barometer; however, this movement is checked, and the barometer begins to fall before the south-east wind begins to blow. The north-east wind is called the polar current, and is cold and dry. While this current is blowing the barometer is high, and the weather usually clear and dry. The barometer rises when a north-east wind is about to succeed a south-west wind; the change beginning as a north-west or north-north-west wind, which is frequently in winter accompanied by a fall of snow.

The storms which are felt on our coasts are generally south-westerly storms, during which the wind may blow from any point between south-east, round by south, to west and west-north-west. In winter, after a prevalence of easterly winds, if the barometer begins to fall, and the thermometer to rise, a gale which commences to blow from south-east will veer to south-west, while the barometer falls constantly. As soon as the wind passes the south-west point, the barometer begins to rise, a heavy shower of rain falls, and a strong west-north-west or north-west wind may follow, after which the sky clears, and the weather becomes colder. In some rare cases this north-west wind may be followed by a north or north-east wind. If the wind "backs" from the north-west towards west and south-west, and continues strong, the bad weather is almost sure to continue.

Most of these gales are felt first on the west coast of Ireland, and, subsequently, at stations lying to the eastward. Accordingly, if the change of direction of the wind takes place rapidly, the storm may be blowing from north-west on the coast of Ireland, while it is only commencing to blow from the south or south-south-east on the east coast of England. Such gales are very violent, and being produced by a south-west (equatorial) current which is forcing its way against a north-east (polar) current, the alternations of pressure and temperature are very rapid, and the storms are frequently accompanied by thunder and lightning.

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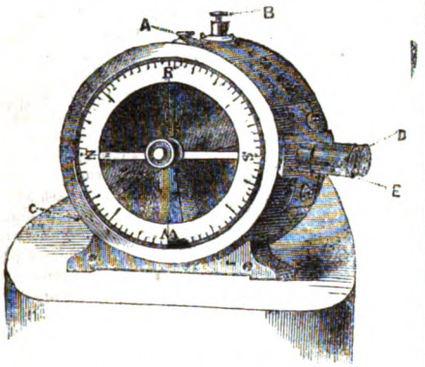
North-easterly storms are not so frequent as those from the south-west. They are very dangerous on the east coast of Great Britain, as they do not give so much warning of their approach as south-west gales, nor can intelligence of them be sent from distant stations so easily.

hey are generally preceded by a low temperature for the season. They frequently begin with a north-west or north-north-west wind, and with a heavy fall of snow; the sky soon clears, and the wind blows hardest from north-east. These polar (north-east) storms do not veer to the same extent as the equatorial (south-west) winds; they very seldom change their direction more than two or three points, while a shift of wind with the sun through six or seven points is very common in the case of equatorial (south-west) storms.

CASELLA'S POCKET ALTAZIMUTH.

THIS elegant and useful little instrument, for travellers especially, is, we are informed, the invention of Mr. Casella, philosophical instrument maker, Hatton Garden, but has been modified and improved by F. Galton, Esq., F.R.S. By its means altitudes, azimuths, bearings, levels, and gradients are obtainable. It is strong, handy, and portable, its diameter being 2¼in., thickness 1in., and weight about 5oz. The following is a description of the instrument, for which, together with the accompanying engraving, we are indebted to the "Horological Journal":—

The altazimuth contains an azimuth compass, with aluminium disc, and a weighted disc for altitudes. Both these are graduated on their edges, and are read off through a lens, in a more simple manner than the ordinary prismatic compass. The instrument is ready for use immediately the catches that hold the discs are released. One face of the aluminium disc is plainly engraved, to serve as a good ordinary compass. One face of the weighted disc is divided, to serve as an ordinary clinometer, the box of the instrument being furnished with a fiducial edge.

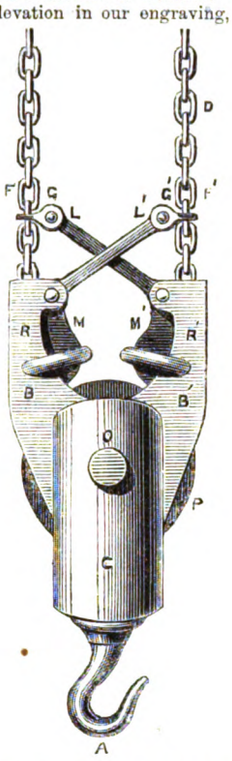


A stops or liberates the compass, on being made to slide backwards or forwards. B acts similarly on the clinometer, on being pushed in or drawn out. C is to be pressed in as a steady pin, before reading the compass. D is the lens of the compass; and E is that of the clinometer. To adjust these lenses, screw them a little, in or out, as required. To use the instrument, hold it vertically for altitudes, horizontally for azimuths, and so direct it that on carrying the eye from the hair line to the object about to be observed, they may be exactly in line. Then read off the division covered by the hair line.

The performance of an azimuth compass is well-known and appreciated. That of the weighted disc must clearly be far more delicate, inasmuch as the directive force of gravity is greater than that of terrestrial magnetism. Both discs are graduated to degrees. The principle of the weighted disc admits of index and other errors being discovered, checked, and eliminated. Two different readings may be obtained from the vertical circle, by observing with the clinometer's face first to the left and then to the right—the mean of these is clearly independent of index error. Again, by taking similar observations of the image of the object, as reflected in water, &c., two additional readings may be obtained, making four readings in all, or one on each quadrant of the disc The mean of these four must be almost wholly independent of instrumental error. A skilful observer, anxious to make the most of this little altazimuth will therefore find it very little inferior t ins ruments of far greater bulk, weight, and pretensions. An intelligent traveller furnished with the altazimuth may, by its use alone, map a country, take the height of mountains, and the dip of strata, and correct his position by very respectable astronomical observations. For, reckoning his accuracy of observation as being correct to one-tenth of a degree, his latitudes will be right to six miles, and his longitudes, by occulations, or (if he has a telescope) by Jupiter's satellites to within thirty miles.

SELF-ACTING SAFETY CATCH.

THE numerous accidents, many of a serious and lamentable nature, that have arisen from the breaking of chains, ropes, and other tackle employed in the hoisting of dead and live weights, have long since called forth various inventions for the purpose of obviating similar catastrophes. It was but the other day that seven men fell victims to the parting of a cable, snapping short at the drum, when engaged in lowering them down a tunnel shaft. In truth, it is not that there is any real want of means and appliances for preventing calamities of this character, but there is a very great want of some regulations, compelling them to be used upon every occasion, where their absence might be attended with disastrous consequences. From our contemporary, "Les Mondes," we extract a sketch of a simple and economical contrivance * for the purpose of preventing the fall of loads, consequent upon the parting of the chains or cables engaged in raising or lowering them. This little apparatus is readily fixed in position, demands no extraordinary attention, is self-acting, and performs its duty equally faithfully under all conditions of fracture. It is represented in elevation in our engraving, where P is



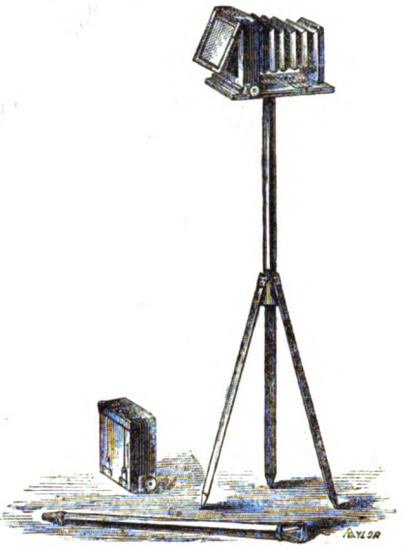
the hoisting pulley, C the spindle furnished with the two arms B and B¹ cast in a piece with it, and M M¹ a pair of movable jaws which clip the chain or cable, and are furnished with the levers L L¹. These levers are forked at one extremity, and slide in small guides G G¹. The jaws M M¹ are attached by springs R R¹ to the arms of the pulley B B¹. O is the axis, and A the shackle.

The manner in which the catch acts is as follows:—Suppose one of the chains F to break, the lower part falls and exercises no farther action upon the lever L, which is forced by the spring R¹ to assume a horizontal position, the jaw M¹ at the same time griping the portion of the chain passing along the other side of the pulley. As the failure of a chain generally results from the breaking of an imperfectly welded link, the remaining portion is amply strong enough to sustain the load until a new one is put into gear. In whatever manner the chain may break, the part remaining sound is sure to be held tight enough to secure it from running loose. From the fewness and simplicity of parts of which this little apparatus is composed, it promises to be strong and durable, and it possesses also the great advantage of acting without much shock. This arises from the comparatively trifling amount of space passed through by the chain after it has parted, and previously to its being clipped by the intercepting jaw. Many of the safety catches hitherto devised, although mechanically perfect, both in practice and theory, are complicated in their details, and not to be obtained at a price sufficiently low to ensure their universal employment, which is the chief desideratum.

* Designed by M. Caron, Rue St. Jacques, Paris.

POCKET PHOTOGRAPHIC CAMERA.

WE have just seen a very compact pocket camera and walking-stick tripod, the invention of Mr. C. D. Smith, and which we illustrate in the accompanying cut. This camera is con-



structed to hold plates 3¼in. × 3¼in., this size being convenient and most suitable for printing transparencies direct for use in the magic lantern, The outside measurement is only 4¾in. × 4⅝in. × 1¾in., and the weight 13oz., being much less than an ordinary-sized opera-glass. The stand is very compact and portable, is 36in. long when folded up, and when extended stands 4ft. 6in. high. This novelty is manufactured by Messrs. Negretti and Zambra, the opticians, of 153, Fleet-street, and will, doubtless, find favour with the photographic public.

ROYAL HORTICULTURAL SOCIETY.

ON Tuesday afternoon the first general meeting of the summer series of the Royal Horticultural Society was held. The council room was filled with a profusion of beautiful flowers, consisting of orchids, tulips, auriculas, pansies, and clematis. Among the novelties were a very pretty little buff-coloured begonia, and a bright yellow-flowered appelandra, from Messrs. Veitch and Sons. Mr. James Bateman, F.R.S., offered some observations on the cultivation of the loquat. Fine specimens of the rose apple in flower and fruit were exhibited, and a plate of St. George's azaric (azaricus gambosas), a vernal mushroom of excellent quality. Mr. W. Wilson Sanders, F.R.S., presided, and the following candidates were elected Fellows of the Society:—Lieutenant-Colonel Moore Brabazon, Mrs. John Bullar, Viscountess Dungarvan, Mrs. Gillespie, Mrs. Reuben Green, Mrs. Woronzow Greig, Mrs. T. J. Henderson, Mrs. Benjamin; Messrs. Lucas Judkins, Nathaniel Lindley, James L. Lobley, Octavius Vaughan Morgan, Arnold Moss, George Robinson, Edward Sheppard, and the Daventry Floral Society was admitted into union.

THE INSTITUTION OF CIVIL ENGINEERS

ON Wednesday last, the annual dinner of the Institution of Civil Engineers was held at Willis's Rooms, the company present numbering about 200. The chair was taken by Mr. Charles Hutton Gregory, the President of the Institute, who was supported by the Archbishop of York, the Duke of Argyll, the Earl of Caithness, Viscount Halifax, Lord Elcho, M.P., Lord Alfred Paget, the Lord Mayor, Admiral Sir John Hay, Bart., Sir Henry Holland, Bart., the Attorney-General, M.P., Sir Charles Trevelyan, K.C.B., Sir Charles Wheatstone, General Lefroy, the Presidents of the Royal, Astronomical, Geological, and Chemical Societies, and of the Institute of British Architects, the Deputy Master of the Trinity House, the Master of the Mint, Professors Sylvester, Tyndal, Donaldson, and Owen, Dr. Percy, Colonel Hutchinson, Colonel Rich, Mr. Bidder Mr. Hawkshaw, Mr. Fowler, and Mr. Vignoles Among the visitors and members of the Institution present, seated at eight cross-tables, which were presided over by Mr. Brunlees, Mr. Hemans, Mr. Cubitt, V.P., Mr. Hawkesley, V.P., Mr. Harrison, V.P., Mr. Bateman, Mr. Beardmore,

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and Mr. Barlow, were Mr. Whitworth, Mr. Penn' Mr. Samuda, M.P., Mr. Brassey, Mr. Leeman M.P., Mr. Sherriff, M.P., Mr. Robertson, Mr. Hodgson, Mr. Mitchell, Mr. Giles, Mr. Shields. Mr. McConnell, Mr. Woods, Mr. Conybeare, Mr. Bramwell, Mr. Siemens, Mr. Bazalgette, Colonel Simmons, Mr. Coode. Sir Charles Lanyon, M.P., Mr. Cawkwell, Mr. Grierson, Mr. Forbes, Mr, Beyer, Mr. Ravenhill, Mr. Ashcroft, Mr. H. A. Hunt, Mr. Murray, Mr. Aird, Colonel Kennedy, Mr. Strapp, Mr. Chance, Mr. Chilton, Mr. Baker, Mr. J. Shaw, Mr. Myles Fenton, Mr. Rennie, Mr. Colburn, Mr. Cochrane, Mr. Field, Mr. C. Waring, M.P., Mr. Kelk, M.P., Mr. C. Lucas, Mr. Blair, Colonel Clarke, Mr. Longridge, Mr. Bruce, Captain Tyler, and Major Palliser, with Mr. Charles Manby, F.R.S., honorary secretary, and Mr. James Forrest, the secretary. The usual loyal toasts were enthusiastically received. Those of the Army, Navy, Militia, and Volunteers, were acknowledged by General Lefroy, R.A., Admiral Sir John Hay, Bart., M.P., and Lord Elcho, M.P. The honours paid to the Houses of Lords and Commons, and to the visitors, were responded to by the Earl of Caithness, the Attorney-General, and the Archbishop of York. General Lefroy, and Sir John Hay, spoke very hopefully of the army and navy, and Lord Elcho aptly associated railways and engineering works in general with the national defences. The Archbishop of York happily touched upon Mr. Whitworth's munificent gift, in the cause of scientific instruction, which he designated the best shot he had ever fired in his life. The Duke of Argyll, who incorporated in his speech more than one local reminiscence, the purport of which was to show that Scotland is the cradle of our best engineers, proposed the toast of the evening, coupling it with the name of Mr. Gregory. Mr. Bidder gave "The Learned Societies," and the President of the Royal Institute of British Architects, Mr. Tite, who returned thanks; and the toast of "The Corporation of the City of London" was proposed by Mr. Hawkshaw, and acknowledged by the Lord Mayor. The entertainment passed off admirably, and was certainly one of the best the Institute had ever had.

Turning to the business proceedings of the Institute we note that at the ordinary general meeting held on the previous day, Mr. Gregory in the chair, twenty-two candidates were balloted for and duly elected, including five members, viz.: Mr. William Bage, Mr. Francis Brady, Mr. Maximilian Hjortsberg, Mr. George Vivian, and Mr. John Wood; and seventeen associates, viz.: Mr. Charles D. Alexander, B.A., Le Chevalier Barroso, Mr. Edwin Bidder, Mr. Peter Brotherhood, Mr. Joao N. Ferreira, Mr. Thomas Gibson, Mr. James Hartley, M.P., Mr. Edward J. Jones, Mr. H. A. O. Mackenzie, Mr. John Milroy, Lieutenant Colin C. S. Moncrieff, R.E., Lieutenant Patrick Montgomerie, Mr. Walter Neilson, Mr. Samuel B. Newton, Mr. Richard Proctor-Sims, Mr. Horace J. Rydon, and Mr. William J. Trehearne. It was also announced that the Council, acting under the provisions of Section IV. of the Bye Laws, had, since the last announcement, admitted as Students of the Institution, Messrs. John S. Carey, Humphrey Henchman, and John A. Owen.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

A VERY crowded meeting of the members of this institution took place at their rooms in Aldermanbury, City, on Saturday last, Mr. Joseph Newton, President, in the chair. Much interest had previously been excited by the announcement that E. J. Reed, Esq. (Chief Constructor of the Navy), would read a paper, on the testing of iron and steel. At half-past eight, Mr. Reed entered the lecture hall, accompanied by Mr. Stock, M.P., Mr. Edward Humphrys, and other eminent scientific gentlemen. The chairman opened the proceedings by stating that there was no need for a lengthy introduction of the lecturer on this occasion, as Mr. Reed was well known to all present. For the last ten years Mr. Reed had been a devoted supporter of that Association, and had rendered it as much service as any member of its managing committee. It was equally unnecessary to claim attention to any remarks which might emanate from the Chief Constructor of the Navy, for they were always worth listening to, and were sure to be instructive.

Mr. Reed then, in a very elaborate statement, illustrated by carefully-prepared diagrams, explained the various modes employed by the Admiralty for testing the quality of iron and steel supplied by contractors for use in the British navy. His practical description of the very severe ordeal through which all such materials were made to pass before finding acceptance at the hands of the authorities, were heard with, apparently, the greatest interest, and it seemed almost impossible that, under the circumstances indicated, any iron or steel of an inferior character could possibly find its way into the construction of ironclad ships. On the conclusion of the paper, the hon. member for Carlow (Mr. Stock) expressed the pleasure he felt in having been privileged to attend the sitting of that evening. He considered that an institution of the nature of the Association of Foremen Engineers was well calculated for the promotion of scientific and technical knowledge, and must at once elevate its members and advance the engineering profession in the United Kingdom. Mr. Reed's paper was worthy of himself, and could not fail to be of value to his audience. Mr. Edmonds recounted his own extensive experiences in the testing of metals at the Royal Arsenal, Woolwich, and agreed in the main with the views put forward by the reader of the paper. Messrs. Keyte, Waring, Campbell, Stabler, Roberts, and others, took part in the discussion which ensued, and which was of a critical and spirited nature. When Mr. Reed had replied to the several queries propounded, and elucidated some points upon which further information was requested, a vote of thanks to that gentleman, proposed by Mr. Gibbon and seconded by Mr. Waring, was put to the meeting by the chairman. It is needless to say that it was unanimously agreed to, and gracefully acknowledged. In closing the sitting, Mr. Newton expressed a hope that other honorary members of the Institution would follow the example now set by Mr. Reed, and thus render its monthly meetings yet more attractive and useful than heretofore.

MANCHESTER BOILER ASSOCIATION.

THE last ordinary monthly meeting of the executive committee of this Association was held at the offices, 41, Corporation-street, Manchester, on Tuesday, April 28, Hugh Mason, Esq., of Ashton-under-Lyne, Vice-President, in the chair, when Mr. L. E. Fletcher, chief engineer, presented his report, of which the following is an abstract:—During the past month 227 visits of inspection have been made, and 478 boilers examined, 278 externally, 6 internally, 6 in the flues, and 188 entirely, while in addition 3 have been tested by hydraulic pressure. In these boilers 95 defects have been discovered, 10 of them being dangerous.

The following is a statement of defects, omissions, &c., met with in the boilers examined from March 28, 1868, to April 24, 1868, inclusive:—Furnaces out of shape, 2 (1 dangerous); fracture, 21 (2 dangerous); blistered plates, 12 (1 dangerous); internal corrosion, 12 (2 dangerous); external corrosion, 14 (2 dangerous); internal grooving, 9 (1 dangerous;) external grooving, 5; total number of defects in boiler, 75 (9 dangerous). Feed apparatus out of order, 1; water gauges out of order, 1; blow-out apparatus out of order, 3; safety valves out of order, 1; pressure gauges out of order, 6; total number of defective fittings, 12. Boilers without feed back pressure valves, 6; total number of omissions, 6. Cases of deficiency of water, 2 (1 dangerous). Gross total, 95 (10 dangerous).

In three internally-fired mill boilers, which were unhoused and set below ground, the plates on the top were found, on being uncovered, to be dangerously corroded, in one of them so much so that three or four plates would have to be removed, while in another such extensive repairs were necessary that, having regard to the age of the boiler, it was thought better to condemn it altogether. This shows the disadvantage of placing boilers in inaccessible positions, while it is recommended that the covering of those that are unhoused should be lifted at least once in two years for examination.

Two explosions have occurred during the past month, by which two persons have been killed and two others injured. Neither of the boilers in question was under the inspection of this Association. The following is the statement of explosions from March 28, 1868, to April 24, 1868, inclusive:—April 4, plain cylindrical boiler, egg-ended, externally fired—1 killed, 2 injured. April 7, two-flued Lancashire boiler, internally fired—1 killed. Total, 4—2 killed, 2 injured. No. 9 explosion, which occurred at a colliery on the morning of Saturday, April 4, and resulted in the death of one man and injury to two others, is simply an illustration of the danger of externally-fired boilers. The boiler was one of a series of four working side by side, and connected together, all of them being of the plain cylindrical egg-ended, externally-fired class so commonly used in collieries, while the exploded one measured 28ft. in length by 6ft. in diameter, and ⅞in. in the thickness of the plates, the load on the safety valve being 30lb. on the square inch.

It appears that the boiler was about twenty-nine years old, and had been frequently repaired at the plates over the fire, while one of these repairs had just been completed, and the boiler only set to work a few hours before it exploded. The repair was considered by the engineer to the collieries to have made the boiler perfectly safe, and he could not at all account for the explosion; notwithstanding which, however, just as some colliers had been lowered down the shaft, and the stoker was in the act of putting some coals on the fire, a few hours after it was set to work, the boiler burst, blowing the poor man out of the firing space and killing him on the spot, in addition to knocking down the chimney and dislodging one of the adjoining boilers, while its own shell was rent into three fragments, one of which was thrown to a distance of 60yds., another 42yds., and the safety valve 30yds, a portion of a brick being shot through the roof of the cottage—though at a distance of 60yds.—in which the stoker who was killed by the explosion had lived.

The boiler failed, in the first instance, just at the part where it had been repaired by a patch immediately over the fire, the old work tearing away from the new. This is frequently found to be the case, so that these boilers are often weakened by the very means adopted to strengthen them, and their explosion hastened rather than arrested by repairs. Explosions of this nature will recur as long as the use of these treacherous plain cylindrical externally-fired boilers is persisted in.

IRRIGATION IN INDIA. *

By Mr. T. Login, F.R.S.E.

THIS paper was on the benefits of irrigation in India, and on the proper construction of irrigating canals. The author stated that he had been engaged, during the greater part of a quarter of a century, on some of the most important irrigation works in Northern India, and an account of the prominent features of the system formed the subject of this communication. With regard to the revenue derived from the older canals and their actual cost, diagrams were exhibited, showing that, at least in Northern India, immediate direct returns must not be looked for, although such canals were certain to be financially successful eventually. If, however, in addition to the water rent, the increase of cultivation and the enhanced value of land were included, the canals even in this part of the empire must be considered highly remunerative. But the strong argument in favour of canals was, that they were calculated to prevent those awful visitations which from time to time swept off hundreds of thousands by starvation; and if canals could be constructed at an outlay of somewhat less than one pound sterling per head of the population, and return a fair per centage for the outlay, these were additional reasons for proceeding with them without delay.

The abrading and transporting power of water in motion was briefly adverted to, and the author expressed the opinion that the power of water to hold matter in suspension was directly as the velocity, and inversely as the depth; and that with given velocities and defined depths, only a certain quantity of matter could be held in suspension, whatever might be the character of the bed and banks of the river or canal. If the velocity were increased, and the depth remained constant, scour would take place; whereas if the velocity were decreased, and the depth was the same, there would be deposit.

With reference to the best slopes for canals, and how the slopes were to be regulated, it was essential, in the first place, to ascertain what was the slope of the river, when not in flood, from which a supply was to be drawn, under circumstances similar to those of the canal to be constructed, that was as to depth and soil; and then to make a small allowance for the tortuous course of the natural river. The slope—that was the velocity, or, in other words, the abrading and transporting power to be given—should be such, that the deposits would be balanced by the abrasion. Experience on the Ganges Canal had shown that this required a mean velocity of about 3¾ft. a second, with a surface slope a little less than 14in. in the mile. One of the greatest

* Read before the Institution of Civil Engineers.

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problems for the canal engineer was the best method of dealing with the excessive slope of the country through which an artificial river had to flow. In Nature this was provided for, first, by waterfalls; secondly, by barriers of rock, stretching like weirs across the channel of the river; thirdly, by rapids, formed of boulders that had been carried down the river, thus creating temporary weirs; and lastly, where only clay or sand existed, the course of the river was found to be tortuous, by which the length was increased, and the slope practically reduced; and, to a minor extent, the flow was also retarded by the sudden bends in the river, which tended to check the velocity and to increase the depth. The last plan had been almost invariably adopted in former times, and it was still to be seen in Egypt; one of the largest and best paying canals in Upper India—the Western Jumna Canal—was also constructed on this principle.

The experience gained on the Eastern Jumna Canal, where masonry falls were built after it was opened, led to the adoption of the ogee form of fall for the Ganges Canal. While these works were in progress, the flooring of all the falls on the first division was lowered so as to form a cistern to receive the descending water; and the water being held up by a framework of timber, 5ft. in height, above the crown of the ogee, no injury has as yet been done to the brickwork where the water impinged. This was probably owing to the water which passed through the open spaces of the timber framework forming a cushion for the descending water. Perpendicular falls were also employed on the Baree Doab Canal, and in Madras; but in the former the water was received into a cistern, while in the latter it impinged on a flooring of ashlar work. The various plans adopted and proposed for overcoming excessive slopes having been succinctly noticed, it was stated that, under such circumstances, recourse must be had to barriers, or, as they were technically termed, weirs. From a table showing, approximately, the sections and slopes best adapted for irrigation canals and water courses in Northern India, it appeared that probably the best slope for a canal discharging 5,000 cubic feet per second was about 13¾in. per mile.

A description was then given of a new system of "zig-zag" falls which had been recommended; by the author for the Rechna irrigation works and a comparison was instituted between the cost of the falls and bridges on the Ganges Canal as executed, and the estimated cost if the proposed "zig-zag" falls had been adopted, from which it was contended that there would have been a considerable saving of expense by the latter plan. As to the question whether the falls would be likely to stand the action of the water, it was proposed that the length of the lip should be so extended, that only 10 cubic feet a second should pass over each foot, which with a full supply would require a height of about 2ft.; whereas, on the Ganges Canal, with two and a-half times the volume descending an equal height on brickwork, no injury had yet occurred.

In conclusion it was remarked that six years ago, the author stood almost alone in maintaining the opinion, that the Ganges Canal needed only some protective works, and did not require the radical alterations then proposed. He believed that the works might be placed out of all danger, by the judicious use of wood and iron, at a less cost than if stone were employed, without depriving the country of the benefits of irrigation beyond a very short time.

DEEPENING OF THE MICHIGAN AND ILLINOIS CANAL.*

By S. W. Robinson, C.E.

THE valley of the Des Plaines River, in the State of Illinois, is supposed to have been at some period during the geological ages, the course of a river which formed an outlet to the Great Lakes, and a tributary to the Mississippi. The bed of this valley, at present, scarcely rises 25ft. above the level of Lake Michigan, the summit being only ten or fifteen miles from the lake. The Michigan and Illinois Canal, which extends down this valley, is ninety-six miles in length, and joins Lake Michigan, at Chicago, with the Illinois River at La Salle. This canal was commenced about thirty years ago. It has now been in use for several years, the boats being carried over the summit by the use of locks, situated at Chicago and near Lockport, which retain the water upon a level 10ft. higher than the Chicago River and Lake Michigan.

Since the city of Chicago has suffered in such a marked degree from the notable stench of the Chicago River, it has been determined to deepen this canal across the summit, so as to induce a current of water down the valley into the Illinois River. This will form an artificial river, by which water will be carried from the lakes towards the Gulf o Mexico. Although the amount of water carried to the sea by this course will be small, yet the fact will exist of two outlets to divide the waters of the great lakes, and depreciate the honours of the St. Lawrence. The amount of deepening required to effect this is about 10ft. between the locks above named, for a distance of twenty-seven miles. The working depth of the canal is to be 6ft., reckoned from the low-water mark of Lake Michigan; the breadth of the canal at the bottom is to be 50ft., and 6ft. from the bottom 60ft. This work of deepening was commenced two years ago; and will probably be finished by the middle of April, 1869. That navigation shall not be interfered with, the work is done between the middle of the months of November and April, each winter. The deepening requires the removal from the bottom of the canal of about two and a-half million yards of earth, 240,000yds. of solid rock. The former is contracted variously at from half a dollar to a dollar per yard, and the latter at from 2¼ to 2½ dollars per yard.

The city is permitted by the State to prosecute this work to the extent of two and a-half millions of dollars, with the understanding that it shall be reimbursed by revenues from the canal, if not sooner paid directly by the State, which, the writer has been informed, will be done, if the State widens the canal to 80ft. or 100ft., to accommodate the Mississippi flat-boats. The excavation is earth for a distance of twenty miles from Chicago, where the excavation of magnesium lime-rock commences, which extends about seven miles further, reaching nearly to Lockport. This part of the canal runs through the limestone beds from which the excellent building stone for the city of Chicago is quarried. To loosen the rock in the canal, blast-holes are used, which are 4in. to 6in. in diameter and 6ft. to 10ft. deep. These have heretofore been bored by raising the drills by horse or steam power, then letting them drop, gravity doing the work of striking the blow.

The drills principally used for this purpose are about 20ft. in length and 2½in. or 3in. in diameter, and of iron, except at the cutting end, which is enlarged with steel to nearly the size of the hole for 1ft. or 2ft., and armed with a Z-bit. Experiments are now being made with direct-action steam drilling machines at the works of Messrs. Singer and Talcott. Much difficulty has been experienced in effecting the speedy removal of the chips, which are formed so much faster than by other appliances heretofore used for drilling. This difficulty, however, is likely to be overcome; and the time is probably near at hand when direct-action steam-drills will be used on all our great works in rock excavation throughout the country. The rock is raised from the bottom of the canal to the banks by means of cranes or derricks, worked by horse-power. The cranes have the advantage of being portable, being mounted upon movable platforms. The derricks, however, perform the operation of hoisting more satisfactorily, and require less work than the cranes, as there constructed.

The easiest working derricks used there are those in which the boom would swing entirely around the mast in disposing of each load. They were so constructed that the horse or horses travelled around the mast, and in the same direction as the boom. The mast rests upon the centre of the sweep to which the horse is attached, and the friction between the mast and sweep, induced by the movement of the latter, causes the boom to move and carry the load around simultaneously with being raised, from the pit to the bank, ready to be dumped. One of the smoothest working derricks I saw had a friction clutch for communicating power to the cable, the latter being of steel wire instead of a chain. One horse worked this with apparently as much ease as two could the cranes, having a chain cable, and where the chains required two to four men each, beside the driver, to manage them, the derricks required but one. These derricks were invented by A. T. Merriman and Brother, of Chicago.

* "Journal of the Franklin Institute."

Legal Intelligence.

COURT OE QUEEN'S BENCH.

May 4.

(Sittings in Banco before the Lord Chief Justice, Mr. Justice Blackburn, and Mr. Justice Hannen.)

WEBB V. RENNIE.

This was a case which has already been twice tried before the Lord Chief Justice and a special jury, and in both trials the verdict was for the plaintiff; and it now, for the second time, came before the Court on a question as to the sufficiency of the evidence to sustain such a verdict. The details of the case were given and its merits were fully discussed by us in our issue for November 8, 1867, page 307. It may, however, be necessary to state here that the action was against the eminent shipbuilders, Messrs. Rennie, by a workman in their employment, to recover compensation for an injury sustained while at work in their yard, by reason of the falling of a pole which supported a frame on which he was working. The pole fell by reason of its rottenness at the end fixed in the earth, and the point was whether the defendants, the employers, were liable for its not having been examined before it was used. It was of white pine, and had been two years in the earth, and evidence showed that such poles were likely, when left in the ground, to become rotten and liable to break. The question, therefore, came to this, who was to blame for not taking it out and looking at the end of it to see if it were sound before it was used as a support of the frame. As to this it appeared, on the one hand, that the defendants were daily in the yard, and, on the other hand, that they had a foreman or manager who had been upwards of twenty years in their service, and who, of course, knew all about the poles, and whose duty it would be to look after them and see if they were sound. But on this occasion the pole was not examined, and it broke off at the bottom, being quite rotten. The argument on the part of the plaintiff was that the employers were liable for bad materials; the argument on behalf of the defendants was that there was no personal or actual negligence on their part.

Mr. D. Seymour and Mr. Daly were for the plaintiff; Mr. M. Chambers and Mr. Woolett were for the defendants.

After hearing the plaintiff's counsel, the Court, without calling on the counsel for the defendants, gave judgment in their favour. They were bound, they said, to determine the case in accordance with the numerous decisions which established the doctrine that a master was not liable for injuries to his workmen arising from the negligence of his fellow servants. The evidence in this case established no exception from the general doctrine. The defendants had a competent and experienced foreman whose duty was to examine the poles, and the accident had arisen from his negligence or neglect. There was no evidence on the part of the defendants in delegating such a duty to him, for he might well be deemed reasonably competent and proper for its discharge. It was his negligence, not theirs, to which the accident was to be ascribed, and therefore the action was not maintainable against them. The Court did not question the opinion of the jury that there was negligence, but the question was whose negligence it was; and the Court were of opinion, upon the evidence, that it was the negligence of the foreman, not of the master.—Judgment for the defendants.

Correspondence.

PRESERVING GUTTA-PERCHA.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I should esteem it a favour if you, or any of your readers, can inform me whether there is any varnish or composition which can be applied to a model made of gutta-percha (without heat), which will prevent the summer atmosphere from softening the same; in fact, anything that would render gutta-percha, after being formed into a delicate model, quite proof against an atmosphere of about 80deg. I may add that the article referred to will be required to be coated with gold bronze, so perhaps you will kindly say whether this can be done previously or subsequently to the operation. By affording the above information you will greatly oblige.—I am, Sir, yours, &c., AN EXPLORER.

May 4.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—J. S.—T. C.—J. T.—C. W. R.—W. B.—W. H. R.—H. G.—H. M. T.—A. H.—M. F.—W. D.—B. W.—R. J. T.—R. C.—Messrs. E. R. and Co.—J. F.—S. M.—W. R. S.—A. N. B.—J. M.—R. H.—J. N.—W. P. M.—J B.—J. T.—G. W. H.—W. H. H.—C. T.—J. R. S.—R. H. S.—J. R.—H. J.—F. B.—J. N.—G. W. H.—R. F.

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Meetings for the Week.

MON.—Royal United Service Institution.—Colonel A. Cunningham Robertson, 8th or King's Regiment, on "The Appointment and Promotion of Regimental Officers," at 8.30 p.m.

TUES.—The Institution of Civil Engineers.—Continued discussion on "Irrigation in India and in Spain," at 8 p.m.

Royal Institution.—Dr. M. Foster on "The Development of Animals," at 3 p.m.

THURS. — Royal Institution. — Professor Bain on "Popular Errors," at 3 p.m.

FRI.—Royal Institution.—Mr. E. Deutsch on "The Talmud," at 8 p.m.

SAT.—Royal Institution.—Professor Bain on "Popular Errors," at 3 p.m.

Naval, Military, and Gunnery Items.

THE annual dinner of the officers of the Royal Engineers will take place on Thursday, the 21st inst., at Willis's Rooms. The Duke of Cambridge will preside.

THE First Lord of the Admiralty will hold a levee on Thursday, the 14th inst., at which he will receive those officers whose names were noted for the levee of the 7th ult.

THE admiral good service pension of £300 a-year, vacant by the death of Admiral Sir Hy. D. Chads, K.C.B., on the 7th ult., has been granted to Admiral Sir Robt. L. Baynes, K.C.B., from that date.

INSPECTOR GENERAL DR. BEATSON, the late head of Her Majesty's British army in India, has arrived in England, after a long tour in the former country. He proceeds to Netley as the principal medical officer of that establishment. We, "Lancet," congratulate Dr. Beatson on his arrival home. Intelligence as to the distinguished way in which he discharged his duties in India has long preceded his arrival.

ON Tuesday, at the Admiralty Court, an application was made in the case of the "Great Eastern" steamship, which is under arrest at this court in reference to a large claim, to amend the petition as to the French company which had chartered the vessel on account of the Paris Exhibition. Mr. V. Lushington and Mr. Butt appeared in the case. The court granted the application, and the case will now proceed to hearing on an important question of liability.

THE Board of Trade have awarded to Captain Francois Breynairt, master of the French steam tug, "L'Industrie," a telescope value £5 15s. 6d., in acknowledgment of his humane services in rescuing from the rigging of their vessel the crew of the schooner, "J. F. Buller," which stranded off Dunkirk on March 7, last. The Board of Trade have also awarded a similar telescope to Captain Nicolai Lindal Walloe, master of the ship "Washington," of Tonsberg, in acknowledgment of his humanity in receiving on board his vessel the master and crew of the brig "Ellen," of Whitby, which encountered bad weather on her passage from Gefle to West Hartlepool, and was necessarily abandoned.

A SAD accident occurred a few days back at Vincennes during the target exercise of the soldiers forming part of the camp of St Maur. A spectator placed at the line of distance fixed by the authorities as quite beyond the range of the fire was struck by Chassepot bullet, which passed through his hand and then entered his groin. The new firearms, it thus appears, have such a force of projection as to exceed the calculations of the military officers best acquainted with the subject. The wounded man was a resident of St. Maur, and had been recently married. After surgical assistance had been rendered he was removed to his home with every precaution.

THE total number of soldiers sent on furlough by the Commander-in-Chief of the North German Federal Army amounts to 12,000.

A LARGE screw steamer, named the "Travancore," has just been built for the P. and O. Steam Navigation Company by Mr. Kay, of Kinghorn. The vessel is 300ft. long, of 2,300 tons burden, and with engine of 400-horse power. The crew numbers 110, officers and men. The principal saloon, which is a very handsome apartment, is 70ft. long by 15ft. wide. The ice-room has a capacity for 20 tons, and a constant supply of iced water can be laid on by a connecting tap. Steam pipes are laid on where either power or heat is required. There are two marble baths for ladies, and seven for gentlemen.

THE "Journal des Connaissances Medicales" describes a couple of slaughter engines, which are suggested as the right things to use in future warfare. One is the Mitrailleuse, and it is described as something resembling a huge coffee mill in shape, into the funnel of which the cartridges are thrown by shovelfuls. A soldier turns the handle, and the movement keeps up a supply of bullets to each of eight barrels, and causes a hammer to rise and fall rapidly on the percussion caps, the whole resulting in a discharge of from fifty to fifty-five shots per minute, to a point-blank distance of 1,700yds. It is to be served out to the battalions of chasseurs, each section of which is to have one. We presume this to be the Gatling gun. The other contrivance is the Foudroyant. It is a species of musket, which discharges two bullets per second from a reservoir for cartridges. As each shot passes out of the barrel it acts upon a lever, which draws a fresh cartridge from the reservoir, and places it on the breech.

A PARLIAMENTARY paper has just been published, which contains Admiral Warden's reports of the trials of the Channel Fleet in 1867, with the remarks of Vice-Admiral Robinson, the "Controller" of the Navy, thereon. The observations of the "Controller" consist of a critical analysis of the performances of the several ships in the squadron as recorded by Rear-Admiral Warden; but in the detailed reports there are very great discrepancies, which further trials alone can clear away. After the most careful consideration, Admiral Robinson can see no encouragement whatever in these reports to return to the construction of unhandy, long, and comparatively slightly-armoured ships; on the contrary, so far as they go, they thoroughly confirm the propriety of the changes that have been made in the forms of ships recently constructed—less length, and greater fighting power combined with handiness, having been secured to them. The engines of the new type alone give cause for dissatisfaction, and they only in some instances, the peculiarities of which are now undergoing the most careful inquiry.

THE "Memorial de la Loire" gives some particulars respecting a French gunmaker, named Bourgaud, who was for some time in the service of King Theodore, but whose fate seems at present uncertain. He formerly carried on business at Saint Etienne, and ten years since conceived the idea that he might open a profitable trade in Abyssinia. Proceeding thither he was warmly received by the King, and treated with distinction, and is even said to have been a Prince. But when M. Bourgaud desired to leave, he discovered that to get into Abyssinia was easier than to get out of it. The Negus found him too useful, from his special knowledge of arms, to part with, and he was retained in a sort of honourable imprisonment. Three years elapsed, and his wife, despairing of his return, decided on going with their children to Magdala with a view of bringing him back to France. They also were well received, but were likewise prevented from returning to Europe. What has become of M. Bourgaud and his family is not yet known.

WE see by the "United Service Gazette" that an act of justice has at last been done by the Admiralty in the promotion of Commander Bedford Pim to the rank of captain. Before attaining the rank of lieutenant Captain Pim served in all quarters of the globe, but this, his first step, came by seniority, and, moreover, he passed the best examination of his day at college. He volunteered, and was employed in three Arctic expeditions, and was the connecting link of the North-west Passage, saving from starvation and death the officers of Her Majesty's ship "Investigator," when hopelessly beset in the ice. He afterwards served with distinction in the Russian and last Chinese wars, and was wounded on three occasions, twice severely, once receiving six bullet wounds. Captain Pim is favourably known as an author and writer of considerable ability. He has devoted much time, energy, and money during the last six years to his great project of opening a transit through Nicaragua, and which is now in a fair way of being carried on.

Miscellanea.

MR. JOHN MELLOR, an antiquary of Derby, states that he has discovered the remains of King Alfred at Hyde Abbey, Winchester.

THE number of visitors to the Patent-office Museum, South Kensington, for the week ending May 2, was 2,915; total number since the opening of the museum free daily (May 12, 1858), 1,292,893.

THE quantity of proof spirits distilled in the United Kingdom and Ireland, during the year ending the 31st December last, was 23,323,613 gallons. The duty paid amounted to £11,382,594 5s. 7d.

FROM a statistical return just published it appears that the damage done in Normandy in 1866 by the larvæ of the cockchafer amounted to no less a sum than twenty-five millions of francs.

A NEW public park thirty acres in extent, was on Friday last formally opened at Southport by Mr. Peter Wood, the mayor. The land for the park was presented about four years ago by the Rev. Charles Hesketh, the rector of Southport.

"WHAT is the use of you gentlemen going to college?" said a farmer in conversation with one of the assistant commissioners engaged in the recent Schools Inquiry. "My son Walter can write a better hand than you." And the commissioner confesses the fact to be so.

A FACT showing the influence of artificial light in the production of green colouring matter is recorded by M. Ermins, in a recent number of the "Revue Horticole." Some lilacs were placed for forcing in a heated cellar, partially lighted with gas. Those leaves that were exposed to the light became green, as if they had been in the open air, while the remainder were etiolated.

AN offer of £3,000 has been made as an endowment for a chair of Applied Mental Science in the University of Edinburgh, on condition that £1,500 or £2,000 more be obtained from other sources.

AT the meeting of the Royal Geographical Society, on Monday evening next, Sir R. I. Murchison, Bart., president, will occupy the chair, and the following papers will be read:—1, "On the Peninsula of Sinai," by the Rev. F. W. Holland; 2, "North-east Coast of Labrador," by Commissioner W. Chimmo, R.N.

ON the 1st inst., the Franco-Italian Commissioners completed their examination of the Mont Cenis Railway, and authorized its being opened for goods traffic for a fortnight prior to the opening for passengers. On the return journey of the Commissioners from Susa to San Michel the time occupied was 5h. 80min., including 1h. 15min. stoppages. The average running speed was about twelve miles an hour.

THE visitors to the South Kensington Museum during the week ending May 2, 1868, were as follows:—On Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 9,215; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 2,252. National Portrait Exhibition, by payment, 2,930; Total—14,397. Average of corresponding week in former years, 12,696; total from the opening of the museum, 7,359,342.

AT the recent important meeting of the Royal Geographical Society, Mr. Camden Hotten exhibited a volume of pen and ink sketches of remarkable scenery in Abyssinia, with portraits of the natives, taken by a German, T. Essler, one of the prisoners just liberated from the hands of Theodore. These drawings are now in course of publication by Mr. Hotten, and the work will, by royal command, be dedicated to Her Majesty the Queen.

IT was announced at the meeting of the Institution of Mechanical Engineers, held on Thursday last, at Birmingham, that in consequence of a memorial, dated 20th March last, it has been decided to appoint three honorary commissioners to act with the Lord Chancellor and the Master of the Rolls in regulating the Patent Office. The first name is to be suggested by the Institution of Mechanical Engineers, the second by the Chemical Society, and the third by the Royal Society. The Institution of Mechanical Engineers have nominated Messrs. Amos and R. May.

ON Tuesday week, about five o'clock in the evening, intelligence reached Cardiff that a dreadful accident had occurred at No. 3 shaft on the Caerphilly branch of the Rhymney Railway. During the dinner hour a man had been working in the shaft, and asked to be pulled to the top of the shaft. Shortly afterwards six other men joined him to proceed to their work in the shaft. When the engine was set in motion it was found that the gearing had got out of order, and before it could be remedied the whole of the men were thrown from the top of the shaft to the bottom, a depth of 117 yards.

OUR facetious contemporary, "Punch," has the following "Science Gossip":—The proper thing to use with gun-cotton is shot silk.—The cuckoo has been heard on Bethnal-green, and the nightingale has commenced singing in Short's-gardens. The swallows have returned to the Mansion House.—A patent has been taken out for manufacturing pens with cocoa-nibs.—Ladies will be pleased to hear that a process has been discovered by which they can electro-plait their hair.—Many persons have burnt their fingers by dabbling in petroleum.—A scientific ghost story will shortly appear in fortnightly numbers, founded on spectrum analysis. These extracts may serve to allay any alarm on the part of Mr. Hardwicke.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—2953, 2987, 2997, 3000
BUILDINGS AND BUILDING MATERIALS—2938
CHEMISTRY AND PHOTOGRAPHY—2952
CULTIVATION OF THE SOIL, including agricultural implements and machines—2945
ELECTRICAL APPARATUS—2942, 2960
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—2932, 2946, 2947, 2951, 2974, 2985, 2996, 3005
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—2931, 2940, 2976, 3006
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—2933, 2936, 2939, 2950, 2956

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GENERAL MACHINERY—2934, 2935, 2962, 2964, 2969, 2975, 2978, 2981, 2982, 2990, 2995, 2998, 3004
LIGHTING, HEATING, AND VENTILATING—2968, 2989
METALS, including apparatus for their manufacture—None.
MISCELLANEOUS—2943, 2944, 2948, 2957, 2959, 2963, 2966, 2970, 2971, 2972, 2977, 2979, 2983, 2984, 2988, 2991, 2994, 3002, 3007, 3008, 3009
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—2954, 2955, 2965, 2967, 2986, 2992, 2993
SHIPS AND BOATS, including their fittings—2937
STEAM ENGINES—2980
WARFARE—2941, 2949, 2961, 2999, 3003

2931 H. J. BALE. *Improvements in apparatus to be used in cooking by means of gas.* Dated October 18, 1867.

In order that an ordinary gas burner carried by a bracket projecting from the wall of a room or chamber may from time to time be used in cooking, the patentee employs apparatus consisting of a bucket so constructed as to be readily applied and secured to the wall of the room or chamber required for use, and afterwards removed from it. This bracket carries a ring or platform to support a pot or kettle, and is jointed so that the platform may be brought over the burner, or swung to one side of it, by moving about the joint in the bracket. He fixes to the wall of the room or chamber where the bracket is to be applied, and in the vicinity of the gas burner, two nails or studs having heads; the base plate of the bracket has holes through it of a size to allow these heads to pass, and the holes are slotted on the upper side, so that when the plate of the bracket has been applied over the nails or studs, it drops down or slides along so as to bring the stems of the studs or nails into the slots, and thus the plate becomes secured to the wall.—Patent completed.

2932 T. WHITEHEAD. *Improvements in roving and spinning fibrous substances.* Dated October 18, 1867.

In the roving frame the inventor takes the roving from a thicker roving than heretofore, and passes it through one or two troughs of hot or cold water, in which, in some cases, suitable chemical agents may be dissolved, then through holding rollers, and then drawing rollers to draw the sliver smaller. Then it is passed round one or more grooved or plain steam rollers, so as to dry the fibre before going on to the bobbin, but so arranged that one or more slivers may be wound on the same bobbin. Another portion of the invention consists in a novel application of a fixed collar to extend the full length of the traverse part of the spindle, so that the bobbin runs upon the fixed collar or tube, instead of upon the revolving spindle, thereby enabling the spindle to make more revolutions.—Patent abandoned.

2933 S. S. MAURICE. *An improved fastening.* (A communication.) Dated October 18, 1867.

Here a movable plate which has, by preference, teeth on one of its edges, and which is hereinafter called the working plate, works on two projections, pivots, or axes, one of which is cranked; these pass through the sides of another plate, which the patentee calls a frame plate, and to which is attached a bent plate forming a spring, through one end of which the crank projection or pivot passes. The working plate is actuated by exerting pressure on it by means of a knob, or similar appliance. Holes are provided in the working plate and frame plate to sew or stitch the necktie or other article thereto.—Patent completed.

2934 J. KING. *Improvements in machinery or apparatus applicable to cages or hoists used in mining or lifting machines.* Dated October 18, 1867.

The patentee claims, first, the construction, arrangement, and combination of two pairs of eccentric pulleys (or clutches), such pulleys (or clutches) being fixed on to the sides of the guide rods of the cage or lift by double-ended spring links or levers, such links or levers, being allowed to act on the pulleys (or clutches) by the overwinding or breaking of the hoisting chain or rope, cause the pulleys (or clutches) to hold the cage or hoist or lift suspended in the shaft or well hole in which it is employed, substantially as described. Second, the arrangement and combination of machinery or apparatus, substantially as described.—Patent completed.

2935 J. J. HOLDEN. *Improvements in apparatus for cleaning and polishing boots, shoes, and other foot coverings, which apparatus may also be adapted for cleaning certain other articles.* Dated October 18, 1867.

Here a framework supports a fly-wheel or driving-wheel, which is actuated by a handle or treadle, and transmits rotary motion by strap and pulley, or otherwise, to two or more shafts placed at the upper part, lower part, and sides (or at two or more of such parts) of the framework. When used for boots, shoes, and the like, these shafts carry brushes made concave at their peripheries, and set on concave stocks, or concave parts of the shafts, and they have projecting ends to accommodate their shape to the boot, shoe, or foot covering. Between the brushes the shafts are made concave. Each shaft or spindle should carry three brushes—one for cleaning off mud, another for applying blacking, polish, or varnish, and a third for rubbing or polishing. The second brush may have a hollow stock to supply the blacking or polishing agent. The framework may be on rollers or castors, to render the apparatus portable.—Patent abandoned.

2936 C. MONTAGU. *An improvement in the manufacture of articles of apparel worn on the head by women and children.* Dated October 18, 1867.

Here the material used is caoutchouc or india-rubber, or a compound or compounds of which india-rubber forms the main or principal ingredient. This material is moulded into form, or reduced to sheets or thin pieces, or they may be shaped by other ordinary processes or contrivances, and any ordinary means may be used for removing unpleasant odour, and for imparting polish or colour to either or both of its surfaces. It is cut or formed to the required external configuration, and any desired device or design may be formed on it by suitable cutting tools, or other means.—Patent abandoned.

2937 M. ALEX. *Improvements in davits for ships and other vessels.* Dated October 18, 1867.

These improved davits have joints near the taffrail, so that they may bend over and swing clear of the ship's side while they are lowering or raising a boat or other body. They are provided with swivel joints attached to a plate fitted to the deck or elsewhere, so that they slew in any direction. The plate is connected with a crab winch and screw break or similar contrivances for raising and lowering a boat or other body, and a ratchet wheel and pawl or detent are added to stop the boat or load at any required position.—Patent abandoned.

2938 F. W. WAIDE. *Improvements in the internal decorations of dwelling houses and public buildings, and in the mode of manufacturing and fixing the same.* Dated October 19, 1867.

This invention consists in making such decorations either wholly or partly of cast iron, thereby facilitating the fitting up of the same, and affording great scope for elaborate and durable ornamentation at a small expense. In making these decorations the patterns are made in one or more parts, and of any convenient length, and the castings are nailed or secured to the walls or ceilings, or to both. The improvements in making ceiling centres consist in making the pattern in radiating segments, so that the entire centre can be cast from a small sectional pattern.—Patent abandoned.

2939 M. J. MATTHEWS. *Improvements in pianofortes.* Dated October 19, 1867.

This invention has principally for its object to obtain in pianofortes, by an improved construction, a greatly increased stability of the case or frame which resists the strain due to the tension of the strings, together with additional power and improved quality of tone. The principal features of novelty comprised in the invention are, first, the disposing of the strings in duplicate, or in two sets arranged back to back, as it were, those on one side thus resisting and balancing the tendency which those on the other side have to bend the frame, combined with the adaptation to such duplicate strings of one or more, and by preference two, sound boards held in position solely by the pressure of the strings. Secondly, the fixing of the bridge pieces, or some of them, on the sound boards; and, third, the application of such duplicate strings of corresponding duplicate hammers arranged to be actuated by means of one set of keys, or by means of two sets of keys.—Patent completed.

2940 W. LIEBERMANN. *Improvements in the construction of churns.* Dated October 19, 1867.

This invention relates to certain improvements in the construction of churns whereby butter may be made in a few minutes, the churns being self-acting. The inventor proposes to set on a framework supported on standards a hollow drum of wood, capable of turning vertically on a horizontal shaft placed and rested in bearings on the frame; one end of the shaft or axis is provided with a pinion or small-toothed wheel which is furnished with a toothed ring gearing into the teeth of the pinion. A box containing a spring is employed, the bearing of this spring box being also in the frame at the side of the pinion. The drum has an aperture at the top fitted with a hinged lid and fastening, by which means the cream to be churned is supplied to the drum; the spring having been wound up by a winch handle fitting a square or triangular spindle, the drum, which is previously secured to the frame by a hook, is released, and is caused to rotate rapidly by the power of the spring, which is to be of such length as to continue turning the drum for about six or seven minutes, when it will be found that the cream has been converted into butter.—Patent abandoned.

2941 W. R. LAKE. *Improvements in breech-loading fire-arms.* (A communication.) Dated October 19, 1867.

This invention relates, first, to breech-loading mechanism of novel construction for firearms, the breech of which is closed by a cylindrical block fitted to slide endwise in a chamber at the rear of the barrel. The block is provided with a catch or projection extending from its surface, and when the breech is closed, the block is turned upon its axis, so as to bring the said catch in front of a shoulder on the breech chamber, the block being thereby kept securely up to the breech. In opening the breech, the catch is turned back into line with a longitudinal aperture, which allows the catch to pass, and the block to be drawn back. The cartridges are ignited by the blow of a firing pin which passes through the cylindrical block, and is driven forward by a spring held by a catch, from which it is released by means of an ordinary trigger. The said improvements may be said to consist, chiefly, in the peculiar construction and arrangement of the main spring and in the devices employed in connection with the trigger for holding and releasing the said spring. The invention relates, second, to certain improvements in needle guns, more especially those known as the "Chassepot" gun. The details are voluminous.—Patent completed.

2942 A. F. JALOUBEAU and C. L. LARDY. *Improvements in the construction of telegraphic cables, and in the apparatus for the manufacture thereof.* Dated October 19, 1867.

These improved cables are constructed in the following manner:—The copper conducting wire is first covered with bituminously prepared thread or twine; the cable thus formed is then subjected to a hot bituminous bath, by which a layer or deposit of bitumen is obtained; this is covered with bituminously prepared paper wound spirally round the cable; it is then again subjected to the bath and a second layer of bitumen deposited thereon, after which it is again covered with the paper, as before, and then coated with bitumen by means of the bath; then another layer of paper, then a layer of bitumen, then a layer of paper, then a layer of thread, as before, and finally a casing of bitumen, which is sanded all over; and in cases where it is desired to make a more powerful cable, it may be strengthened by iron bands wound in a spiral form round it; this is done previously to the final coating and sanding. The cables thus manufactured are flexible and solid, whilst at the same time, the wires, being perfectly insulated, have all the necessary conducting properties, and from the simplicity of the manufacture, and the materials employed therein, have considerable advantage over those in present use. The apparatus employed is not described apart from the drawings.—Patent completed.

2943 L. NEWTON and J. SWAILES. *Improvements in corks or stoppers for bottles, and in machinery for manufacturing the same.* Dated October 19, 1867.

The patentees claim, first, corks or stoppers for bottles or other vessels with flat-sided or round, milled or fluted heads, as described. Second, the combination and arrangement of mechanism for forming at one operation in each spindle one or more of the head parts of corks or stoppers, as described. Third, the improved modes of gripping and holding the blank, and of holding and fluting the blank, so that it will rotate with the spindle and also the mounting of the reducing tools directly upon the end of the lever, actuated by the cam, thus dispensing with the slide, as described. Fourth, the combination and arrangement of the mechanism for making the head parts of corks or stoppers, as described. Fifth, the modes of fluting or milling the heads of corks or stoppers, as described. Sixth, the arrangements for facilitating the dipping of the point ends of the head parts of corks or stoppers into the cement, as described. The details of the invention are too voluminous to be quoted here.—Patent completed.

2944 J. SCHWARTZ. *Improvements in cooling or refrigerating water.* Dated October 19, 1867.

The patentee claims the mode of and apparatus described for cooling or refrigerating water by subdividing it or dividing it up into drops or thin films or streams, so that the heat may more readily escape or be abstracted therefrom, as set forth.—Patent completed.

2945 F. ADKINS. *Improvements in the manufacture of hoes.* Dated October 19, 1867.

This invention consists in manufacturing hoes, whether of iron, steel, or steel iron, or iron and steel, or any of these metals combined, by rolling strips, sheets, or bars of such metal or metals into a form to make, when cut into shapes, the article required to be produced.—Patent abandoned.

2946 J. ANDERSON. *Improvements in the manufacture of felts, and in machinery connected therewith.* Dated October 19, 1867.

This invention relates to the manufacture of the materials commonly known as sheathing, inodorous, and roofing felts, and consists, first, in coating or covering one or both of the surfaces of such felts, after they have passed through the ordinary process of manufacture, with a thin layer of the native mineral pitch, commonly known as asphalte, or other bituminous substance, so as to render unnecessary the painting or coating thereof by means of brushes, as ordinarily practised when such felts have been applied to use. The means employed for so coating or covering the surface or surfaces of the said felts consist in passing such felts over or under a cylinder or cylinders attached to or in connection with the ordinary machine, and during their passing they receive a coating of the said substance, which percolates or flows through a long narrow slot in, or is lifted by, the cylinder or cylinders out of, or is otherwise conveyed from, a box or pan filled with the said substance, and placed over, under, or at the side of the cylinder or cylinders. And the invention also consists in covering or dusting the surface or surfaces so coated as aforesaid with the refuse of flax or card waste, commonly known as shives, in order to give the material a light colour, and to prevent the coating above described from adhering to anything with which it may be brought into contact.—Patent abandoned.

2947 E. BUTTERWORTH. *Improvements in machinery for preparing and spinning cotton or other fibrous substances.* Dated October 19, 1867

This invention consists, first, in an improved apparatus for driving the bobbin shafts of slubbing, intermediate, and roving frames. In performing this part of the invention, the inventor fastens a bevel wheel on one of the bobbin shafts, which is driven by a bevel wheel on one end of a diagonal or cross shaft (which shaft is carried by a frame, one end of which frame is supported by the lifting rail or slide, and the other by a fixing stud or shaft that is concentric with the wheel that drives the diagonal shaft); on the other end of this diagonal shaft is another bevel wheel, which is driven by a wheel fastened on the boss of the "Jack-in-box," as usual. This wheel he makes with the teeth to face the teeth in the wheel on the bobbin shaft first mentioned. The second part of the invention consists in making the shafts, studs, or bosses, on which revolve the "Jack-in-box" wheels of slubbing, intermediate, and roving frames, hollow or smaller in diameter for a portion of their lengths, so as to form a reservoir for oil. The third part of the invention relates to the drawing rollers of slubbing, intermediate, or roving frames, or other preparing or spinning machines. These have formerly been made of steel, or iron not hardened; but this invention consists in making them, or the surfaces of them, of hardened steel or iron, or other material which cannot easily be dented.—Patent abandoned.

2948 M. W. SHOVE. *Improvements in the construction of letter boxes, pillar letter boxes, and money and other such like boxes.* Dated October 19, 1867.

The patentee claims, first, the combined arrangement of certain plates acting together in the manner described; and, secondly, attaching an alarum to a letter-box so that it shall be caused to sound each time that the flap or letter plate of the box is opened.—Patent completed.

2949 R. WATKINS. *Apparatus for discharging projectiles from vessels or forts below the water line.* (A communication.) Dated October 19, 1867.

Here the patentee employs a tube of bronze, or any other suitable material, of a suitable length internal bore and thickness. This he mounts in two or more bearings to permit of its being slid or moved longitudinally therein by means of a rack and pinion, or mechanical equivalents therefor. One end of this tube or conductor is fitted to the muzzle of the gun, to which it may be securely fixed. The bore of the tube and that of the gun may be of the same diameter and coincident. The other end of the tube or conductor is fitted with a plug or cap piece. Thus the tube or "conductor," when attached to the muzzle of the gun, will form a continuation or elongation of the gun itself. Near to the gun end of the tube or "conductor" he prefers to employ or fit a sliding or other convenient form of shut-off valve for the purpose of preventing water entering the muzzle of the gun after each discharge, and the valve may either be closed by hand, or by means of the recoil of the gun, or by a spring or weighted lever. A cock or union and valve may be fitted to the lower side of the tube for the purpose of drawing off any water that may be therein; also for the purpose of effecting a connection with an air pump, or other exhausting apparatus. Reference to the drawings is essential to a full description of the invention.—Patent completed.

2950 H. HUGHES. *Improvements in the manufacture of ornaments for dresses and decorative purposes.* Dated October 19, 1867.

This invention consists, essentially, in combining with a skeleton frame, having depending edges and pins or points, a piece of velvet or other desired material, the edges of this material being held within the edges of the frame, and the metal pins serving to secure the whole to a dress or other article.—Patent abandoned.

2951 M. B. NAIRN. *Improvements in power looms.* Dated October 21, 1867.

This invention has principally for its object, by an im-

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proved construction, to render power looms suitable for weaving very wide and heavy fabrics, such as floorcloth canvas of, for example, eight yards in width, and the principal features of novelty are—first, the actuating of the lathe by cams which keep it back for a length of time sufficient for the passage of the shuttle, and allow it to beat up by the action of gravitation alone or combined with springs; second, the actuating of the picking levers also by gravitation, by means of weighted levers which are raised and let fall by cams; and, third, the arranging of the driving gearing in duplicate at the two sides of the loom. —Patent abandoned.

2952 W. CROSSLEY and T. C. HUTCHINSON. *Improvements in the manufacture of alumina and salts of alumina from blast furnace slag or from other silicates of alumina containing all excess of lime or magnesia.* Dated October 21, 1867.

This invention consists in certain improved processes for the manufacture of alumina and salts of alumina by means of the decomposition of blast furnace slag, or other silicates of alumina containing an excess of lime or magnesia.—Patent completed.

2953 W. BARRETT and C. MARTIN. *Improvements in tuyeres for blast furnaces and other purposes.* Dated October 21, 1867.

Tuyeres constructed in accordance with this invention are formed of heavy piping, such as is used for Perkins's well-known hot water apparatus, the same being made into a coil of the desired size. The pipes are arranged as flow and return pipes, and commence at and return to any convenient positions, at which they are connected together and placed in the form of a coil or otherwise in a cistern or reservoir of cold water when required for use; the pipes are previously charged with water, such space as may be necessary for its expansion being left therein. As the water passes down the flow pipes to the nozzles, it becomes heated, and rises again through the return pipes, and having been cooled by passing through the cistern or reservoir of cold water, again descends, the tuyere pipes being thus constantly charged with a circulating current of water.—Patent completed.

2954 C. D. ABEL. *Improvements in screw bolts and nuts for securing fish plates and other objects.* (A communication.) Dated October 21, 1867.

This invention consists in constructing screw bolts with two threads of a different pitch, and with square or polygonal ends of equal dimensions with or less than the other part, whereby to turn the bolt. These bolts are provided with two nuts, one at each end, each nut having a thread of a pitch corresponding to the thread of that part of the bolt on which it fits. These nuts are so formed that they cannot turn.—Patent abandoned.

2955 J. HUNTER. *Improvements in the permanent way of, and in signalling on, railways; also in lubricating the axle and other bearings of the engines and other carriages of railways.* Dated October 21 1867.

This invention is not described apart from the drawings. —Patent completed.

2956 J. CLAPIER. *An hygienic pillow (Parisian).* Dated October 21, 1867.

The distinctive character of this invention consists, first, in the use of metal plates, bare or covered, of cane, whalebone, or hooping formed into a sort of trellis work cage, containing springs, and permitting air to circulate freely within it. Second, in the style of the cushions fastened together by a lacing through metal or other eyelet holes by ribands, cords, buttons, or clasps set far enough apart to permit air to pass freely into the cushions or coverings applied on the trellis-work cage above described. Third, in the style of the feather cushion with even covering stuffed in compartments closed by platbands sewn or glued, the effect being that the down cannot pass from one compartment into the other.—Patent completed.

2957 A. H. BRANDON. *An articulated artificial leg.* (A communication.) Dated October 21, 1867.

This invention is not described apart from the drawings. —Patent completed.

2958 C. DUNCOMBE. *Improvements in apparatus for charging and closing breech-loading cartridge cases.* Dated October 21, 1867.

We cannot here give space to the details of this invention. We shall probably describe and illustrate it in a future number.—Patent completed.

2959 H. HUGHES. *Improvements in bottles and other like receptacles, and in apparatus for stoppering and unstoppering the same.* Dated October 21, 1867.

This invention—so far as it relates to bottles and other like receptacles, such as preserving jars and others—consists in forming an aperture transversely through the neck extending through both sides in addition to the ordinary vertical aperture. This transverse aperture may be square, round, or of other convenient shape in section; it is preferably tapered, and is intended to receive a cork or stopper for closing the mouth of the bottle or receptacle. The ordinary vertical aperture is then only used when filling or cleaning. The apparatus for stoppering and unstoppering bottles and like receptacles having these transverse apertures consists of a ring or cap to fit over the neck of the bottle; this ring or cap is provided with a nut through which a screw passes; this screw has at its inner end a button or plug which, as the screw turns, is pushed in or out; the outer end of the screw is provided with a handle. In corking or stoppering, the cork or stopper is inserted into the transverse aperture; the stoppering apparatus is then applied, and by turning the screw the button drives the stopper in tight. To unstopper, the apparatus is applied at the opposite end of the stopper.—Patent abandoned.

2960 W. R. LAKE. *Improvements in electric telegraph apparatus.* (A communication.) Dated October 21, 1867.

This invention relates, chiefly, to the construction of recording or writing instruments wherein the pen or marking point is attached to a magnet which is supported in fluid contained in a suitable vessel surrounded by coils of insulated wire. An electric current passing through these coils moves the pen or marker into contact with the surface of a strip of paper or other material which is caused by clockwork or mechanism to travel past the point of the pen. The magnet may either be supported in the ink or other marking fluid, or in alcohol, or other liquid, the ink or other marking fluid being contained in a separate reservoir attached to the pen, or otherwise arranged. The specification of the invention comprises much detail which we cannot devote space to here.—Patent completed.

2961 J. ADAMS. *Improvements in the construction of breech-loading revolver firearms.* Dated October 22, 1867.

The patentee claims, first, the construction and application of a movable shield to the cylinders of breech-loading revolver firearms, as and for the purpose described and set forth, or any mere modifications thereof. Second, the combination and arrangement of the several parts, and mechanism described and set forth, for the purposes aforesaid, or any mere modifications thereof. The details of the invention are voluminous.—Patent completed.

2962 T. WEBB. *Improvements in the construction of sewing machines.* Dated October 22, 1867.

Under the first head of this invention the patentee connects to the shuttle carrier a bar in the form of a cross, the ends of the said bar being supported by and guided in rectangular-shaped holes or pieces fixed to or formed upon the under side of the bed-plate of the machine, and crosswise thereof. The middle portion of the bar has a long slot or opening formed therein, into which a pin takes, the pin being fixed in a disc of metal fastened on to a spindle mounted in bearings, and revolving at right angles to the shuttle bar before mentioned underneath the bed-plate of the machine. He connects this bottom motion with another spindle or top motion for actuating the needle bar and feed, either by means of pulleys and an endless band, or a train of wheels. The needle bar is worked by a pin fixed in a cam or eccentric fastened on the top spindle, and the said pin takes into a slot of a heart shape, or somewhat resembling that shape, and formed near the upper end of the needle bar, so that as the before-mentioned disc of metal revolves, the pin therein will lift up and force down the needle bar and needle at the proper times, the shape of the heart-shaped slot being such as to allow the needle bar to pause whilst the shuttle is passing through the loop of the stitch. The cam or eccentric above-mentioned is also employed to work the feed bar for advancing the work to be sewn, and for holding the work firmly whilst it is being sewn, and to release it at the proper time; or the feed bar may be worked from the bottom motion if desirable. The machine may either be worked by a treadle or by hand.—Patent completed.

2963 C. RITCHIE. *Improvements in tobacco pipes.* Dated October 22, 1867.

This invention has reference to all pipes having two bowls, one inside the other, and consists in applying to the inner bowl a rim or collar of meerschaum, wood, or other material suitable for the purpose, which is fixed to the inner bowl, but separate therefrom, whereby the inner bowl can be removed at all times with perfect ease whenever it may be desired so to do.—Patent abandoned.

2964 T. LEMIELLE. *Improvements in fans for the ventilation of mines, or for propelling air into furnaces, or for other purposes.* Dated October 22, 1867.

This invention relates to a former patent granted to the present patentee, dated 8th May, 1854 (No. 1031), which consists in the employment of a circular outer case, within which, and situated eccentrically to the axis thereof, a cylindrical or hexagonal case, capable of rotary motion, is provided with rectangular vanes, called doors, hinged to the outer surface of the said cylinder, or to the angular points of the hexagonal case. The object of the present invention is to prevent the entrance of air into the eccentric cylinder above described, and thence its return into the mine or other place, either between the covering of the ventilator and the upper and lower ends of the said eccentric cylinder, or through the slots or apertures in the said eccentric cylinder through which the connecting rods pass to the vanes or doors. The details of the invention are too voluminous to be produced here.—Patent abandoned.

2965 P. and A. WALKER. *Improvements in shoes for horses and other animals.* Dated October 22, 1867.

The object here is to render unnecessary the use of nails, and to give ease and freedom to the horse's feet. Each shoe is provided with a projection standing up at or near the front thereof, and lying against the front of the hoof for receiving, by a catch connection, part of a band of iron or other metal. This band thence passes round the lower part of the wall of the hoof to the back thereof, and at its ends is by nuts and screws secured to lugs or projections standing up at the back ends, or the heel of the shoe, in order that the band may be tightened to the extent desired to retain the shoe in position on the foot.—Patent abandoned.

2967 G. JONES. *Improvements in mounting or applying wheels to road carriages of all kinds.* Dated October 22, 1867.

This invention consists in means of mounting the wheels of road carriages so as to reduce the friction on the axle to a minimum, and consists in forming the nave of the wheel, through which the fixed axle runs, with two annular fixed collars, and about one-fourth of the distance from each end of the opening. On the outer of each of the annular rings is placed a number of anti-friction rollers, which encircle the axle, and have their axes in line with the stationary axle which they surround, and the bearings of the anti-friction rollers are formed in a pair of rings which are together and connected parallel by short studs dispersed at equal distances between the rollers, so as to insure the unity of motion of the several parts of the anti-friction rollers. The inner end of the fixed axle is formed with an annular collar, and is provided with a plate or loose disc surrounding the axle, but which is secured by nuts and bolts, or in any other convenient way to the nave, thus preventing the travelling wheel being drawn off its fixed axis. The outer set of rollers may be held in position by a screwed cap or cover, or in any other convenient manner.—Patent abandoned.

2968 J. WHITE. *Improvements in means for ventilating buildings and other places.* Dated October 22, 1867.

This invention relates to means for withdrawing vitiated air from a room or enclosed space. For this purpose the patentee forms apertures in the ceiling of the room or enclosed space, and he employs suitable channels or passages communicating therewith, and with a chamber connected with the grate or fireplace employed to warm such room or enclosed space, and from such chamber a pipe or channel is carried a short distance up the flue. Thus, by the heat generated by the grate or fireplace in the chamber connected therewith, the air contained in such chamber is rarefied, and in passing off by the flue such rarefied air carries away with it the vitiated air from the room or enclosed space. The vitiated air passes through the apertures in the ceiling, and by the channels or passages into the chamber connected with the grate or fireplace, and out thereof through the pipe into the flue.—Patent completed.

2969 W. BEALE. *A telescopic apparatus applicable as a temporary or stationary observatory for temporary bridges, building, and other purposes.* Dated October 22, 1867.

This apparatus consists of a telescopic column or columns arranged upon and adapted to a base or framework, the base or framework being provided with wheels for the purpose of moving the apparatus from place to place. Wheels, pulleys, chains, and other parts or contrivances, are employed in working the apparatus.—Patent completed.

2970 H. W. SAMBIDGE. *Improvements in sliding gasaliers, chandeliers, and other pendent lamps.* Dated October 22, 1867.

This invention consists in dispensing with the ordinary water joint by the substitution of a solid boss or carrier upon the outer tube, which boss or carrier is for the purpose of sustaining the balance weight chains. Two tubes only are employed, one sliding within the other, and above the boss or carrier is fitted a gland or stuffing-box through which the inner tube works.—Patent abandoned.

2971 A. V. NEWTON. *An improvement in dredging and spice boxes.* (A communication.) Dated October 22, 1867.

This invention consists, simply, in forming a group of lateral perforations in one side only of the cap or covering of the vessel containing the powdered materials to be sprinkled, whereby the act of sprinkling or discharging the materials is easily and conveniently performed by holding the vessel in a horizontal position.—Patent completed.

2972 W. GRAY. *Improvements in the manufacture of file blanks, and in the machinery or apparatus employed therein.* Dated October 22, 1867.

This invention relates to the rolling of file blanks of all shapes and sizes required by the trade, in lieu of forging the same by hand labour, and consists in the employment for that purpose of rolls to which are attached or fitted plates and collars of steel, wrought iron, chilled cast metal, brass, or other suitable metal or alloy, such plates and collars being specially formed and adapted for the production by rolling of file blanks.—Patent completed.

2974 J. HADDOCK. *Improvements in the construction of shuttle tongues.* Dated October 23, 1867.

This invention consists in uniting the shuttle tongue to the head or tumbler by means of a spring, or some other analogous contrivance, so that, when the shuttle is stopped by the swell, or the nose of the shuttle is struck by the picker, the shuttle tongue, with the cap upon it, can yield, and thus the liability of knocking the cap off, or loosening it, is avoided.—Patent abandoned.

2975 C. D. ABEL. *Improvements in the means and apparatus for pulverizing substances more particularly applicable to the pulverization of materials for porcelain paste.* (A communication.) Dated October 23, 1867.

The patentee claims pulverizing materials for porcelain paste and other substances by introducing them together with balls of glass or porcelain inside a revolving porcelain cylinder, arranged and operating substantially as described.—Patent completed.

2976 T. WELTON. *Ozonized or oxygenated bread, biscuits, cakes, and other substances.* Dated October 23, 1867.

This invention relates to a new process for curing disease in man and animals by means of charging the food with ozone, oxygen, or other gases as found most suitable, and also for rendering that food more nutritious, and more capable of sustaining animal life. The inventor uses, by preference, vegetable substances, either in their raw or cooked state. It is probable that an extension of time for completing this patent will be petitioned for. It is at present in that stage to which we append the words —Patent abandoned.

2977 F. J. BUGG. *Improvements in the manufacture of pressed leather.* Dated October 23, 1867.

Here the patentee employs in the manufacture of pressed leather (which is made from curriers' shavings, &c.), a cementing material which is not soluble in water, and he dissolves it for use in a suitable solvent. India-rubber and shellac may advantageously be employed as cementing materials in this manufacture, and they may be dissolved for use in naphtha or turpentine, but other cementing substances not soluble in water may also be used with appropriate solvents.—Patent completed.

2978 F. SEILER. *Improvements in apparatus for compressing air, and for working pneumatic railways.* Dated October 23, 1867.

This hydro-pneumatic apparatus is an improvement upon certain single-acting hydro-pneumatic apparatus, invented by the present inventor, a modification of which has been, and is now, employed in connection with the Mont Cenis railway tunnel for supplying the compressed air for the rock-boring machines, and for renewing the air in the tunnel. The details of the invention are too voluminous to be produced here.—Patent abandoned.

2979 C. S. JEAFFRESON. *Improved apparatus for treating fractures of the limbs.* Dated October 23, 1867.

This invention consists, principally, in substituting for the pads ordinarily employed bags or pads of india-rubber, waterproof cloth, or other suitable impermeable material. These bags are provided with tubes and nozzles by means of which they are inflated with air, or filled with water, as may be thought most desirable. They will then fit exactly to the limb, and will give an equal pressure at all parts.—Patent abandoned.

2980 A. M. CLARK. *Improvements in steam governors and valves.* (A communication.) Dated October 23, 1867.

This invention relates to centrifugal ball governors for regulating the motion of steam engines, waterwheels, and other machinery, and they consist, first, in a device for controlling the action of ordinary ball governors, so that they shall more perfectly perform their function as regulators of machinery to make the motion uniform and steady. This object is accomplished by providing a lever in connection with the governor stem, which is actuated directly by the pressure of the steam upon a small piston in a pipe leading from the boiler, and also other devices connected therewith, whereby the closing and opening of the valve is exactly graduated, and the steam cut off entirely by an instant closing of the valve in case of accident or interruption to the machinery. Second, in a device to be applied to governors for the purpose of preventing the joints and valves from gumming or becoming rough and dirty with scale and oil, causing them to work stiff. This improvement consists in stopping the governor spindle in the

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valve stem in such manner as to produce a bobbing or saltatory motion, which keeps all the parts moving continuously, and thereby always in good working condition. Third, in forming the valves and valve seats with chilled rubbing surfaces to prevent cutting and wearing away.—Patent completed.

2981 J. L. NORTON. *Improvements in sinking or forming wells, and in apparatus to be used for this and similar purposes.* (Partly a communication.) Dated October 23, 1867.

The patentee claims driving a well tube by means of a weight or driver guided in its rise and fall by the well pipe itself, or by a guide or lengthening bar carried thereby. He also claims employing a ring clamp capable of being fixed on the tube at any part of its length to receive the blows of the weight or driver. He also claims the construction of the said clamp in the manner described. He also claims employing a ring clamp fixed on the tube, or on a lengthening bar carried thereby, to carry the pulleys for the ropes or chains to lift the weight or driver. Also he claims carrying these pulleys, and steadying the upper end of the pipe, by means of a tripod, or similar support. Also he claims applying springs to maintain a strong downward pressure on the well tube whilst it is driven by the blows of a weight or driver. Also he claims a tube perforated at its lower end, and with a screw thread upon it, externally applied, to produce a well in the manner described. Also he claims the application of springs in a similar manner when driving piles and exploring tubes. Also he claims clearing the soil from the interior of the well tube by the introduction within it of a smaller tube having a pump applied and worked so as to draw up the soil together with the water poured down the well tube. Also he claims forcing water down the well tube, both to lubricate it during the driving and also to form passages to the water-bearing strata.—Patent completed.

2982 A. CHAMBERS. *Improvements in machinery for the manufacture of files.* Dated October 24, 1867.

The specification of this invention is too elaborate to be quoted here at sufficient length for an intelligible abstract. It is probable that an extension of time for completing this patent will be petitioned for. It is at present in that stage to which we append the words—Patent abandoned.

2983 H. R. ST. MARTIN. *Improvements in ornamenting transparent, or partially transparent, glass.* Dated October 24, 1867.

This invention consists, first, in subjecting those parts of the transparent or partially transparent glass which are to be covered by the intended ornamentation to the action of any suitable acid, whereby such parts may be eaten away to a depth equalling the thickness of the parti-coloured transparent glass to be used in the composition of the ornament. The various pieces of coloured glass are then inlaid in their prepared bed, according to the various lines presented by the object, design, or device intended for representation. The pieces of glass thus inlaid and arranged may be fixed and retained in their proper position by any convenient means, such, for instance, as the use of some agglutinative matter, as copal, amber, or other varnish, or by placing a sheet of transparent glass so as to rest on and cover the whole surface of the ornament, or by a combination of such methods. Second, the pieces of coloured glass intended under various forms and in various combinations for the species of ornamentation which the inventor has indicated, instead of being cut into their required shapes, may be produced in any form from sheets of coloured glass in a similar manner to that referred to for inlaying glass. But instead of only eating away the glass to a certain depth by the application of appropriate acid, the inventor proposes to eat through the entire thickness of the coloured glass surrounding the outline of the traced figure. Third, he proposes to affix pieces of transparent parti-coloured glass, having either flat-faceted or curved external surfaces upon a sheet or sheets of transparent glass, the pieces of parti-coloured glass being so formed and arranged as to present various objects, designs, or devices.—Patent abandoned.

2984 F. GERHARTZ. *Improvements in the manufacture of manures and disinfectants.* Dated October 24, 1867.

This invention relates to the preparation and use of charcoal obtained in the manner described in the specification of this invention in the manufacture of sugar from beet root. The details are voluminous.—Patent abandoned.

2985 J. THOM and A. MACLURE. *Improvements in the manufacture of ornamental fabrics.* Dated October 24, 1867.

This invention consists in producing ornamental devices in the weaving process by heddles, harness, or other known means, and in producing the ornamental devices or parti-colourings either by printing the warps, or by printing the weft, or by printing the warps and weft before they are woven.—Patent abandoned,

2986 R. W. THOMSON. *An improved wheel for steam carriages, to be used on common roads.* Dated October 24, 1867.

This invention consists in applying to the wheels of such carriages external bands or tires of vulcanized india-rubber, instead of making such wheels with tires or external treading surfaces of iron or wood, as hitherto.—Patent completed.

2987 J. ELLISON and J. STIRK. *Improved means and apparatus for economizing fuel and consuming smoke in steam boilers and furnaces.* Dated October 24, 1867.

This invention has reference, principally, to Cornish boilers, though applicable to other boilers and also furnaces. The patentees take an old Cornish boiler, for example, which is fired internally within the flue, and behind the bridge they insert an Archimedean screw composed of metal, cast or wrought, or of any other suitable substance. This screw may be of nearly the same diameter as the flue itself, and may extend from the bridge to the end of the flue. The action resulting from the use of it is that the flames from the fire, after passing the bridge, are conveyed equally over the whole internal surface of the flue, by which means the water under the flue in the lower part of the boiler becomes heated (instead of being nearly cold, as is the case in ordinary flues) as well as that surrounding the top and sides. A further result arising from the use of this screw (the vanes of which are supposed to be solid as well as its centre or core) is, that its vanes becoming heated from the action of the flames, the smoke which would otherwise be emitted into the chimney is consumed, consequently the two points of economizing fuel and consuming smoke are attained.—Patent abandoned.

2988 W. E. GEDGE. *A novel kind of nail or tack specially intended for upholstery and cabinet work.* (A communication.) Dated October 24, 1867.

This improved nail or tack is made of brass or of copper, and by casting, so that any desired ornamentation may be moulded on its head, which may then be gilt, silvered, or burnished, as may be preferred.—Patent completed.

2989 G. OLNEY. *Manufacturing and for improving illuminating gas.* Dated October 24, 1867.

The main features of this invention are, first, the arrangement, in connection with retorts, a cooler and a gasometer of carburators provided with tanks, filters, liquor chambers, connecting pipes, an air pump and its connections, an independent air pipe, a liquor pump with pipe, a gas pipe, a steam pipe, a liquor gauge and syphon gauges (as described in the specification), for the purpose of converting carbonihydrons and napthene vapours with atmospheric air into illuminating gas, or for making or producing a fixed or illuminating gas from carburetted air. Second, the injecting of petroleum, or its products, into heated retorts direct, by means of a pipe, and there combining it with atmospheric air, carburetted or not, and thus chemically producing illuminating gas by passing carburetted air through heated retorts. Third, the producing of illuminating gas by combining the carburetted air after having passed through the heated retorts (or within the same) with ordinary coal or oil gas. Fourth, the employment of an oil or equivalent seal as and for the purpose explained.—Patent abandoned.

2990 J. DODGE. *Improvements in machinery for cutting files.* Dated October 24, 1867.

This invention refers, firstly, to file cutting machines in which a shaper is used to regulate the force of the hammer on the cutter, and consists in transferring the weight of the acting spring from the part which moves on the shaper to a fixed point. Second, in the use of an abutment for the cutter, whereby it is prevented from slipping on the blank when the hammer has struck it. Third, the invention relates to loose cutters, and consists in an arrangement whereby they may readily be removed for whetting or other purpose. Fourth, the patentee mounts the cutter with an elastic abutment, in order that, when the hammer presses upon it, it may adjust itself to the blank before the blow is struck. Fifth, he compounds the hammer to make the part which effects the blow adjustable. Sixth, the invention relates to cutting half-round or other such files. Reference to the drawings is essential to a full description of the invention.—Patent completed.

2991 H. ADCOCK. *Improvements in kilns for burning pipes, tiles, bricks, pots, and earthenware.* Dated October 24, 1867.

The patentee claims economizing the heat in kilns for burning pipes, tiles, bricks, and earthenware articles, by causing the waste heat from one kiln to pass into a second, and thence to a third or more kilns, as and for the purposes set forth.—Patent completed.

2992 J. MITCHELL. *Improvements in buffers and draw springs for railway carriages.* Dated October 24, 1867.

The patentee manufactures these articles in a simpler form and more inexpensive manner than heretofore. He dispenses with the ordinary plunger, and instead thereof he forms the spiral spring of a flat broad piece of sheet steel, the outer coil of which, by being made parallel, fits in the fixed box, and acts as a plunger, and instead of the ordinary plunger.—Patent completed.

2993 H. RITCHIE. *Improvements in carriages.* Dated October 24, 1867.

This invention consists in constructing a four-wheeled semi-open carriage in the following manner:—The body of the carriage is made with a rigid head overhanging the back seat, and on this head at the front the driver's seat is formed, and under the driver's seat, to give it a firm support from the fore part of the body, two metal columns are erected; they carry also the coachman's footboard. In front of these columns, and immediately over the locking frame of the fore wheels, on the fore part of the body, is a platform on which luggage may be carried. The interior of the carriage has a back seat for two persons. There may be three outside seats on the head of the carriage, one by the side of the coachman and two behind, with their backs to him.—Patent completed.

2994 S. STACKARD. *Improvements in bottling apparatus.* Dated October 24, 1867.

This invention has for its object the so arranging bottling apparatus that the bottles may automatically, or without requiring the attention of the bottler, be all filled to the required level, and this without involving the exposure of the liquor to the air, as when an open trough is employed, such as is used in other bottling apparatus where the filling of the bottles to given a level is effected automatically. The details are too voluminous to be produced here.—Patent completed.

2995 A. M. CLARK. *Improvements in apparatus for transmitting and multiplying motive power.* (A communication.) Dated October 24, 1867.

This invention relates to a combination of parts forming an improved motor, whereby increased power may be produced and applied. This motor consists of two fly-wheels, independent one of the other, mounted in the same plane, the ends of their shafts being contiguous to each other. Two pulleys are mounted at each end of these shafts, the one fixed and the other loose, and provided with bands by means of which the fixed pulleys are driven alternately for setting the fly-wheels in motion. These four pulleys are of equal diameter, so that the driving bands may be readily transferred from one to the other. The two pulleys fixed one at the end of each shaft are loose, and made only half the diameter of the fixed pulleys, so that the two only have a surface equal to one of the pulleys. These two movable pulleys are so fitted for the purpose of transferring the belt from one to the other of the fixed pulleys without actuating them both at the same time, they being driven at different speeds, as the belt would meet with an obstacle to its motion were it to be placed at the same time on two fixed pulleys having different speeds. This improved motor may be set in motion in different ways, either by means of water, steam, gas, or air engine, or by animal or human power. Reference to the drawings is necessary for a full description of the invention.—Patent abandoned.

2996 J. H. JOHNSON. *Improvements in spinning machinery.* (A communication.) Dated October 24, 1867.

This invention has reference to improvements in the bearings of the spindles of mules, and the spinning machinery, and also to an improved system or mode of and means for lubricating the journals of such spindles. The main feature of this invention consists, first, in the application of oil or other lubricating liquid to the bolster and the step of spindles by means of a saturated fibrous substance, in such a manner as to prevent the waste of the oil and confine its action to the bearings. Second, in the form of a bolster which is so made as to allow the spindles to be removed with great facility. Third, in the mode of affixing the bolster and adjusting it in the line of the axis of the spindle. Fourth, in the shape or contour of the bearings to conform to the direction of the driving band. Fifth, in the substitution of a long bearing for the bottom of the spindle, in place of the common shallow cup or step, for the purpose of securing a more steady motion and reducing the wear of the spindles, especially of those that are driven from the bottom of the upright drum in mules, and have the driving wheels near the bottom of the spindle.—Patent completed.

2997 C. W. HARRISON. *Improved means of preventing incrustation in boilers and other vessels in which water is heated.* Dated October 24, 1867.

This invention consists in combining or connecting by any suitable means the shell of the boiler or vessel with another body which, in their electrical relations, shall be of a differing or opposite polarity or condition the one to the other, or capable of being rendered so.—Patent abandoned.

2998 R. WEARE. *Improvements in, and in apparatus for, the treatment and for the reception of urine and fæcal matter.* Dated October 24, 1867.

Here the patentee employs for the reception and treatment of urine and fæcal matter a vessel, by preference of a cylindrical form, and closed at the top and bottom. Within this vessel is an inner lining; it may be conveniently of perforated zinc; the sides of the vessel are thus double, and the space enclosed is packed full of powdered charcoal and dry earth, or other deodorizing powder. The soil pipe from an ordinary closet pan is connected with the top of the vessel, so that the urine and fæcal matter from the pan are discharged into the interior of the vessel. The more fluid matters then filter through the deodorizing material into channels which are formed for it against the outer sides of the vessel, and which are perforated, and these channels lead the fluid matters to a small pipe connected with the bottom of the vessel, and with a drain.—Patent completed.

2999 E. M. PALLISER. *Improvements in magazines or reservoirs for containing explosive compounds or liquids, and gunpowder.* Dated October 24, 1867.

The magazines consist of tubes of coiled wrought iron, steel, cast iron, or brass or gun metal, either closed at one end with a breech-plug screwed in, or open at both ends, and provided with copper doors to shut off the contents from fire or other explosions. If the breech-plug be used, the threads in the tubes should be in relief, so that the greatest depth of the threads may not encroach on the thickness of the tube.—Patent abandoned.

3000 W. and D. FISKEN. *Improvements in the construction of steam and other boilers.* Dated October 25, 1867.

This invention is carried out as follows:—The boiler, the ultimate form of which is that of an upright cylinder, the patentees construct of a series of sections, each of which somewhat resembles a multiform wedge. They connect these sections at the centre by as many crossties as possible consistent with the free passage of smoke and gas, and they connect them around the outer circle at the bottom by a tube for the reception and equalization of water, placing the junction of this tube in each wedge section above the mud-hole in each, except those in which the firedoor occurs. They also connect the steam space of each wedge section with a common duct, which may be made as large as the known wants of such steam receivers and conductors are known to require. They also connect the different sections in the fireway with cross stays, solid or hollow, or both solid and hollow, which stays have the effect of imparting the strength of the whole to each individual section, whilst the hollow ones will have the effect of adding to the heating surface of the boiler. In addition to the stays in the fireway, stays may be placed in the water space, solid or hollow, or both solid and hollow, by which stays each section will become sufficiently strong of itself. They make the sections as numerous as possible, so that each shall contain as small a body of water as practicable, circulation being secured by the differential thickness of the water exposed to the heating surfaces.—Patent completed.

3001 G. RUSSO and C. A. MACCARONI. *An improved apparatus for saving life and property in case of shipwreck at sea.* Dated October 25, 1867.

Provisional protection has not been granted for this invention.

3002 L. STOCKMAN. *Improvements in the construction of rollers for window blinds.* Dated October 25, 1867.

Here the patentee divides the roller through about the central line thereof into two parts longitudinally (except that he does not usually divide its extreme ends), and he has one half solid and the other slightly hollowed out (except as aforesaid). These parts he connects together by hinges or joints so that action similar to that of a box and lid is obtained. Into the now hollowed part of the roller he fixes a convenient number of small tenter hooks or catches, whereby the upper edge of the blind is to be secured to the roller, and to facilitate the attachment of the blind he prefers to provide the same with eyelet holes corresponding to the said tenter hooks, pins, or catches, and when the blind is secured the two parts of the roller are to be closed together, and then the blind will be tightly held between them, and the two parts are firmly kept in connection by a pin, bolt, lock, or hook and eye, or other suitable fastener.—Patent completed.

3003 G. J. GUNTHER. *Improvements in plating or protecting ships of war, fortifications, and other like structures, and the manufacture of the plates employed therefor.* Dated October 25, 1867.

The objects here are, chiefly, first, that none of those parts of the armour which are exposed to the effects of the enemy's fire shall exhibit any bolt holes, or other similar sources of weakness. Second, that by the shape of the armour plates, and of other necessary parts, and by the mode in which they are put together, the cohesion of all the parts composing the armour may be independent of any backing, or any fastening to any backing, and that thus the improved armour, instead of being by its weight a source of weakness and danger to any structure floating or stationary which it may enclose (or compose), will, on the contrary, contribute in an eminent degree towards the solidity, internal cohesion, and stability of any such struc-

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ture. Reference to the drawings is essential for a full description of the invention—Patent completed.

3004 H. WILSON. *Improvements in cocks or valves for discharging water, oil, and other fluids or gases.* Dated October 25, 1867.

This invention consists in an arrangement by which the passage of fluids through cocks or valves is so regulated that no waste can take place through negligence in closing the same. The inventor forms the barrel of the cock with a valve seating inside, through the centre of which a spindle passes on which two valves are fixed at any suitable distance apart, one above and one below the valve seating; under the bottom valve he fixes a spring which rests upon the bottom of the cock and presses against the valve above, thereby keeping it against the seating. On the top of the upper valve rests a flat disc, on the upper surface of which ridges or teeth are formed, which fit into corresponding ridges or teeth formed upon a similar disc which is fixed to the spindle by which the valve or cock is opened. Then, by moving the spindle of the valve or cock either to the right or left, the valve is freed off the seating by the discs, at the same time compressing the spring; as soon as the spindle is released, the spring closes the valve.—Patent abandoned.

3005 W. R. LAKE. *Improvements in carpet linings and in machinery for manufacturing the same.* (A communication.) Dated October 25, 1867.

This invention consists partly in the arrangement of mechanism through which the fibrous material is formed into a bat by being fed up to the surface of a card cylinder, the teeth of which carry the filaments to the surface of a lap-forming cylinder, upon the rotating gauze surface of which it is drawn and formed into a sheet, leaving the cylinder in this form, and passing thence between presser rolls, and between the sheets of paper passing between such rolls. The invention also consists in forming such lining of two strips of paper (receiving the batting between them), one of which strips is wider than the other, so that when they come together with the lining between them the opposite edges of the wide strip overlap the adjacent edges of the other strip in such a manner that they may be folded over and cemented to the said overlapped edges. The invention also consists in the means for applying cement to the edges of the wide strip, and in the mechanism for effecting the folding over of the cemented edges; also in a carpet lining in which the loose fibrous material is secured to a sheet of paper, or between sheets of paper, by cement applied over the surface of the paper. Also in a carpet lining having the paper and loose fibre united in a paper-making machine, or while the paper is in a pulpy or semi-pulpy condition. Also in a carpet lining having the loose filling secured between sheets of paper by cementing together the outer contiguous edges of the paper. Also in a lining having the loose filling secured to or between sheets of paper by rows of stitches or "quilting;" and, lastly, in a lining made of the general size and form of steps of stairs to be used as a carpet pad or lining.—Patent abandoned.

3006 W. R. LAKE. *Improved modes of, and means for, curing, drying, preserving, and packing meat, fruit, vegetables, and other perishable substances.* (A communication.) Dated October 25, 1867.

This invention relates, chiefly, to processes and apparatus for cooling and regulating the temperature of preserving and packing houses; also to warming and ventilating packing houses and other buildings for drying and curing meat, fruit, and other animal and vegetable substances, and for similar purposes. The patentee takes advantage of natural principles for the purpose of cooling air in the several classes of buildings and structures mentioned above. To do this it is necessary that the air to be cooled should be brought into contact either directly with ice, or with a good conducting surface which is cooled by the ice. The latter plan, the patentee states, is far preferable, and he has, therefore, adopted it. The details are very voluminous.—Patent completed.

3007 T. STENNETT. *Improvements in dressing and other bags.* Dated October 25, 1867.

This invention consists in constructing bags, such as "fitted dressing bags," with a box or case at bottom; the lid, which forms the base of the bag proper, is hinged to the box or case, and fitted with a lock or other fastening. The box or case contains drawers at each end, which are secured by springs. The box or case proper is fitted with articles, such as brushes, combs, or as taste or requirements may dictate; the cover is also fitted with articles such as knives, razors, scissors, or otherwise. When the box is open, all the contents are exposed to view. The upper part resembles an ordinary bag, and is secured by a lock, spring-catch, or other fastening.—Patent abandoned.

3008 A. M. CLARK. *Improvements in the mode of obtaining publicity and affording information or amusement.* (A communication.) Dated October 25, 1867.

This invention consists in introducing into skeins or reels of thread, silk, cotton, wool, and into other similar articles, small sheets or slips of paper on which are printed or lithographed either plain or coloured advertisements of all kinds, biblical and moral texts, verses, mottoes, rebuses, fashion plates, charades, songs, pictures of historical personages, views, and generally any printed information that may serve to attract, instruct, or interest the purchaser.—Patent completed.

3009 A. M. CLARK. *Improvements in apparatus for the manufacture of postage stamps and other labels, and for reproducing designs on paper or fabrics, and in the preparation of engraved surfaces to be used therefor.* (A communication.) Dated October 25, 1867.

This invention consists, first, in an improved process of engraving, by means of which a design in relief is obtained on a cylindrical surface for producing a typographic impression, the colours applied being indelible, which result has only hitherto been obtained in copperplate engraving on plain surfaces, and with non-continuous impressions. This improved process of engraving, therefore, consists, first, in obtaining a relief engraving having all the artistic finish desired from which a perfectly identical sunk engraving is obtained. Second, in the application of this sunk engraving, which reproduces with mathematical exactness the lines of the graver, and forms a typographic relief on any suitable cylindrical surface of copper, brass, steel, or other metal. The second part of the invention relates to apparatus for the manufacture of postage stamps or labels, the chief feature in this apparatus being that the impression, instead of being produced by flat plates, as usual, is effected by the aid of printing cylinders prepared or engraved in the manner before described. The same machine may both at once perforate, print, and gum the continuous paper surface. —Patent completed.

3010 P. LOVE. *Improved apparatus for regulating the supply of food to cattle, sheep, and other animals.* Dated October 25, 1867.

This invention is not described apart from the drawings. —Patent completed.

PROVISIONAL PROTECTIONS.

Dated March 23, 1868.

975 H. Paulus, Boulevart de Strasbourg, Paris, merchant. An improved pile-driving engine with modifiable length of stroke of the ram, applicable also to other purposes.

Dated March 25, 1868.

1025 A. P. Price, Lincoln's Inn-fields, consulting chemist. Improvements in the treatment of ores, and in apparatus or means employed therein.

Dated March 27, 1868.

1061 H. Hughes, Bristol, builder, and C. Jones, Wolverhampton, lockmaker. Improvements in locks and keys.

Dated March 31, 1868.

1088 W. Allen, Port-street, Manchester, manufacturer of pumps and valves. Improvements in diminishing valves and steam traps for steam pipes.

1090 M. Hawthornthwaite, clerk, and T. Abbott, plumber, Lancaster. Improvements in taps, cocks, or valves for water, gas, steam, or other liquids.

Dated April 1, 1868.

1103 L. Appleton, Princess-terrace, St. Mark's-square, Regent's Park. An improved method for calculating interest and apparatus therefor.

1108 W. Clissold, Dudbridge Works, near Stroud, Gloucestershire, engineer. Improvements in belt fastenings, which improvements are also applicable to the uniting of parts of harness.

1111 J. H. Dufort, merchant, and D. Gance, mechanician, Boulevart St. Martin, Paris. Improvements in sewing machines.

Dated April 2, 1868.

1118 W. Robertson, Glasgow. Improvements in machinery or apparatus for making mitre or other angular joints. (A communication.)

Dated April 4, 1868.

1138 W. Johnson, Stanhope Villa, Campden Hill, Kensington. New or improved machinery for compressing and moulding coal, peat, clay, and other plastic materials.

Dated April 6, 1868.

1152 J. Dunbar, Vicarage-road, Camberwell, S.E., engineer, and R. Nicholson, Dulwich, S.E. Improvements in the construction and arrangement of machinery or apparatus for supplying coal, cannel, or other substances to retorts or ovens, and for withdrawing the same after distillation; also improvements in retorts, retort chambers, mouthpieces, doors, covers, or lids.

1155 M. A. F. Mennons, Rue de la Chaussee d'Antin, Paris. Improvements in apparatus for the transmission and reception of typographic or autographic telegrams. (A communication.)

1158 J. Perry, Rathdowney Brewery, Queen's County, brewer. Improvements in packing bottles and similar articles, and in cases or holders therefor.

Dated April 8, 1868.

1182 G. H. Palmer, Exchequer-place, Lewisham, Kent. An improved spring brace.

Dated April 9, 1868.

1193 J. Plews, Rosedale Villa, Grove-road, Hounslow. Improvements in steam engines.

1197 J. H. Whitehead, Royal George Mills, near Manchester, woollen manufacturer. Improvements in apparatus for removing soot from the surfaces of heating tubes.

1199 J. Leeming, Bradford, Yorkshire, machine maker. Improvements in looms for weaving.

1201 R. A. Wright, Homerton, Middlesex, engineer. Improvements in heating structures and articles, and in the mode of, and apparatus for, obtaining heat from petroleum and other hydrocarbons, and in apparatus for supplying air to furnaces.

Dated April 11, 1868.

1203 J. Sutcliffe, Bradford, Yorkshire. Improvements in outline maps, charts, plans, and similar other articles for educational purposes.

1205 C. Martin, Chancery-lane, civil engineer, W. Barrett, ironmaster, and T. S. Webb, metallurgical chemist, Norton, Durham. Improvements in the treatment and reduction of titaniferous iron ores for the manufacture of iron, and in the application of slag or cinder produced in such processes.

1209 R. Nicholls, Aldermanbury, City, fancy trimming manufacturer. Improvements in self-attaching buttons or ornaments to be applied to ladies' dresses and such like purposes.

1211 H. A. Archereau, Boulevart St. Martin, Paris, chemist. A new method of obtaining heat and light, and its various applications, and in apparatus connected therewith.

1213 A. Woodcock, Edinburgh. An improved mode of, and apparatus for, suspending pictures.

1217 G. Paton, Kilbirnie, Ayrshire. Improvements in looms for weaving.

Dated April 13, 1868.

1219 J. Rothery, Yorkshire, colliery viewer. Improvements in machinery or apparatus for getting and hewing coal, stone, and other minerals, parts of which improvements are applicable to motive power engines.

1221 T. F. Shillington, College-square North, Belfast. Improvements in reaping and mowing machines.

1225 J. Combe, Kensington-terrace, Great Victoria-street, Belfast. Improvements in breaking, spreading, and drawing flax and other fibrous substances, and in machinery to be used in carrying out such improvements.

Dated April 14, 1868.

1226 C. and S. Hargrove, Birmingham, manufacturers. An improvement in the manufacture of breech-loading actions.

1227 T. Smith, millwright, Tenter-lane, Leeds, T. W. Miller, Birstwith, Yorkshire, and T. Don, millwright, St. John's, Red Hill, Surrey. Improvements in manufacturing wheat and other grain into meal and flour, and in machinery and appliances for that purpose.

1231 J. H. Johnson, Lincoln's Inn-fields. Improvements in saw handles, and in securing the same to saw blades. (A communication.)

1233 M. P. W. Boulton, Tew Park, Oxfordshire. Improvements in apparatus for receiving motion or energy from fluids, and for imparting it to them, and in apparatus to be used for propulsion or in connection therewith.

Dated April 15, 1868.

1235 W. Watts, Turner's-court, St. Martin's-lane, Middlesex. Improvements in mangles.

1236 A. V. Newton, Chancery-lane. Improvements in breech-loading firearms. (A communication.)

1237 G. Glover, Ranelagh-road, Pimlico. Certain improvements in the arrangement and construction of submerged or subaqueous lamps, and in the fluid used in, and adapted to, such lamps. (A communication.)

1238 E. Page, Bedford, engineer. Improvements in firing the tines of harrows and other agricultural implements.

1239 W. S. Fletcher, Bradford, Yorkshire, machine maker. Improvements in machinery for combing or dressing silk, flax, china grass, cotton, and other fibrous substances.

1241 R. Ward, "North of England Advertiser" Office, Newcastle-upon-Tyne. Improvements in machinery for spinning or twisting tobacco.

1242 R. Boby, Bury St. Edmunds, Suffolk, agricultural implement maker. Improvements in the construction of horse rakes.

Dated April 16, 1868.

1243 F. A. Leigh, Rose Garland, New Ross, Wexford. An improved machine for planting potatoes.

1247 W. Callander, Newton-Stewart, Wigton. Improvements in apparatus for filling cartridges.

1248 R. Weir and J. Gray, Glasgow. Improvements in furnaces for burning oil.

1249 H. S. Evans, Bartholomew-close, City. Improvements in taps, valves, or apparatus for measuring and registering the quantity of liquid passed therethrough.

1251 J. Robinson, Creek-road, Deptford, Kent. Improvements in the manufacture of paint.

Dated April 17, 1867.

1253 C. W. Siemens, Great George-street, Westminster. Improvements in electrical apparatus for transmitting signals and for ascertaining the distance of objects, as also in instruments employed in connection with such signalling apparatus. (A communication.)

1254 G. D. Kittoe and P. Brotherhood, Compton-street, Clerkenwell, mechanical engineers. Improved apparatus for refrigerating or cooling worts and other liquids.

1255 H. O. Robinson, Glasgow. An improved screw propeller.

1256 W. Gorman, Glasgow, engineer. Improvements in the manufacture of iron and steel, and in apparatus therefor.

1260 Lieut. F. Bacon, Royal Marine Artillery, Wymondham Rectory, Leicestershire. Improvements in breech-loading firearms.

1262 A. V. Newton, Chancery-lane. Improved machinery for gathering hay and other crops from the ground. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated April 22, 1868.

1314 W. R. Lake, Southampton-buildings, Chancery-lane. An improved lubricating packing. (A communication.)

Dated April 23, 1868.

1333 W. R. Lake, Southampton-buildings, Chancery-lane. An improved steam cultivator. (A communication.)

Dated April 27, 1868.

1374 V. Delperdange, Brussels. Improvements in the construction and modes of connecting pipes or tubes of metal or other material.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," May 5, 1868.

3645 W. Walker. Cotton ties. (A communication.)
3649 J. Dawkins. Tanning.
3655 P. F. Tranchat. Universal machine for manufacturing circular cutters and milling tools.
3660 F. Render. Traps for pigeon shooting.
3664 G. E. Allshorn. Manufacture of artificial fuel.
3669 N. Greenhalgh, W. Shaw, and J. Mallison. Steaming certain yarns.
3672 E. G. and E. E. Rafer. Braiding machine.
3673 J. Edge. Rag rolls of rag engines.
3674 E. J. Hughes. Blankets used in machines for printing textile fabrics. (A communication.)
3677 J. M. Rowan. Moulds for casting steel.
3679 H. Higgins and T. S. Whitworth. Machinery for spinning cotton.
3680 J. Clarke. Wrappers for needles.
3682 J. W. Lewis. Warming and ventilating apartments.
3701 G. Glover. Lamps. (A communication.)
3703 J. Aschermann. Machine for cutting the hair from skins.
3706 M. A. F. Mennons. Mode of combining the vapours of liquid hydrocarbons with oxygen and hydrogen. (A communication.)
3707 M. A. F. Mennons. Manufacture of a vegetable substitute for animal hair. (A communication.)
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THE

MECHANICS' MAGAZINE.

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TESTING AND ANNEALING STEEL PLATES.

IN describing the effects consequent on punching holes in steel plates for use in shipbuilding, and for other similar purposes, and comparing their strength and adaptability with plates having drilled holes, it becomes a matter of the highest importance to notice the quality of the steel submitted to each of these processes. The highly carbonized plate, or one that is characterized by hardness and density of substance, reveals in its fracture a very fine, bright, granular appearance. This, when closely inspected, is found to contain a well-arranged and well-developed mass of particles, each of which, by the laws of cohesion and affinity, will closely adhere to its fellow, and, being so highly carbonized, and pure, will offer immense resistance and power all the time there is not a leading fracture in any part of the plate. But the exceeding hardness of the particles prevents what is most desirable in a plate subjected to varied strains and fitful action, namely, a certain amount of elasticity, combined with capability of elongation. Thus, while the more inferior particles of a common plate, under heavy strains, have a tendency to overlap each other and blend together, the reverse is the case with the hard plate, the particles of which, refusing to elongate and overlap each other, continue to hold intact their more perfect forms till they suddenly part. This is evident in the process of punching, for the pressure of the punch and die on the metal disturbs and disarranges the particles in the immediate locality of the hole, and creates internal—though imperceptible—fractures.

To illustrate this, we may state that a great number of specimens of steel plates have been prepared and tested at Chatham Dockyard, and although the pieces were so prepared that they should break at the smallest part, they all, without exception, broke at a place where two small holes had been punched. But when the holes were drilled (instead of being punched), and in the largest sectional area of the steel, they all, without a single exception, broke in the smallest part—exactly the reverse of what resulted when the holes were punched. The following is a remarkable illustration of the superiority of the system of drilling holes in armour-plates to that of punching them:—A steel plate was punched and fitted in place on the sides of the "Hercules," recently built at Chatham, and, after having been secured there for several days, it broke suddenly (with a loud report) in the direction of the holes, rendering the plate useless. From experiments which have been made from time to time on different qualities of steel by drilling and punching holes, the advantage gained by the holes being drilled appears to be that the steel plate will stand a higher tensile strain by 22·5 per cent. From what we have stated, it will be seen that there cannot be two opinions as to the superiority of the system of drilling over that of punching holes in steel plates.

Referring to the annealing of steel plates, it has been found by experiment that steel plates annealed, when tried with others in the original condition, give an extraordinary result, for, although holes have been punched in both cases, the pieces which have been annealed have been found to stand a much greater tensile strain than a similar number unannealed, the difference being as much as 60 per cent. It seems, therefore, that annealing lessens the amount of carbon, and the softened particles have a tendency to overlap each other under a tensile strain; but though, doubtless, this is the case, the steel being of a very hard granular nature, has not been found to develope fibre, but still retains its granular appearance. Crucible cast steel, verging towards the quality of fine iron, presents at the fracture a very fine silky appearance, and this description of steel annealed will stand a tensile strain 16 per cent. greater than that which is unannealed, this class of steel being of a very soft nature. Thus the difference between annealed and unannealed crucible cast steel is not nearly so great as it is between steel of a harder nature.

A judicious selection of steel plates is most desirable. Those should be chosen which possess the following qualities, namely, elasticity, capability of elongation, development of fibre under heavy strains, and the possibility of being altered in shape when cold without fracture of surface. It will be seen from the foregoing that punching holes in steel plates injures the metal, and that annealing steel plates of the same quality after being punched improves the metal. The steel plate referred to with reference to the "Hercules" had been punched and cold hammered; the plate in its original condition was of a very hard nature, and evidently had been injured by cold hammering, as well as by punching. The practical conclusion, therefore, is, that the best way to insure against such contingencies is to anneal all steel plates which have been punched or hammered cold before putting them on to the ship, whether such plates be of a hard or soft nature. Thus we have shown that punching holes and cold hammering steel plates not only injures the plate but renders it absolutely useless by its being dangerous to use.

PRESENCE OF OZONE IN THE ATMOSPHERE.

EXCEPT by those who are professed materialists, it will be readily admitted that there are many substances, sensations, and influences which do not admit of tangible proof, although their existence cannot be doubted. It was for a long time suspected that besides oxygen, there was a peculiar modification of that gas exhibited in the air under certain circumstances. In the case of severe storms accompanied with a great deal of lightning, or where a series of electric sparks is passed through dry oxygen or atmospheric air, a metallic odour is at once perceptible. A similar odour can also be obtained by placing some pieces of phosphorus in contact with oxygen slightly damped or moistened. Recent investigations have shown that in addition to the distinguishing odour, ozone possesses some especial qualifications of its own, not common to the other gas. One of these consists in the power it is endowed with of separating or liberating iodine from iodide of potassium. The mere existence of the peculiar smell cannot be regarded as conclusive, for the same phenomenon has been observed in the decomposition of water by electricity, which an undoubted authority has pronounced to be due to the formation of a teroxide of hydrogen, although that substance has never been isolated or obtained in a free state. It is quite possible that there may be two substances which have been confounded under the same name, for whatever may be the cause of the odour during the decomposition of water by the electric current, yet it could not possibly be due, in the case of the passage of electricity through the air, to the formation of a teroxide of hydrogen, as the latter gas is not present.

That there are many different conditions in which oxygen exists in the atmosphere—whether as ozone, teroxide of hydrogen, or other substance—is immaterial, is probably the real solution of the difficulty, and we are inclined to give credit to the views upon this point of M. Houzeau. That able and energetic chemist and savant has classed them under three heads:—Firstly, inactive oxygen, which produce not the slightest perceptible action upon moist ioduretted paper; secondly, oxygen directly active, which immediately imparts a bluish tint to the above description of paper, developing at the same time a peculiar and characteristic odour; thirdly, oxygen indirectly active, possessing no perceptible odour and requiring the aid of another body to affect the test paper. The invigorating nature of country air is presumed to be due to the presence of the second of these modifications of oxygen, which may be regarded as identical with the substance ozone. It cannot be caused by the first description of gas, since inactive oxygen does not affect iodine or its preparations, nor to the third class, since oxygen, indirectly active, requires the aid of an acid to affect the test paper. But the air of the country, although it imparts a bluish tint to slightly ioduretted litmus paper after the lapse of a short time, does not redden the most sensitive litmus, even after it has been submitted to its action for many hours. It effects its complete discoloration but does not redden it. Having demonstrated that the first and third of the presumed modifications of the gas oxygen do not bestow upon country air its peculiar properties, it is but natural, and moreover reasonable, to attribute them to the presence of the second, or ozone proper. Granting this assumption, it is manifest that the odour which invariably betrays the existence of ozone should also be present in the air, and unquestionably so it is. Whenever pure air is respired in the mass, it has not only a distinct smell, but also a distinct colour. It would be in vain to seek for this air in the vicinity of capitals of kingdoms or manufacturing towns, but near the sea side, upon the plains of Salisbury, or out upon the elevated plateaux of the Continent, or the pampas of America, the lungs can appreciate the vital energy they inhale. We would advise all sceptics, who doubt the accuracy of these statements, to first of all familiarize themselves with the smell of diluted ozone or vitiated air, a thing easily accomplished, and then, after sleeping in a close room, to inhale the fresh morning air immediately after rising. They will find that the more the air in the chamber has been contaminated and infected, the stronger and more palpable will be the difference in the odour of the two currents.

In support of his theory, M. Houzeau carried out an experiment, which is at once curious, interesting, and conclusive. Being well aware of the property that flannel and other stuffs possess of condensing in their pores diluted ozone or oxygen, he caused two linen cushions to be prepared of precisely the same material and size, and placed one in the open air, and the other in a room badly ventilated and well filled with company. After the expiration of a certain time he had them both brought to him, and ascertained that the first emitted a distinct odour similar to that of ozone, while the second was completely inodorous. Fresh air in its normal state is endowed with decided powers of decoloration. Litmus and turmeric paper, exposed to its influence and sheltered from the effects of rain, dew, and sunlight, are blanched in a short time, demonstrating that ozone acts energetically as a decolorizing agent. It has long been known as a powerful disinfectant, and could means be devised for procuring it in a free state it would be of the greatest advantage in purifying vitiated atmospheres.

ENGLISH PHOTOGRAPHIC LENSES.

VERY large sums are spent by photographers in lenses, and many instances have come under our notice wherein the purchasers have paid twice as much for their

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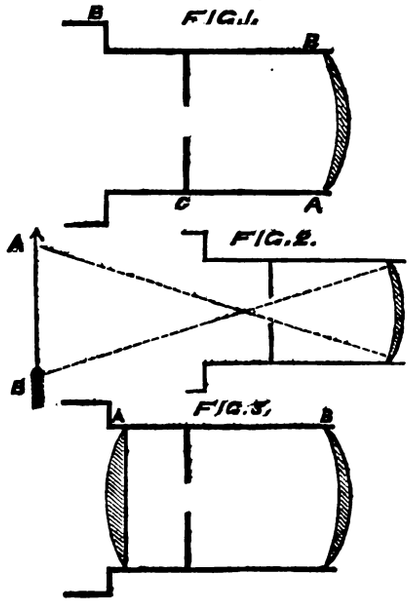
lenses as they are worth. Some of the photographic periodicals have plenty to say on everything connected with photographic lenses except their price. Now, as the majority of photographers are not scientific men, and as the lens is the most important implement in their business, the bulk of them are very considerably in the power of the photographic journals, in the matter of the purchase of lenses; and it is the duty of these periodicals to inform their subscribers why the best photographic lenses in London are now sold at about twice the price of equally good lenses in Paris. This they will no doubt do when they see how very much the ventilation of this subject will promote the interests of their subscribers, but hitherto the fact has been unfortunately overlooked.

Many young beginners and others who are not wealthy would like a little information on the subject of cheap lenses, not to be found in all photographic periodicals. In the early days of photography, pictures of a high class were taken by a lens which did not cost above one or two shillings, and if it could be done then it becomes interesting to enquire why it cannot be done now. The difference between an ordinary and an achromatic single lens is that the chemical and visual foci do coincide in the latter, but do not coincide in the former. That is to say, if the picture thrown by a common lens be brought to a focus by the aid of the eye, upon a sheet of ground glass, it will not be photographically in focus, because the bulk of the photographic or chemical rays come to a point nearer to the lens. To bring these chemical rays into focus with a common lens, the lens should, after focussing with the eye, be pushed nearer to the ground glass, by moving it over a distance of about one-thirtieth of its focal length. Achromatic lenses themselves are only a compromise, for they do not bring all the chemical and all the visual rays to a focus at exactly the same point, and practically the same good photographic results may be obtained with a common lens, by an arrangement hereinafter to be described. In the youthful days of photography, Voigtlander constructed lenses achromatized for the chemical rays only, which were all brought as much as possible to concentrate their action upon a flat glass plate. But photographers would not continue their use, preferring, perhaps wisely—but probably wrongly—to adopt lenses wherein the chemical and visual foci should approximately coincide, though this could only be done at the cost of a loss of intensity of chemical action. Leaving these lenses of Voigtlander out of consideration, there is no advantage in the substitution of an achromatic for a common non-achromatic landscape lens, provided the owner understands the best form and method of using the latter, and does not object to the trouble of pushing in the lens a little after focussing. This movement gives perfect sharpness, and the operator is as well off as if he used the ordinary achromatized lens.

To make a cheap landscape lens, an ordinary circular meniscus "spectacle-eye" should be bought, at a cost of twopence or threepence, or wholesale at a little less than a penny. It should be mounted in a tube of brass or tin, or a pill-box will answer the purpose, but whatever the tube may be it should be blacked inside. The hollow side of the lens has to be mounted towards the view outside the camera, and a stop, consisting of a piece of card or metal with a round hole punched in it, must be placed outside the lens. In the accompanying cut, fig. 1, A is the meniscus lens, B B the blackened tube, and C the stop. If the lens be 1in. in diameter, and the focal length be, say, 6in. or 9in., the stop should be placed about 1in. in front of the lens, that is to say, the best distance of the stop from the glass is usually equal to the diameter of the lens. But the stop may be made movable in the tube to give different effects, and several stops should be provided with holes of different sizes. The same results could not be obtained by using a small lens the size of the hole in the stop, the object of the use of the stop being to cause the sides of the picture to be taken by the sides of the lens, as shown in fig 2. The rays from the top and bottom of the arrow A B cannot reach the centre of the lens, because of the interposition of the stop, but they reach the sides of the lens, and the object just mentioned is gained. The centre of the lens should not be employed to make the sides of the picture. The larger the diameter of the lens, the larger should be the aperture in the stop, and the further should it be placed from the glass. The focal length of the lens and not its diameter determines the size of the plate which it will cover, so that the larger the picture desired the longer must be the focus of the lens. The smaller the stop the longer is the focus. A convenient focal length for landscape lenses for stereoscopic photography is six inches, and if some of our readers will mount a crown glass spectacle lens in the manner here described, and test it against expensive landscape lenses in their possession, they may be astonished at the pictorial results, and find a difficulty in seeing the advantage of using achromatic landscape lenses at all.



So much for a cheap method of obtaining landscape lenses. In portraiture it is desirable to posesss a lens giving a narrow angle of view, and broad pencils, in order to include a large amount of light. A wide angle and flatness of field is not so much required as great intensity and rapid action. In portraiture, therefore, not one, but a combination of lenses is desirable. A well-made achromatic combination is best for the purpose, but good results may be obtained by the use of a simple plano-convex and a meniscus crown glass lens, mounted in one tube, with a stop between the two, as in fig. 3. The front lens A, instead of being plano-convex, may be very slightly hollowed on the side next the stop, that is to say, a shallow meniscus lens will do. The back lens should be a deep meniscus. The front lens should be shorter in focus than the back one. The size and focal length of these lenses depends upon the size of plate they are intended to cover, and experiment is the best course to be adopted by those who wish to try non-achromatized lenses. As a rough guide to those who wish to cover a plate of a particular size, lenses of about the following dimensions may be tried:—

Description of Lens.	Size of Plate.	Front Lens.		Back Lens.	
		Diameter.	Focal length.	Diameter.	Focal length.
	Inches.	Inches.	Inches.	Inches.	Inches.
Stereoscopic.	3 × 2½	1	6	1¼	12
Quarter plate	4¼ × 3	1¼	9	1½	16
Half plate ...	6½ × 4¼	1¾	12	2¼	20
Whole plate	8½ × 6½	2¼	16	3¼	24

The stop, to give sharpness, must be small, so that these lenses are not very rapid in action, but softness combined with depth of focus will be gained by using a large aperture. In fact, these lenses with large stops are capital implements to give the "diffusion of focus" so much in demand of late. Intense definition in one plane only is entirely abolished by this lens, so that in this respect it has an advantage over its more expensive brethren. The time of exposure is governed by the focal length of the combination, and by the diameter of the stop. The larger the stop, and the shorter the focal length, the quicker will be the action of the lens. The effect of slightly varying the distance between the lenses in the tube does not materially affect the results. When the two lenses are placed closer together they cover a larger plate, but the marginal definition is less perfect; whereas, the further separation of the lenses, the more contracted is the field, but the better is the definition. At one time, opticians mounted the two lenses so that the distance between them might be varied at the will of the operator, and the plan was a good one.

Achromatic lenses of foreign manufacture, carefully made and well finished, are imported into England from abroad in great quantities, and sold wholesale, unmounted, at very cheap rates. By purchasing such lenses, and mounting them in home-made tubes, photographers may obtain combinations for various purposes at inexpensive rates, but a good optician is the best man to supply large quick-acting portrait lenses. There are many first-rate opticians in Paris who sell photographic lenses as good in every respect as the best turned out by English manufacturers, and usually at less than half the price, the Parisian optician at the same time gaining a large margin of profit. Such being the case, the assertions of photographic journals to the contrary notwithstanding, it is time to raise the question why a large proportion of their subscribers pay twice as much for lenses as is done by Parisian photographers. When the pictures of M. Adam Salomons beat all those sent to the Paris Exhibition by Englishmen, the photographic journals made a great noise about the fact, and wrote columns on the peculiarities and prices of his pictures. Yet, at the same Exhibition, a foreigner carried off the first prize for photographic lenses, leaving the best English opticians out in the cold; and most of the photographic journals said nothing about the peculiarities of the successful lenses, or their price, although the subject is of great interest to English photographers.

Those photographers to whom these facts may be new are recommended to examine the advertising pages of the particular photographic journal they take in, and learn who are the one or two opticians who advertise most in its pages. Then they are advised to consult the editorial pages during the same period, and see whether the amount of praise given to the lenses exactly corresponds with the length and number of the advertisements. Then other photographic periodicals may be consulted, to see whether or not the same rule also holds good in their pages, with the exception that a different optician may be the head man. After this has been done, it would be well for purchasers not to place the slightest faith, in future, on the praise of any journal, if such can be found, which is seen habitually to mete out its commendations to the largest advertisers, and no others. At the Paris Exhibition, the only silver medal awarded for photographic lenses was given to a French optician, whose charges for splendid lenses are shadows compared with those of some of the English makers. An English optician carried off, also, a silver medal for one particular form of lens, though not for his lenses in general. All the other opticians received only medals of bronze. What is very much wanted is an establish-

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ment in London where any photographer may send his lenses to be accurately tested, at a moderate fee, and have their working qualities certified in figures. Then, deserving opticians whose names are not known, would soon rise into notice, since the fame of opticians would depend upon the merits of their lenses, and the charges for the same would find their natural level by competition in the usual way. Thermometers are now tested on this principle for a very small fee at Kew Observatory, and the fees clear the expenses.

LORD BROUGHAM.

YESTERDAY week saw the close of the earthly career of a great man. Henry Lord Brougham passed away in sleep, at his villa near Cannes, from a world in which he once and for a long time played a most important part, although of late years he had passed his time in seclusion and well-earned rest. Lord Brougham was born on September 19, 1778, and had, therefore, exceeded the average time allotted to man by nearly a score of years. Although Lord Brougham's biography will find more interest in legal and political circles, still, during his life, he often entered heartily into scientific matters, and, therefore, claims a passing notice at our hands. The more, in that Mr. Robertson, one of the founders of the MECHANICS' MAGAZINE, was associated with his Lordship in the promotion and establishment of mechanics' institutions. In 1825 he published, in the form of a pamphlet, some observations on the education of the people, addressed to Dr. Birkbeck, another coadjutor in the formation of those mechanics' institutes which are now so universal through this country. During this same period he took a chief part in establishing the Society for the Diffusion of Useful Knowledge, and he advocated its cause in the earliest of its publications, issued in March, 1827—a treatise on the pleasures and advantages of science. Later on, he added to numerous publications on a variety of subjects, an edition of "Paley," which he supplemented with two volumes under the title of "Dissertations on Subjects of Science connected with Natural Theology." Lord Brougham took a leading part in matters of education and social science, and in his time did an enormous amount of work in this and other directions tending to improve the condition of the masses. The services he has rendered to his country have earned for his memory universal esteem and respect.

COAST DEFENCES.*

THE American war has proved a fruitful source of practical information upon military science to the profession to which it directly addresses itself, as well as to that of engineering. Several distinguished American officers have laid down the sword and taken up the pen, and have placed on record the results of their experiences in such a form as to prove of inestimable value to military engineers and artillerists. We have had, for example, General Gilmore's excellent treatise on the engineer and artillery operations against Charleston, in 1863. We have now, in the valuable work before us, a treatise on coast defences, by Colonel Von Scheliha, which is based upon the experience gained by officers of the corps of engineers of the army of the Confederate States. It is compiled from official reports of officers of the United States' navy, made during the late war, and extends over the four eventful years during which it lasted. The experience of that war shows that the coast defences and fortifications are insufficient when compared with the means of aggression possessed by fleets. Steam power has rendered ships independent of wind and current, their screws are comparatively safe from an enemy's fire, their decks and sides are protected with armour, and they are armed with few but very heavy guns, the projectiles from which break solid masonry like so much glass. Seeing, then, that vessels of war have thus become altered in their build, their method of propulsion, and their armament, it is not to be expected that they can be resisted by fortifications and defences made to withstand the means of naval attack of past years. During the first two years of the American war, the fleet of the Northern States had great successes in the Atlantic as well as upon the Mississippi. But when the Confederates changed their system of defence and fortification, the Federals had far greater difficulties to contend with, and sometimes did not dare to commence the attack.

In the year 1861, Colonel Von Scheliha, then chief engineer of the staff of General Leonidas Polk, of the Confederate army, was entrusted with the erection of land batteries near Columbus, on the Mississippi. In General Johnston's staff he was sent in the year 1862 to Fort Donelson, after the destruction of which he was sent to erect batteries and barriers at the Cumberland River, below Nashville. In March he joined General Beauregard's staff, and went first to Fort Pillow, then to Island No. 10, both on the Mississippi. At the surrender of the latter place he became a prisoner of war, but was exchanged in August, and became captain of artillery to the corps situated in Kentucky and Middle Tennessee. In January, 1863, he joined General Buckner in Mobile, and was entrusted with the construction of the Alabama and Tonibigbee batteries. In May he was called into active service as chief of staff of the department of East Tennessee. He was promoted after the battle of Chickamanga to lieutenant, and in the autumn was sent to Mobile as chief engineer of the department of the Mexican Gulf. He remained at Mobile in this capacity till the entry of the allied troops, the 12th of April, 1865.

After stating the position he occupied during the war, the author gives the result of his experience in the fortification of coasts, and the entrance of rivers, and the erection of batteries and barriers. The barriers used at Sebastopol were used with great success by the Confederates, with the addition of new methods. For instance, at the entrance to the Bay of Mobile, a torpedo destroyed the armour-plated ship "Tecumseh;" nearly the whole of the crew were drowned. Farragut, who had passed Fort Morgan, dared not attack the town of Mobile, observing that it was impossible to do so with ships so long as the water was barricaded. This is a striking testimony to the value of torpedoes, and a proof that even the iron-plated ships of the present day could not pass the batteries of an enemy, if they were obliged to remain under the fire of heavy guns, by reason of the water being barricaded. In England, Austria, and France experiments have been made for some time with torpedoes, and lately a special torpedo corps has been formed at Toulon, where the importance of these subaqueous mines has been fully acknowledged. According to the experiences of the American war, land batteries should be constructed in conjunction with barriers upon the water, as illustrated in the volume before us, which, we may observe, is furnished with a series of splendidly-executed plans and comprehensive drawings, executed in chromo-lithograph, in Messrs. Spon's happiest style.

The first section of Colonel Von Scheliha's work shows that the progress made in naval architecture and artillery render an alteration of the principles of coast defence imperatively necessary. In the first years of the war the Confederates scattered their forces by trying to fortify every possible point of landing on the long coast line of the Atlantic and of the Mexican Gulf. It would have been preferable to have fortified a few points strongly, with a sufficient garrison and armament, and to have connected the fortifications by railways and telegraph wires. That the strongest masonry cannot resist the monster guns of the present day, and that it should, therefore, always be protected by earthworks, is a fact long known to us with regard to inland fortifications, but it is also the case with coast defences. The bombardments of Forts Sumter, Morgan, and Pulaski show that the strongest walls can be laid in ruins from ships as well as from land batteries, while earth or sand-works suffer but little injury. In 1863, Admiral Porter anchored before the works of Arkansas Port, fired into the trenches, and dismounted the guns. Every shell which entered the trenches and there burst caused immense slaughter among the artillerists. The walls were covered with two trac s of railway, which were torn off and destroyed after a few shots. On the other hand, the land and earthworks of battery Wagner on Morris Island, Forts Fisher and Caswell o Cape Fear, and Fort Powell on the Bay of Mobile, show that earth—and especially sand—works resist the heavy modern artillery far better. The artillerists should be protected by strong shields and coverings, and the garrison should be provided with bomb-proof places of refuge.

No fort of modern construction can hinder a fleet from passing if the water is not barricaded. The coast and river defences in the Northern and Southern States are the same as in Europe. After the first examples, given by the gunboats "Carondelet" and "Pittsburg," in the spring of 1862, at the batteries on Mississippi Island, Farragut passed Forts Jackson and Phillipp below New Orleans, then Port Hudson, and, later, Port Vicksburg, in ships for the greater part constructed of wood, and protected by hay and cotton bales. For several weeks gunboats of the Confederates nightly passed the batteries of the Federals on the Upper Mississippi, below Tiptonville, and the blockade runners passed the blockading fleets during the whole time of the war without sustaining much injury from their fire. That a partial barricading of navigable water is insufficient is shown by Farragut, who, although he lost the "Tecumseh" by the explosion of a torpedo, yet forced an entrance into the Bay of Mobile. He is said to have learnt from spies and deserters from Mobile where there were no torpedoes or where they had been destroyed by remaining too long in the water. An interesting example is afforded of the fact that well-constructed torpedoes may remain for a long time under water without their power of explosion being in the least injured. After the taking of Mobile in the spring, the torpedoes were fished out of the rivers and the bay. One torpedo, however, could not be found, and in the spring of 1866 a merchant ship touched it; it exploded, and the ship was sunk.

That no fleet can pass a fort under the fire of heavy batteries, if the water is barricaded, is shown by Dupont's unsuccessful attempt to enter the harbour of Charleston, in 1863, and Farragut's report to the Minister of War Welles, after he had taken the town of Mobile. He declared it impossible to take Mobile by water, or to enter Spanish River and Choctaw Pass if the entrance were properly barricaded. Colonel Von Scheliha agrees in all important points with Admiral Porter, the first authority on this subject. Porter, besides his experience in former wars, has taken part in nearly all the expeditions on the Mississippi, the Gulf of Mexico, and the coasts of the Atlantic, and is said to be more renowned in the United States, on account of his knowledge and education, than even the brave Farragut. Admiral Porter, in the spring of 1865, sent to the Minister of Marine a memorandum on coast defences, which is given at length in the work

* "A Treatise on Coast Defence," &c. By VON SCHELIHA, Lieut.-Colonel and Chief Engineer of the Department of the Gulf of Mexico of the Army of the Confederate States of America. London: E. and F. N. Spon, 48, Charing-cross. 1868.

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before us. He considers the fortifications in the Northern States—for example, Fort Munroe and those before New York—as inefficient as most others in Europe, and he recommends fortifications of sand, and iron revolving towers; where there are loopholes of masonry they should be defended by strong iron plates. He says, "barriers upon the water and torpedoes are better defences than our forts," and he recommends the plan which the Confederates have so successfully used. Admiral Porter is by no means of opinion that no fort can resist armoured ships with their monster guns; on the contrary, he says, "The use of land fortifications is not in the least diminished by recent experience; their value is, on the contrary, greater than ever, but they must be suitably constructed." If this is the opinion of the most experienced Admiral of the allied fleet after a four years' war, it ought to be considered as decisive till some European marine has proved the contrary, and has shown that fleets can destroy all land batteries, and can enter places protected by barriers under a heavy fire.

The second section of this important and interesting work treats of the barricading of navigable water. The first condition is that the barriers must be protected by the guns of a battery. Colonel Von Scheliha distinguishes sunken obstructions as follows:—Dams, sunken ships, and masses of rock; posts, trunks of trees, or floating obstructions; chains, ropes with nets, beams, and rafts; and, lastly, torpedoes. These latter are deservedly treated in detail, inasmuch as they were in reality first used in the American war, and with remarkable success. The torpedoes are divided into two classes, viz., stationary torpedoes, which are fastened at short distances below the surface of the water to posts, &c., and floating torpedoes, which are anchored according to the strength of the charge at depths of from 6ft. to 12ft. below the surface of the water. They can be discharged by friction, percussion, or galvanic apparatus from the shore. The torpedo boats and rockets for offensive operations were used with very little success. Colonel Von Scheliha rightly places but little confidence in torpedo boats which approach the enemy's ships under the surface of the water; they can only be moved very slowly, and the men are placed in great danger. The construction of torpedoes, the manner of laying and discharging them, the cost, advantages and disadvantages of the different kinds, are fully discussed and are further explained by means of comprehensive drawings. The most efficient method of barricading water would seem to be a combination of ropes and nets and floating torpedoes. Of course, the position of the torpedoes must not be visible from the enemy's ships; only those places which are left free should be marked by buoys for convenience. The conclusion of the volume forms an interesting section on the illumination of the water and banks by fires of wood, calcium, petroleum, and electric lights.

It will thus be seen that Colonel Von Scheliha's work contains much that is interesting and instructive. Indeed, it abounds in information of real practical value to military men. We see how the Confederates discovered new methods of fortifying and defending coasts and rivers, and those methods, although capable of much improvement, have generally sufficed against a superior naval force of the enemy. These methods, and the experience of the four years' war, are well worthy of careful study, and for that purpose no better means offer than Colonel Von Scheliha's treatise. It is but just to add that the publishers have done their best to render the book worthy of the matter. The type, paper, and binding are of the best kind, whilst the large folding plates are beautifully executed, and are perfect specimens of the lithographer's art.

ELECTRICAL MEASUREMENT.*

WHEN we compare the early with the present days of telegraphy, we are truly astonished at the strides we have made with the science. Our knowledge has become greater, and our instruments and observations of greater precision. In no special department has this improvement become more manifest than in that of electrical measurements. When telegraphs were first erected, the instrument used and placed in the hands of inspectors was a simple galvanometer, very similar in construction to the needle and coil of the ordinary needle instrument; when a line broke down the fault was detected by means of this galvanometer, which, from that circumstance, obtained the name of "detector," which still clings to it. In the manufacture of the first submarine cables similar instruments were used, but of far more delicate construction, to note what leakage occurred in the insulator, and whether the copper wire was continuous. As cables improved, instruments of greater delicacy were introduced, as well as more precise methods of observation and record for comparison. We have successively had the introduction of resistance coils, differential galvanometers, Wheatstone's bridge, and Thomson's reflecting galvanometer, which now enable us to take observations with the greatest possible exactitude.

We have been led into the foregoing remarks by the perusal of Mr. Latimer Clark's book on "Electrical Measurement," and it is surprising to note the amount of information and knowledge required now for testing, compared with what it was in those early days we spoke of. The origin of the book is due to the special circumstance of Mr. Clark having designed a modification of the differential galvanometer for use out in India. In sending out those instruments a manual written by him accompanied them, so that the inspector, or whoever had charge of the instrument, might have full information of how to use them, and, at the same time, have the necessary instruction for the various tests which hitherto they had no experience of. Mr. Clark "thought that its publication might be of use to students preparing themselves for the service of the electric telegraph, and to others who might desire an elementary treatise on the subject of electrical measurement." "The first half of the work is designed for the use of the student and the practical telegraphist who has not given much time to the study of his subject;" "the second half is in the form of an appendix, which has been added to make it useful to the practical electrician." Mr. Clark is well known as one of the leading members of his profession, and, as an electrical engineer, his experience of submarine cables and their testing is necessarily large. We are glad to see, therefore, this appendix contain much valuable information, the result of the experience of himself and others, which will be of incalculable advantage to those whose duties are connected with the electrical measurements of submarine cables. It is this part of the work that will be found most useful, as there is an enormous amount of condensed information contained in its pages. We do not praise the second part at the expense of the first: by no means. The chapter on batteries, the methods of measuring their resistances, the explanation of testing by differential and by bridge for faults, as well as for insulation and resistance, will be found most useful to the telegraphist who is anxious to understand the *modus operandi* of electrical measurement.

The first portion contains definitions, mostly illustrated by diagrams, of electrical terms—such as resistance, electromotive force, tension or potential, induction, quantity and units of measurement; it also gives a description of his "double shunt differential galvanometer," and the method of using it for the different purposes of measurement. The usual form of differential galvanometer is a coil wound with two wires of equal length and resistance, so that a current passing through the two wires in opposite directions exactly balances the needle. Mr. Clark's galvanometer differs in detail in minor points, and contains an excellent keyboard for the necessary connections; but the principal "peculiarity of the instrument consists in the addition of a 'shunt' or derived circuit to each half of the galvanometer." These shunts are a multiple of 100, so that the addition of the shunt to one coil enables one hundred times more resistance to be measured. We remember to have used a movable shunt to a differential galvanometer many years ago, so that it could be applied to one coil or the other; but this is the first time, we believe, a double shunt has been attached to a differential galvanometer. With the resistance coils that accompany it, we do not doubt but that it will be found a most useful instrument.

In testing a submarine cable for the measure of its insulation, or, rather, for a method of giving its comparative insulating qualities, a plan has of late come much into use, and it is really about the most satisfactory that can be obtained to give you a perfect knowledge of the insulating capabilities of your dielectric. If an insulated wire be charged with electricity, and then be allowed to remain insulated for a certain interval, it will be found that, according to the insulating properties of the dielectric, a portion of the electricity has escaped. The better the insulator the more charge will be found retained, and *vice versa*; the method usually adopted is to take the time of falling from charge to half-charge. Now, this can be calculated by formula from one observation, instead of frequent observations, until the final correct one is obtained. Mr. Clark gives the following formula for producing the required result; the formula is the same as that given by Mr. Varley to Mr. Hooper for his core:—

$$\frac{\cdot 30103}{log.\ \frac{C}{c}} \times t = n\,t;$$

·30103 being the *log.* of 2 (charge C divided by half-charge); c is charge observed at interval of time t. This formula comes out nearly right with high insulators at low temperatures, but it is quite wrong when applied to gutta-percha at a high temperature. The formula to be correct should prove so under all circumstances, and we therefore venture to submit that it is incorrect. No *rationale* is given for it, neither can we see any. Mr. Clark gives himself the key to the correct formula, when he states that if "a certain" percentage of the charge escape during the first minute, the same percentage of the remaining quantity will escape during the second minute, and so on *ad infinitum*. We have our observation of the percentage of fall in t, interval of time; we require, then, to know how many intervals it will take to fall to half-charge. This is simply a question similar to that of compound interest, and the following formula, supplied by Mr. Preece (see "Culley's Handbook of Telegraphy"), will give the required answer:—

$$\frac{\cdot 30103}{log.\ (1+r)} \times t = n\,t.$$

In this r = percentage of loss in interval of time t; this formula will be found correct with all insulators at all temperatures. In our extract of the above, we have substituted a "certain percentage" for "seven" per cent., which Mr. Clark gives as the escape with gutta-percha at a temperature of 75deg. Fah. Our own observations, as well as those of others, seem to show that this amount is very much understated, and that the escape varies much according to the age and quality

* "An Elementary Treatise on Electrical Measurement, for the Use of Telegraph Inspectors and Operators." By LATIMER CLARK. London: E. and F. Spon, 48, Charing-cross. 1868.

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of the gutta-percha. We believe that about 25 per cent. will be found about the average.

Our space will not allow us to go into more extended detail, although there are several points we should have wished to have noticed. We may perhaps be able to allude to them in a future number in discussing electrical matter. We believe that the work before us will be received with pleasure by electricians generally, possessing the advantage of combining so much information in so small a space, enabling one to carry on the necessary observations without the reference to the multitudinous works formerly necessary. The author has disarmed us from finding fault with the arrangement of the work, for he remarks that "the book having thus been written in two different portions, is necessarily wanting in all unity of design, for which, as for other imperfections, he claims the indulgence of his readers." The very careful and complete manner in which the work is indexed makes up in a very great measure for this want of unity in design. We trust to see the work run through its first edition, so that, in the next, Mr. Clark may be able to give us a work free from those imperfections to which he, and also ourselves, have alluded, which somewhat mar the utility of a valuable book, such as we must unquestionably acknowledge the present work.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

M. MASSELOTTE'S PROCESS FOR GILDING—GILT WIRE—PASSAGE OF HYDROGEN THROUGH IRON AT A LOW TEMPERATURE—MAGNESIA CYLINDERS FOR THE DRUMMOND LIGHT.

A PROCESS for gilding, the advantages of which, we must confess, we do not exactly see, but which has been deemed worthy of a prize by the Société d'Encouragement, is published in the Bulletin of the society, so we transcribe it for our readers. The articles are first electro-gilded in the ordinary way. An alloy of gold and quicksilver is afterwards deposited from a solution of the cyanides of the two metals. When this coating is sufficiently thick, it is done over with a paste formed of borax, with some additional boracic acid, and sal ammoniac. It is then placed in a fire until the paste is calcined, and afterwards in a bath of acidulated water. By this process a surface of gold is obtained in just the same state as by the old water-gilding process, without any risk to the health of the workmen, and it may be burnished or left dull as desired.

The gilt wire employed in making gold lace soon tarnishes, especially in a London atmosphere. The surface of gold seldom being perfectly continuous, sulphur gets at the metal beneath, whether copper or silver, and the wire quickly blackens. To avoid this result, M. Helouis proposes to insert a thin layer of platinum between the copper and the gold. To do this, he drives a bar of copper into a ring of platinum strongly heated. The contraction of the platinum on cooling fixes it firmly to the copper, and the wire may be drawn without any risk of separating the two metals. The gilding may be done as usual. The colour obtained is as good as that of silver gilt wire, and, of course, lasting, for sulphur will have no effect on the platinum.

Not long ago we gave some account of the transmissibility of gases through cast iron at high temperatures. To-day we give an interesting experiment which shows that hydrogen will pass through cast iron at the ordinary temperature. M. Cailletet took an iron flask with a long (curved) neck, exhausted the air from it, and placed the mouth under mercury. The body of the flask was then set in a vessel of dilute sulphuric acid. The outer surface was, of course, attacked by the acid and hydrogen evolved, some of which passed into the interior of the flask, and, driving out the mercury, escaped in bubbles from the trough. There may be more in this experiment than M. Cailletet suspects. Hydrogen passes into metals with most remarkable facility, and Mr. Graham believes is liquefied within them.

M. Caron has published a short account of the way in which he makes his magnesian cylinders for the Drummond light. He takes magnesia which has been purified from alkalies and the other alkaline earths, and after moistening it with a solution of boracic acid, presses it into moulds. The reason for separating the other alkaline earths and alkalies is that their presence would affect the colour of the light. The boracic acid, we should think, would give a greenish tinge to the flame.

PARLIAMENTARY NOTES.

THE recent melancholy occurrence at Horfield Barracks, near Bristol, gave occasion to Mr. Hayter to ask the Secretary of State for War, on Friday last, whether, having regard to the increased danger to life from the use of breech-loaders in the hands of soldiers either insane or of intemperate habits, he would undertake to advise with His Royal Highness the Field-Marshal Commanding-in-Chief as to the propriety of withdrawing the twenty rounds of ball cartridge now in the possession of all non-commissioned officers and men of the British army, and of serving out the same to the troops on parade when about to proceed on military duty.

Sir J. Pakington said he had not had the opportunity of seeing the Commander-in-Chief that day upon the subject to which the hon. member's question related. Stating merely his individual opinion, he thought the occurrence of a single crime, however atrocious and much to be deplored, would not be cause sufficient for taking a step which would be felt as a slur by the whole army, the ammunition having from time to time been confided to the care of soldiers. We quite agree with Sir John, and believe Mr. Hayter's fears to be groundless.

The great question of the present week has been the Navy Estimates, previously to the discussion of which, however, Captain Mackinnon, a new naval reformer, declined to comply with a request of Mr. Corry, not to let a motion of his stand between committee of supply. The hon. and gallant gentleman then went on to argue out a case, that though our ironclad fleet had cost ten millions, there was scarce a good ship amongst them, and that it was impossible with our vessels to form a line of battle. Mr. Samuda next remonstrated against alleged favouritism in the selection of competitive designs for ships asked from private builders by the Admiralty. Mr. Corry replied to these remarks, after which, the House having gone into committee, commenced the annual statement of the Navy Estimates, at a date nearly three months later than usual. He went into the most minute details, from which we can only spare space for some general points of interest to our readers, reserving our comments for our next number. In the first place, Mr. Corry referred to the increase in the amount over the estimates of last year of £201,937; this, he said, was only an apparent increase, as it included an estimated amount of naval stores, and extra receipts to be paid direct to the Exchequer. In order to institute a fair comparison, that sum must be deducted. The amount of the estimates for 1868-9 is £11,177,290; deduct estimated value of supplies to other departments, £203,292, making the real amount £10,733,998; so that the amount of the two estimates may be said to be practically the same.

Mr. Corry deprecated the further reduction of the estimates by the abolition of our foreign squadron, observing that the value of a foreign squadron was seen when the rebellion broke out in Jamaica, and during the calamities at St. Thomas. Last year the North American and West India squadron consisted of 26 ships and 5,358 men, but it had been reduced to 20 ships and 3,776 men. Notwithstanding the convulsions in South America, our squadron on the south-east coast had been reduced from 9 ships and 1,115 men to 6 ships and 969 men. A reduction had not been practicable on the important Pacific station, where the number of ships was still 12; and the number of men had been increased from 2,676 to 2,755, in consequence of reinforcing the marines on the station. The Australian squadron had been reduced from 5 ships and 1,112 men to 4 ships and 776 men. In the opinion of Sir Henry Keppel and other authorities, the reduction of the China squadron would be attended with danger not only to our commerce, but to the lives of those engaged in carrying it on; and that squadron was of great use in protecting our interests in Japan during the revolution last year. It had been reduced from 36 ships to 34; but the reduction of men was insignificant, being only from 4,082 to 4,080. The only station on which an increase had taken place was the East India station; and the cause was obvious—the Abyssinian war. The squadron had been increased from 7 ships and 1,275 men to 10 ships and 1,815 men; but it would now, no doubt, be possible to revert to the former state of things. He had always regretted the necessity for having a squadron on the West Coast of Africa, and the Admiralty had introduced new regulations, from which the most beneficial results were anticipated. The squadron had been reduced from 18 ships and 1,829 men to 14 ships and 1,475 men.

With respect to Votes 6 and 10, which provided for the building, repairs, equipment of the fleet, and purchase of ships, there was an increase of £117,527, but that increase was owing to the appropriation of large sums for the construction of armour-clads. It was with great reluctance that he made any reduction in the vote for dockyards. He knew that it would throw a number of industrious men out of employment, and that there was also great depression in the shipping trade, and he, therefore, endeavoured to accomplish the reduction with as little inconvenience as possible. At two of the dockyards iron ships were built, and the reduction of men there was only 150; but the reduction at the other yards was 3,049. The number of men now employed was 15,272. In the storekeeper's department there was an increase of £7,106 on timber, and £21,930 for hemp, for which no contract was made last year; an increase of £17,822 on coals, in consequence of the larger use of fuel, especially by the Channel squadron, being a total increase of £31,397.

Turning to our vessels of war, Mr. Corry observed that the ships provided for by the original programme of last year were 4 armour-clads and 37 unarmoured ships, 1 frigate, 2 corvettes, 7 sloops, 26 gunboats, and 1 tug; or a total, armour-clad and unarmoured, of 41 vessels. This was the number in the dockyards. The number ordered by contract when he came into office was 3 armour-clad and 14 unarmoured ships, which he altered to 4 armour-clad and 13 unarmoured. The estimated cost was, for the armour-clads, £915,500; for the unarmoured vessels, £210,800; total, £1,126,300. The estimated expenditure on the two classes in the financial year was £435,150. The total estimate for the ships building by contract was £1,126,300; upon which there had been a total saving of £131,500; and, £79,000 having been spent in building the "Active," ordered in the autumn, there still remained a surplus of £52,900. The number of tons ordered to be built in the dockyards in 1867-8 was 6,854 in armoured ships, and 23,544 in unarmoured ships; and the quantity actually built was 6,829 of the former and 23,256 of the latter—the whole deficiency being 294 tons, notwithstanding several disturbing causes. Three armour-clads—the "Penelope," the "Hercules," and the "Repulse"—were ordered to be launched from the dockyards during the year. Two were launched, and the "Repulse" was ready, but was kept on the stocks for convenience. Twenty-five unarmed ships were ordered to be launched, and were launched, so that the programme had been faithfully performed. The money ordered to be spent on armoured ships by contract was £269,350, and the amount spent was £264,400, or £5,350 less. This punctuality was principally owing to the satisfactory progress made by Messrs. Laird with the "Captain." The sum ordered to be spent on unarmoured ships was £165,800; the amount spent, £119,500, and the deficiency, £46,300. The engagements of the contractors on the whole were well kept.

Following Mr. Corry in his lengthy statement, we find that the number of ships building, or ordered and provided for in this year's estimates is four armour-clads—the "Audacious," the "Captain," the "Invincible," and the "Vanguard"—two corvettes, and one gunboat, and there remain to be delivered during the financial year two armour-clads—the "Repulse" and the "Monarch"—one frigate, two corvettes, five sloops, two gun-vessels, and one tug, being a total ordered and building of twenty-eight vessels, for which £1,162,894 is taken in the present estimates, £759,981 for armour-clads, and £356,913

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for unarmoured vessels. Mr. Corry stated that, for the present year, there were two unarmoured corvettes, the "Druid" and the "Briton," building in the dockyards. One was being built at Deptford, and would be launched within the present financial year; and he hoped that the whole of the ships now being built at Deptford would be launched within the year. There was no intention to lay down any fresh ships there. In addition to the ships he had mentioned, there were six armoured ships, three of which were to be built in the dockyards, and three by contract. The corvettes would have a tonnage of 1,322 tons, 350-horse power, 12 guns, two of which were 6½-ton guns, and ten 64-pounders; their speed would be thirteen knots, and they would be worked by a single screw.

We now come to the armoured ships, of which there are six. One is being built at Pembroke; the expenditure, says Mr. Corry, would be £70,422, the tonnage was 3,774; an iron-clad with double screw. She would be of 800-horse power, with a speed of 13½ knots, and built on the same principle as the "Audacious" and the "Invincible." Her armament would consist of ten 12½-ton guns, with four 64-pounders on the upper deck. All these vessels would have a large battery on the upper deck, armed with four 12½-ton guns, which would command the whole of the horizon. The next ship, the "Sultan," would be a vessel of the first class, and would resemble the "Hercules." She was to be advanced during the year 2¼-eighths; and her expenditure, £91,113; tonnage, 5,226; single screw, 1,200-horse power, and a speed of nearly fourteen knots. Her armament would consist of eight 18-ton guns on the main deck, and one 12½-ton gun forward, and two 12½-ton guns on the upper deck battery, and two 6½-ton guns under the forecastle. There would be a central armour-plated battery on the upper deck, with two 12½-ton guns, which would range over a large area. The next ship building at Chatham—the "Triumph"—had progressed very little during the year. The estimated expenditure on this ship would be £18,815; she would be an iron-clad broadside sloop, with a single screw lifting. Her tonnage would be 3,800 tons, and her armament would be ten 12½-ton guns, six on the main, and four on the upper deck, and two 64-pounders on the upper deck; her horse power would be 800; estimated speed 12½ knots; and her bottom would be sheathed with wood and copper. These were the three ships it was proposed to commence in the dockyards during the present year. There was another ship to be built by contract, exactly the same as the "Triumph," the estimated cost of which for the present year would be £80,000.

The turret ships next came in for notice, and here Mr. Corry observed that there could be no doubt of the superiority of the turret principle for coast defence, and it was therefore proposed to build a ship, the "Glutton," on that principle. She would be capable of sailing to any port, although it was not intended to make her a cruising vessel. Her cost during the year would be £40,000; her tonnage would be 2,709; length, 245ft.; breadth, 49ft. She would have only one turret, and would fire in all directions. She would have two guns in this turret of 25 tons, if they could be made. She would have 500-horse power, and her estimated speed would be nine knots. The sixth and last ship it is proposed to build is one which in this country will be perfectly new, although there are several such vessels in the French navy. She will be a ram, and capable of accompanying the fleet. It is intended to expend £30,000 upon this vessel during the year. Her length will be 235ft.; breadth, 50ft. She will have a twin screw, and her estimated speed will be twelve knots. She will carry only one 18-ton gun in a fixed tower, with four port-holes; the gun to be worked on a turn-table. Her tonnage will be 2,637; her horse-power, 600.

Turning to the dockyard work we find it is proposed to build of iron-clad broadside frigates, 4,476 tons; of turret ships, 2,072 tons; one iron frigate, 930 tons—making a total of 7,478 tons of armoured shipping. Of unarmoured shipping, one frigate 1,680 tons; wooden corvettes, 1,607; iron corvettes, 120; sloops, 1,623; twin-screw gun vessels, 1,241; small twin-screw gunboats of second class, 240; tug steamer, 20; and mooring lighters, 400—making a total of 6,931 tons in unarmoured ships. With respect to the actual state of the armour clad navy, including ships ordered to be built, under these estimates, of the first and second class there are in commission, fitting for reserve, and building, thirty-four. The estimates provide also for a great want, namely, a reserve of iron-clad ships of war in our dockyards in such a state of preparation as to meet any emergency, and by October 1 Mr. Corry expects to have the "Black Prince," the "Agincourt," the "Northumberland," the "Sovereign," the "Hector," the "Resistance," and the "Hercules."

To sum up matters, we find that the nominal estimate for the year is £11,177,290, the actual one £10,826,690; the nominal increase over last year £201,037, but the real increase only about £9,000. The number of men, including marines, is 67,120 this year, as against 69,762 last year, and there has been a reduction of fifteen ships and 2,768 men in the squadrons on foreign service, while generally there have been reduced 1,333 seamen proper and 1,500 marines. We have now forty-four iron-clad ships, of which eleven are building. Some of these will be launched this year, and eighteen new vessels of various kinds will in that period be added to our navy. There will be a reserve of seven powerful armoured ships. The general condition of the navy, as regards health, efficiency, and discipline is exceedingly satisfactory.

After some discussion, in which Mr. Childers took a very active part, the vote was agreed to, and the Admiralty authorities are now supplied with the sinews of war for another year and once more made happy. Let them look to the use they make of them.

MR. WHITWORTH'S SCHOLARSHIPS.

THE practical and praiseworthy step taken by Mr. Whitworth in furtherance of the object of technical education has met with the consentaneous approval of all, as, indeed, it could not fail to do. We have now before us copies of documents relating to the details of this noble endowment, which applies to all subjects of the Queen, whether at home or abroad. We, therefore, place the matter before our readers without comment, which is superfluous, but with the hope that others who have the ability may have also the will to imitate so excellent an example.

"I. Minute.

"At Whitehall, the 5th day of May, 1868.

"By the Right Hon. the Lords of the Committee of Her Majesty's Most Hon. Privy Council on Education.

"My Lords read Mr. Whitworth's letter of the 4th of May, 1868, transmitting a memorandum on his scholarships, and on the establishment of 60 exhibitions of £25 for the present year preparatory to the competition for his scholarships, and requesting that the Science and Art Department may conduct the necessary examinations and correspondence.

"Their Lordships have great pleasure in acceding to Mr. Whitworth's request, and giving every assistance in their power in carrying out his patriotic munificence."

"II. Mr. Whitworth's Letter.

"Manchester, May 4.

"Sir,—Referring to your letter of March 28, by which you transmit to me a copy of the minute which the Lords of the Committee of Council on Education had passed in acknowledgment of my endowment of scholarships for promoting mechanical science, and to the concluding sentence of the minute, which invites further suggestions, and offers to render assistance in carrying out the intentions of the endowment:—

"1. I beg leave to enclose, for the information of the Lords of the Committee of Council on Education, a memorandum on the subject of the endowment, which I trust will meet with the approval of their Lordships, and that they will cause it to be circulated, and the necessary correspondence arising out of it to be conducted by the Science and Art Department.

"2. I would beg leave to ask the Lords of the Committee of Council on Education to undertake the examinations for these scholarships.

"3. As respects the preparation of the necessary details, for the examinations in the use of tools, I am willing to be responsible myself, with the aid of friends; and I propose to obtain the consent of a few gentlemen to advise with me from time to time in whatever may arise in the future for my consideration.

"4. In reply to the invitation of their Lordships to submit any suggestions, I venture to submit for consideration whether honours in the nature of degrees might not be conferred by some competent authority on successful students each year, thus creating a faculty of industry analogous to the existing faculties of divinity, law, and medicine. I am of opinion that such honours would be a great incentive to exertion, and would tend greatly to promote the object in view.

"5. I venture further to express a hope that the Government will provide the necessary funds for endowing a sufficient number of professors of mechanics throughout the United Kingdom.

"6. In conclusion, I inform you that the necessary arrangements for securing the endowment have been made, and I have given instructions for the preparation of the draught of a deed of trust which will be sent for the approval of the Lord President.

"I am, Sir, your obedient servant,

"Joseph Whitworth.

"To Henry Cole, Esq., Secretary of the Science and Art Department."

"III. Memorandum on Scholarships of £100 for Mechanical Science and Practice.

"To be competed for in May, 1869.

"I. Having offered to the Lords of the Committee of Council on Education to 'found 30 scholarships of the annual value of £100 each, to be applied for the further instruction of young men, natives of the United Kingdom, selected by open competition for their intelligence and proficiency in the theory and practice of mechanics and its cognate sciences, with a view to the promotion of engineering and mechanical industry in this country,' I propose that the following should be the general arrangements in the first instance, which may be modified after the first competition has taken place in May, 1869.

"II. That the 30 scholarships of £100 each should be open to all of Her Majesty's subjects, whether of the United Kingdom, India, or the colonies, who do not exceed the age of twenty-six years, and be held either for two or three years, as experience may prove to be desirable: that ten scholarships should be competed for and awarded in May, 1869, at the annual national examinations in science, provided that a sufficient number of candidates prove themselves to be competent; that the successful candidates should be required to spend the period of holding the scholarships in the further satisfactory prosecution of the studies and practice of mechanical engineering, and pursue their studies according to the spirit of the endowment, making periodical reports of them; that the student should state where he proposes to pursue his studies, the Lord President of the Council deciding if the proposal can be allowed, also if the student's progress be satisfactory, and the manner in which it shall be tested from year to year. In deciding if the plan of study proposed by the student be satisfactory, as much latitude as possible may be allowed. If the student wish to complete his general education instead of continuing his special scientific study, he may be permitted to do so. He may go to the universities or colleges affording scientific or technical instruction, or he may travel abroad. The successful artizan should be encouraged to study theory, and the successful competitor in theory aided in getting admission to machine shops and other practical establishments. All further details would be hereafter prepared and issued by the Science and Art Department.

"III. The candidates must be of sound bodily constitution.

"IV. The first competition should be in the following theoretical subjects:—1. Mathematics (elementary and higher). 2. Mechanics (theoretical and applied). 3. Practical plane and descriptive geometry, and mechanical and freehand drawing. 4. Physics. 5. Chemistry, including metallurgy. And in the following handicrafts:—1. Smiths' work. 2. Turning. 3. Filing and fitting. 4. Pattern making and moulding.

"V. No candidate should obtain a scholarship who has not shown a satisfactory knowledge of all the following theoretical subjects:—1. Elementary mathematics. 2. Elementary mechanics. 3. Practical plane and descriptive geometry and freehand drawing. With the power to use one or more of the following classes of tools:—*a*, the axe; *b*, the saw and plane; *c*, the hammer and chisel; *d*, the file; *e*, the forge. I propose that the maximum number of marks obtainable in the theoretical subjects and those obtainable by the most skilled workman should be about equal.

"VI. My object in devising the foregoing scheme has been, while requiring a practical aquaintance with a few simple tools as a *sine qua non*, to render the competition accessible on fairly equal terms to the student who combines some practice with his theory, and to the artizan who combines some theoretical knowledge with perfection of workmanship.

"Preparatory Exhibitions of £25 for the Year 1868.

"VII. As the scholarship scheme can only come

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into full operation by degrees, I propose from the fund ultimately available for the scheme at once to create 60 exhibitions or premiums, of the value of £25 each, tenable until April, 1869, and to place them at the absolute disposal of the governing bodies of the following educational institutions and towns, in order that they may award them to youths under 22 years of age, who may thus be aided to qualify themselves, and must undertake to compete for the scholarships of £100 in May, 1869,

"VIII. Eight exhibitions to Owen College, and two to the Grammar School, Manchester, the seat of my workshops; three University of Oxford; three University of Cambridge; three University of London; and one to each of the following Universities, Colleges, and Public Schools:—University of Durham, University of Dublin, University of Edinburgh, Watt Institution, Edinburgh; University of Glasgow, Andersonian University, Glasgow; University of St. Andrew's, University of Aberdeen, to each of the Queen's Colleges at Belfast, Cork, Galway, Ireland; King's College, London; University College, London; Eton, Harrow, Rugby, Charterhouse, Westminster, Winchester, St. Paul's, London; Merchant Taylors, Christ's Hospital, City of London, Shrewsbury, Marlborough, Cheltenham, Chester, Clifton, Brighton, Liverpool, two to the College of Preceptors, three to the Science and Art Department. I propose that the following exhibitions shall be given to artizans only:—Three to the Society of Arts; also one for artizans to each of the following towns:—Birmingham, Bristol, Swansea and Cardiff, Halifax or Huddersfield, Leeds, Northampton, Sheffield, and if there be any of the above unapplied, they may be given by the Science and Art Department to any other scholastic institution which makes satisfactory arrangements for affording instruction in mathematics and mechanics, freehand and mechanical drawing.

"IX. I would point out that the exhibitions to artizans may, perhaps, be increased to £50 for the year, by connecting them with the Science and Art Department, under the minute of the 21st December, 1867.

"Manchester, May 4. JOSEPH WHITWORTH."

MICROSCOPICAL EXAMINATION OF THE SOLID PARTICLES FROM THE AIR OF MANCHESTER.

BY J. B. DANCER, F.R.A.S.

WE recently noticed a paper read by Dr. R. Angus Smith, before the Literary and Philosophical Society upon the search for solid bodies in the atmosphere. That paper will be appropriately supplemented by the following one, from Mr. Dancer, on the microscopical examination of the solid particles found in the 2,495 litres named in Dr. Smith's paper, and the amount of fungoid matter in which is rather surprising. The air had been washed in distilled water, and the solid matter which subsided was collected in a small stoppered bottle, and on the 13th of March Dr. Smith requested me to examine the matter contained in this water. An illness prevented me from giving it so much attention as I could have wished. The water containing this air-washing was first examined with a power of 50 diameters only, for the purpose of getting a general knowledge of its contents; afterwards magnifying powers varying from 120 to 1,600 diameters were employed. During the first observations, few living organisms were noticed; but, as it afterwards proved, the germs of plant and animal life (probably in a dormant condition) were present.

I will now endeavour to describe the objects found in this matter, and begin in the order in which they appeared most abundant. First, Fungoid matter.—Spores or sporidiæ appeared in numbers, and, to ascertain as nearly as possible the numerical proportion of these minute bodies in a single drop of the fluid, the contents of the bottle were well shaken, and then one drop was taken up with a pipette; this was spread out by compression to a circle half an inch in diameter. A magnifying power was then employed, which gave a field of view of an area exactly 100th of an inch in diameter, and it was found that more than 100 spores were contained in this space; consequently, the average number of spores in a single drop would be 250,000. These spores varied from 10,000th to 50,000th of an inch in diameter. The peculiar molecular motion in the spores was observable for a short time, until they settled on to the bottom of the glass plate; they then became motionless. The Mycelium of these minute fungi were similar to that of rust or mildew (as it is commonly named), such as is found on straw or decaying vegetation.

When the bottle had remained for thirty-six hours in a room at a temperature of 60deg. the quantity of fungi had visibly increased and the delicate mycelial thread-like roots had completely entangled the fibrous objects contained in the bottle and formed them into a mass. On the third day a number of ciliated zoospores were observed moving freely amongst the sporidiæ. I could not detect any great variety of fungi in the contents of the bottle, but I cannot presume to say that all the visible spores belonged to one species, and as there are more than 2,000 different kinds of fungi it is possible that spores of other species might be present, but not under conditions favourable for their development. Some very pretty chain-like threads of conidia were visible in some of the examinations.

The next in quantity is vegetable tissue. Some of this formed a very interesting object, with a high power, and the greater portion exhibited what is called pitted structure. The larger particles of this had evidently been partially burnt and quite brown in colour, and were from coniferous plants, showing with great distinctness the broad marginal bands surrounding the pits; others had reticulations small in diameter. They reminded me of perforated particles so abundant in some kinds of coals. The brown or charred objects were probably particles of partially burnt wood used in lighting fires. Along with these reticulated objects were fragments of vegetation, resembling in structure hay and straw and hay seeds, and some extremely thin and transparent tissue showing no structure. These were doubtless some portions of weather-worn vegetation. A few hairs of leaves of plants and fibres, similar in appearance to flax, were seen, and, as might have been expected in this city, cotton filaments, some white, others coloured, were numerous, red and blue being the predominant colours. A few granules of starch, seen by the aid of the polariscope, and several long elliptical bodies, similar to the pollen of the lily, were noticed. After this dust from the atmosphere had been kept quiet for three or four days, animalcules made their appearance in considerable numbers, the monads being the most numerous. Amongst these were noticed some comparatively large specimens of paramecium aurelia, in company with some very active rotiferæ; but after a few days the animal life rapidly decreased, and in twelve days no animalculæ could be detected.

Very few hairs of animals were noticed, with the exception of wool; of this both white and coloured specimens were mixed up along with the filaments of cotton. After each examination as much of the drop of water as could be collected by the pipette was returned to the bottle, in order to ascertain if any new development of animal or vegetable life would take place, and the stopper of the bottle was replaced as quickly as possible to prevent the admission of the particles from the air in the room; and I am tolerably certain that the objects named in this paper are those which the bottle contained when Dr. Smith brought it to me. The particles floating in the atmosphere will differ in character according to the season of the year, the direction of the wind, and the locality in which they are collected, and, as might be expected, are much less in quantity after rain.

The small amount of fluid now remaining in the bottle emits the peculiar odour of mildew, and at present the fungoid matter appears inactive. For the purpose of obtaining a rough approximation of the number of spores, or germs of organic matter contained in the fluid received from Dr. Smith, I measured a quantity by the pipette, and found it contained 150 drops of the size used in each examination. Now, I have previously stated that in each drop there were about 250,000 of these spores, and as there were 150 drops, the sum total reaches the startling number of 37½ millions, and these exclusive of other substances, were collected from 2·495 litres of the air of the city*—a quantity which would be respired in about ten hours by a man of ordinary size when actively employed. I have to add that there was a marked absence of particles of carbon amongst the collected matter.

LORD COLCHESTER and the Right Hon. Stephen Cave, M.P., have been placed on the Commission to enquire into the condition of the Exchequer standards of weights and measures, in the room of the Earl of Rosse and Lord Wrottesley, deceased.

* Behind Dr. R. Angus Smith's laboratory.

ROYAL INSTITUTION.

ON the evening of Friday week, Mr. F. T. Palgrave gave a lecture at the Royal Institution on the subject of the formation of good taste in art. Mr. Palgrave's argument was that independently of the individual partiality of every observer for particular works of art, there is such a thing as good taste, governed by fixed laws, and dependent upon accurate knowledge. Among the things which ordinary observers and inferior artists often overlook were "the laws of material." In sculpture, for instance, he said that marble is only suited for works of repose, whilst bronze, being a lighter material, and of more tenacity, is suitable for works of activity. As the lecture closed considerably before the usual time, Professor Tyndall was invited to state what he saw during his recent visit to Vesuvius, and he stated that he had just returned from Naples, where Sir John Lubbock and himself had been examining the phenomena of the eruptions The country all round Naples is very smoking and hot, showing the existence of extensive subterranean fires, but they had gained no information of scientific value. On different occasions they ascended the mountain from different sides, and in one instance, when a hurricane of wind favoured them, they went further than the guide would lead them, and had a look down the fiery tube of the crater itself. The wind was so strong, that on the way Sir John Lubbock was blown down flat on his face. They also explored some hot subterranean galleries in the side of the mountain, and visited the Grotto del Cano, the well-known cavern, where the floor is covered several feet deep with carbonic acid gas. The heavy invisible gas, in fact, runs out of the cavern in a great stream, and will in the open air put out torches when they are held near the ground. He repeated some of the commoner experiments with the carbonic acid gas, by collecting some in his hat, and carrying it away a little distance from the cave, where it was poured over lighted matches, and put out the flame. A little dog is kept near the cave to be half suffocated, by immersion in the gas when visitors arrive; and Professor Tyndall protested against the cruelty of the experiment, which, he says, serves no useful purpose, and ought to be stopped.

THE NATIONAL RIFLE ASSOCIATION.

THE Council of the National Rifle Association have submitted to His Royal Highness the Field-Marshal Commanding-in-Chief the proposal to offer the following series of prizes, to be competed for at Wimbledon by non-commissioned officers and privates of Her Majesty's regular army. His Royal Highness has approved of the programme, and the Secretary of State for War has kindly complied with the request of the Council that the competitors from the various regiments should be provided with routes to proceed to Wimbledon. The "Army" Prizes and Challenge Cup, total aggregate value £265, presented by the National Rifle Association, to be competed for by non-commissioned officers and privates, being marksmen in Her Majesty's regular forces, two competitors from each regiment or battalion. First stage:—£155, divided into 50 prizes, as follows:—One prize of £10, four prizes of £5, ten prizes of £4, fifteen prizes of £3; twenty prizes of £2. Distances, 500yds. and 600yds.; number of shots, five at each distance; rifles, regulation three-groove Snider; ammunition, Government; position, regulation; sighting shots, two gratis at each distance. The prizes will be adjudged according to the highest aggregate scores made at the two distances. Second stage.—A cup, value £100, and a prize of £10 to the best shot. Competition restricted to the winners of prizes in the first stage. Distance, 600yds.; number of shots, seven; rifles, ammunition, position, sighting shots, as in first stage. The cup shall be held by the officers of the regiment, if at home; and, if abroad, by those of the depôt battalion to which the regiment is attached. In each case the commanding officer shall be responsible for the safe custody of the cup, and for its return to the Secretary of the National Rifle Association by June 20 of the year following that in which it was competed for. The Spring General Meeting of the National Rifle Association will be held at Willis's Rooms on Thursday, May 21, at 2·30 p.m., Field-Marshal his Royal Highness the Duke of Cambridge, President, in the chair.

DURING the past week thirty-six wrecks were reported, making for the present year 855.

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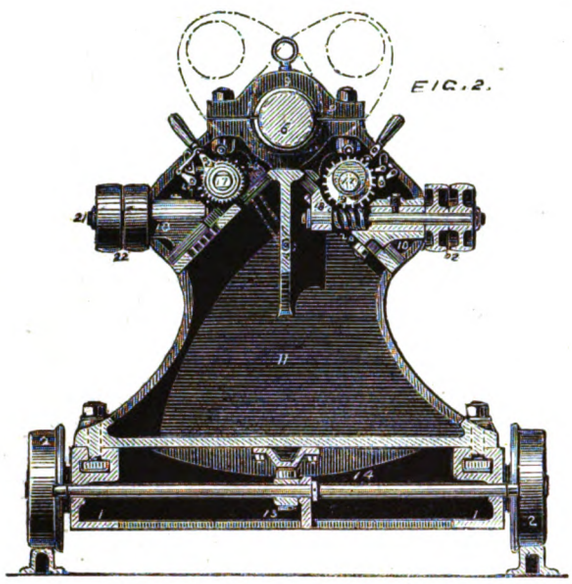
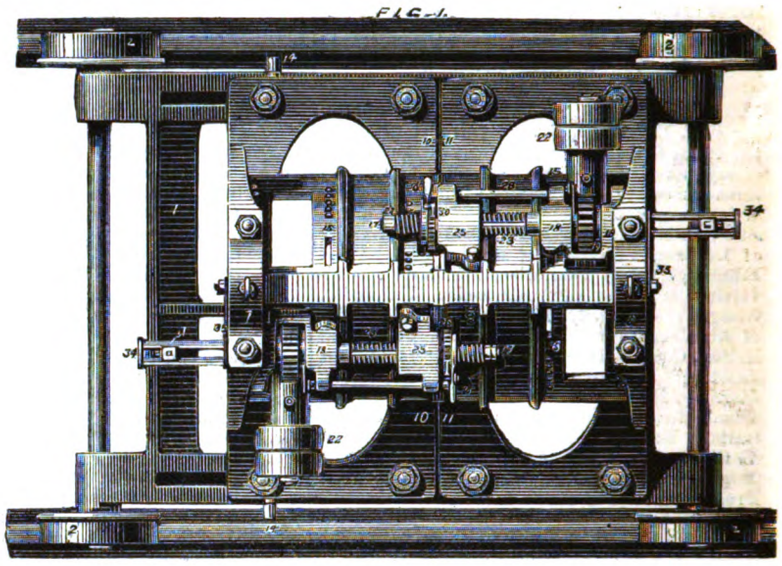
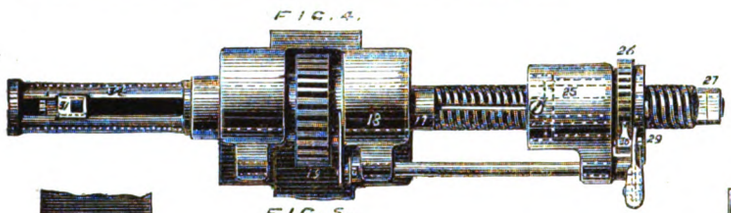
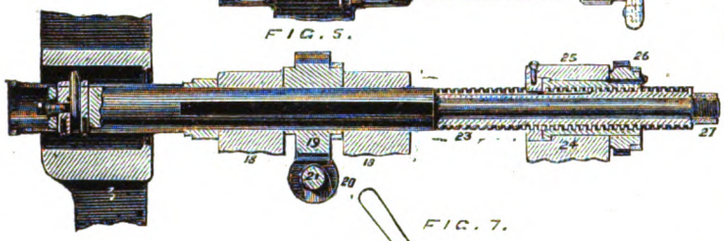
APPARATUS FOR FINISHING PARTS OF LOCOMOTIVE WHEELS.

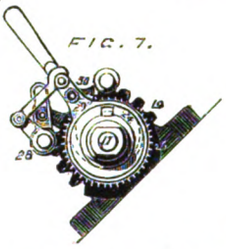
BY MR. JAMES REID.

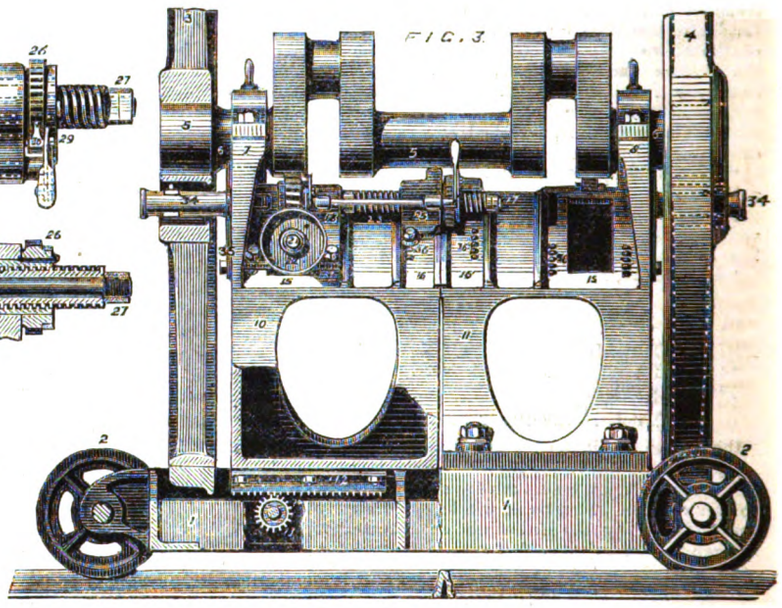












APPARATUS FOR FINISHING PARTS OF LOCOMOTIVE WHEELS.

MR. JAMES REID, of the firm of Messrs. Neilson and Co., Hyde-park Locomotive Works, Glasgow, has recently patented an apparatus for finishing the details of locomotive wheels. It was designed by him, and constructed especially for the above establishment, where it is at work and giving the most satisfactory results. It overcomes the practical difficulties experienced in all other machines, and is all that can be desired. The apparatus refers, principally, to the crank pin holes, and comprises arrangements for accurately adjusting a pair of wheels by means of the journals of their axle for insuring the crank pin holes being accurately in planes at right angles to each other, and parallel to the journal axis, and for forming these holes with a uniform and correct taper. The improved details for forming the taper are also applicable to the axle holes. In our engravings, fig. 1 is a plan; fig. 2 is a transverse vertical section; and fig. 3 is a sectional side elevation of the apparatus. Figs. 4, 5, 6, and 7, are enlarged views of one of the tool spindles and its accompanying details.

The apparatus is represented as mounted on a truck frame 1 with wheels 2, but it can be fixed to a stationary foundation. Mr. Reid, however, prefers to arrange it as shown, so that it can be run under any convenient crane to receive a pair of wheels to be operated upon, and to be thence transferred to any locality where a pair of driving belts can be conveniently applied to it. The pair of wheels 3 4 having been previously placed and keyed on their axle 5, this is placed horizontally in the machine with the journals 6 in bearings 7 8, provided for them, and furnished with accurately-formed lining pieces 9 (fig. 2) adapted for different diameters of journal. The bearings 7 8 are also adjustable at different distances apart, to obtain which adjustment, the body of the machine is made in two separate castings 10 11, and one (10) has a rack 12 fixed to its under side, having in gear with it a pinion 13 on a shaft 14 carried in the truck frame 1, and formed with squared ends to receive keys or handles. Elongated holes are provided in the truck frame 1 for the bolts, by which the adjustable body part 10 is fixed to it, and these bolts are loosened when a change is required in the adjustment.

The provision for adjusting the bearings 7 8 more or less apart is convenient for a private establishment for constructing locomotives where various gauges have to be provided for; but when only one gauge has to be provided for, as at the works of a railway company, the body of the machine may be made in a single casting. For such works also it may be convenient to have the machine permanently fixed to a stationary foundation. Between the bearings 7 8 the body or framing 10 11 is formed with equally inclined surfaces or seats 15 16 on opposite sides of the longitudinal centre line, and the surfaces 15 16 on one side are made accurately at right angles to the corresponding surfaces 15 16 on the other side. On these inclined seats a series of racket castings or heads are fixed for carrying the boring bars or tool spindles with their driving and feeding gear. There are two boring bars which are set at diagonally opposite corners, but, for the sake of clearness, we will describe the details connected with one only, those of the other being exactly alike. The boring bar 17 is carried in two bearing heads formed on one casting 18, and has on it between these heads a worm wheel 19 which turns it by means of a key and groove, and which is driven by a worm 20 on a shaft 21 carried in bearings in the same casting 18. The shaft 21 is provided with fast and loose pulleys 22 to receive a driving bel from any convenient shaft. The back end of the boring bar 17, which end is of reduced diameter, has on it a tube 23 screwed externally to work in an internally screwed bush 24, which is held in a bearing head 25, and which has a spur feed wheel 26 keyed on its projecting back end. The screwed tube 23 is prevented from turning by means of a groove and key, and it is held on the boring bar 17 so as to make this bar move longitudinally with it by nuts 27 screwed on the outer end of the bar.

The feeding is effected by means of an eccentric formed on the side of the worm wheel 19, the strap of which eccentric actuates a rocking spindle 28. A lever and link at the other end of tthe rocking spindle 28 imparts a reciprocating motion o an armed ring 29 loose on a flange on the feed spur wheel 26 on which the armed ring acts by m ans of a reversible catch 30. The front end of the boring bar 17 is formed with a transverse slot, and in this a small block 31, which is the tool holder, has the small transverse movement necessary for producing the taper of the crank pin hole 32. The steel tool or cutter 33 fits in a square socket in the holder 31, and is fixed by a pinching screw. The holder 31 is formed with flanges at one end, and a flange piece is fixed upon the other end after the holder is put into its slot. These flanges bear on the outside of a tube 34 fitted on the boring bar 17, so that this bar can move longitudinally in it. The tube is formed with longitudinal slots in which the ends of the holder move as the bar is fed along; and the outside of the tube is turned concentric with an axis slightly inclined to the axis of its bore in a plane passing through the centre lines of the slots, which causes the edges at the slots that the holder flanges bear on to be slightly tapered or inclined. With this arrangement, as the tube 34 is stationary from bearing against the casting 18, the longitudinal move-

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ment inwards of the boring bar 17 causes the slight transverse movement of the tool that produces the required taper. The tube 34 is kept against the casting by a lever collar clutch 35, which prevents it from moving outwards with the boring bar. The castings 18 and 25, which carry the boring bar and its accessories, can be shifted in such a way that the two tools can be placed at either diagonal pair of corners of the body or frame to suit either a pair of wheels with the right-hand crank pin leading, or a pair with the left-hand one leading.

When effecting a change from one diagonal disposition to the other the various parts are separated, the boring bar 17 and the screwed tube 23 are entered into their places the opposite way, and the castings 18 and 25 are respectively fixed on the seats 15 and 16, represented in the engraving as unoccupied. If the parts are shifted to the opposite ends of the same sides the larger casting 18 has not to be turned about, but the smaller one 25 has to be so turned. Duplicate lugs for carrying the rocking spindle 28 are required and provided, and the worm wheel 19 is formed with eccentries on both sides of it, so that it can be put into its place either way. Provision is made for different throws of effective lengths of crank by having gauge holes 36 corresponding to the various throws ordinarily adopted accurately bored in the inclined body surfaces or seats 15 16 to receive pins fixed in the under sides of the brackets or castings 18 25, or screw bolts, by means of which these castings are fixed to the seats, the holes and pins or bolts being carefully bored and turned to fit each other accurately. The surfaces of the seats 15 16 are parallel to planes at right angles to each other, and passing through the centre line or axis of the journal bearings 7 8, and the boring bar bearings in the castings 18 25 are actually constructed so that their centre lines are in the said planes in all positions of those castings.

THE MIDLAND RAILWAY TERMINUS.*

By PROFESSOR DONALDSON.

I VENTURE to call the attention of the members to the terminus of the Midland Railway, near King's-cross, London, which may be considered one of the most important works now carrying on in our metropolis, vast in extent—for it will cover seven acres—and gigantic in the proportions of its terminus shed. This grand feature is distinguished by a construction which, as to boldness and ingenuity, reflects the highest credit for conception and execution, on its eminent engineer, Mr. W. H. Barlow; on Messrs Waring the contractors; on Messrs Ordish and Le Fouvre, who designed the details of the roof; and on Mr. Alleyne, of the Butterley Iron Works, who arranged the travelling, staging, and hoisting gear for the purpose of fixing the roofing in its place.

The roof of the terminus shed is 690ft. long and has a clear span of 240ft. The main ribs, which are 29ft. 4in. apart from centre to centre, are latticed, and 9ft. deep, forming the curve of four-centred pointed arch, the radii being 57ft. and 160ft. respectively, and rising to the height of 96ft. above the level of the platform. The feet of the ribs cover a remarkably small area, as though they stood on pins; but here at the springing, instead of being latticed, they have plate webs and are let into a shoe, which spreads out on each side and to the projection of a buttress, so as to give a firm footing, and these shoes are bolted down to anchor plates at the foundation, built into the wall to ensure further stability. Except the shoes, the whole consists of plate iron, three intermediate ribs between the main ribs being of rolled iron, I-section, 10½in. deep. There are at regular distances on the sweep of the roof trussed purlins to carry the intermediate ribs, and so constructed that they stiffen laterally the lower flanges of the main ribs. In the whole height of the roof there are no ties, the sweep being so adjusted, and the weight so distributed and equipoised, that the series of girders, about 2ft. deep, extending across the station at the level of the floor, are sufficient to retain the feet and resist the tensile strain at that point upon the ribs.

The floor is also designed with considerable ingenuity, and merits our attention. The whole area, 690ft. by 240ft., is upheld by a series of cast columns, 14ft. 8in. apart from centre to centre, and 15ft. high, and on the caps are the transverse girders already mentioned and a series of longitudinal girders. The vaulting, if it may be so called, of this basement storey or ceiling rests on this network of girders, and is formed of Mallet's buckled plates securely fixed to the girders, and thereon comes the floor. Thus it will be perceived that the columns afford clearer space for stowage beneath than piers would have done, and the buckled plates are lighter and more sure in construction than brick vaults.

The ribs and roofing are erected and fixed in place by means of a travelling staging and hoisting gear. The system on which Mr. J. G. N. Alleyne, of the Butterley Iron Works, has designed the staging is, that the main rib is never lost hold of until all the wind-ties are finally fixed to the walls. The staging is divided into three sections, the centre consisting of six divisions, the side ones of five divisions each, and from front to rear there are four divisions. The standards consist of die-square balks of timber, 12in. square; the horizontal traverse pieces are double, 12in. by 6in. each, except the two lower one, which is 12in. square, with iron shoes bolted down to receive the feet of the standards and braces. The cross braces are 12in. by 12in. in the lower tiers, 10in. by 10in. in the two next tiers, and in the upper ranges 9in. by 9in. The wheels, on which the three sections move, are 2ft. 8in. in diameter, and run on a balk of timber 18in. square; altogether, there are 123 wheels under the staging. Of course, the three divisions of the staging can be moved, and are moved distinctly and separately; but when main ribs are being hoisted and adjusted, they are all three bolted together at each horizontal timber with wrought-iron clamps and bolts, and screwed firmly together against a chock of timber. Each gallery of the stage is fitted with two slides, which are forced outwards against the rib by folding wedges, so that the work can be adjusted to the greatest accuracy.

For moving the staging the following process is followed. When, in the first instance, two ribs have been fixed and the riveting finished, and everything is properly adjusted, the folding wedges of the two side stages are knocked out; the rib, in taking its proper deflection, rests firmly on the centre compartment; the wedges of this are not disturbed, the whole centre compartment being kept bolted down to the floor. The slides are drawn inwards, and the side divisions of the staging are moved, so that the slides orginally opposite to No. 1 rib are brought to be opposite No. 2. rib; they are then wedged out and hold No. 2, and are in turn bolted down to the floor. The wedges of the centre compartment are now removed; it is set free from the floor, moved up to No. 2 rib, and the three compartments or divisions are bolted together as before, and are then ready for No. 3 rib. The sides may be moved in about thirty minutes each, and the centre in ten minutes. These movements may be effected by hand-power of three men with iron bars to each wheel. For hoisting steam-power is used. The derrick employed for the purpose is arranged with an universal joint, so that it can be raised, lowered, or twisted round in any direction. The steam crab is furnished with a double warping barrel, so that the rope does not accumulate on it—a system first used, probably, at the Exhibition in London, 1862.

* Read before the Royal Institute of British Architects.

VENTILATION OF BARRACKS.

A PAPER, of which the following is an abstract, was recently read before the Society of Arts on a new ventilating stove in use for barracks and military buildings, by Mr. Douglas Galton, C.B., F.R.S. The stove was designed about eight years since to meet the conditions laid down by the Barrack and Hospital Improvement Committee at that period, and which aimed at supplying at all seasons every room in a building, by itself, and independent of the other rooms, with a sufficiency of air, and at the same time to prevent the temperature from falling below a desirable point. The committee, not being satisfied with the form of grate already in use, adopted the fireplace which this paper is intended to describe. The stove, which is not patented, is made of the best cast iron, and consists of three pieces, connected by screws. The first piece forms the moulded projecting frame, the second the body of the grate, and the third the nozzle or connection with the smoke-flue, the bottom flange of which is bolted to the back of the grate. The stoves are made in three sizes. The fireplace has a lining of clumps in five pieces—two sides, one back piece, and two bottom pieces. A clear space half an inch deep is formed between the back lump and the iron back to receive a supply of air through the ash-pit, which passes through a slit in the fire lump immediately above the fire. By this means a more perfect combustion of the smoke is effected. The flame, heated gases from combustion, and small amount of smoke as exists are compelled to impinge upon a large heating surface, so as to subtract as much heat as possible out of them before they pass into the chimney, and the heat thus extracted is employed to warm air taken directly from the outer air. The fresh air when warmed is passed into the room by a flue near the ceiling. The flue, which has been adopted for barracks, is carried up by the side of the smoke flue in the chimney breast. The grate (No. 1 size) will contain about 18lb. or 20lb. of coals; 40lb. will maintain a good fire for 16 hours, that is, at the rate of about 2.5lb. per hour.

In new buildings it would be very desirable to carry up the smoke flue inside the warm air flue, and so extend the heating surface. This plan was adopted in the wards of the Herbert Military Hospital, where the fireplace is in the centre of the ward, and the chimney consequently passes under the floor, and by this means an additional heating surface of 36 square feet has been obtained. The limit to which the heat from the fire can be so utilized is the point at which it cools down the chimney so as to check the draught and combustion of the fuel. With respect to the application of the grate to existing buildings, the recess in which an ordinary fire grate would be fixed forms the chamber in which the air is warmed. The front of the stove can be easily removed, thus rendering the air-chamber accessible for cleansing purposes. In applying the stove to existing fireplaces the air-chamber must be left as large as possible, cleansed from soot, and lime whited. Should the fireplace be deeper than 1ft. 6in., the depth required for the curved iron smoke flue, a lining of brickwork is built up at the back to reduce it to that dimension. The chimney bars, if too high, must be lowered to suit the height of the stove, or to a height of 3ft. 3in. above the hearth. They must also be straightened to receive the covering of the air-chambers. These coverings should be of 3-inch York or other flagging, cut out to receive the iron smoke flue, and also to form the bottom of the warm air flue in the chimney breast. In new buildings the air-chambers may be rectangular. They must be 4in. narrower than the extreme dimensions of the moulded frame of the stove, so as to give a margin of 2in. in width all round for a bedding of hair mortar.

General results of numerous experiments show that the air is admitted to the rooms at a temperature of from 20deg. to 30deg. Fah. above that of the outer air. The design of the grate was intended to preclude the possibility of such a temperature as would in any way injure the air introduced. The principle of these arrangements has been adopted for barracks in the case of grates for married soldiers; these would be useful as cottage grates. These grates have a small oven, and an open fire; warmed air is introduced into the room by means of an iron flue, carried up from the fire-brick lining of the stove inside the chimney, and introduced into the room near the ceiling through a louvred opening; by this means the heat of the smoke is utilized. This description of grate was devised for the purpose of combining a power of cooking for a cottage with great compulsory economy of fuel. It must, however, always be observed that in proportion as the heat is removed from the chimney, so is the draught, *i.e.*, the effect of the chimney as a pumping engine to remove the air, diminished, and the combustion of the fuel to some extent checked. There is one point connected with the flue which must be carefully attended to, viz., the fresh air should be taken from places where impurities cannot affect it, and the flue must be so arranged and constructed as to afford easy means of being periodically thoroughly examined and cleaned. In barracks the rule is that such cleansing should take place at least once a year. Now that the question of economy of fuel is becoming daily of more importance, it is desirable that we should adopt every means of utilizing, to the fullest practical extent, the fuel which we burn. If this was done in all households the saving of fuel to the country and of money to individuals would be considerable.

In conclusion, the merits which are claimed for this fireplace are:—

1. That it ventilates the room.
2. That it maintains an equable temperature in all parts of the room, and prevents all draughts.
3. That the heat from radiation is thrown into the room better than from other grates.
4. That the fire-brick lining prevents the fire from going out, even when left untouched for a long time, and prevents the rapid changes of temperature which occur in rooms in cold weather from that cause.
5. That it economises fuel partly by making use of the spare heat, which otherwise would all pass up the chimney, and partly by ensuring by its construction a more complete combustion, and thereby diminishing smoke.

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THE GOVERNMENT BREECH-LOADING REVOLVER.

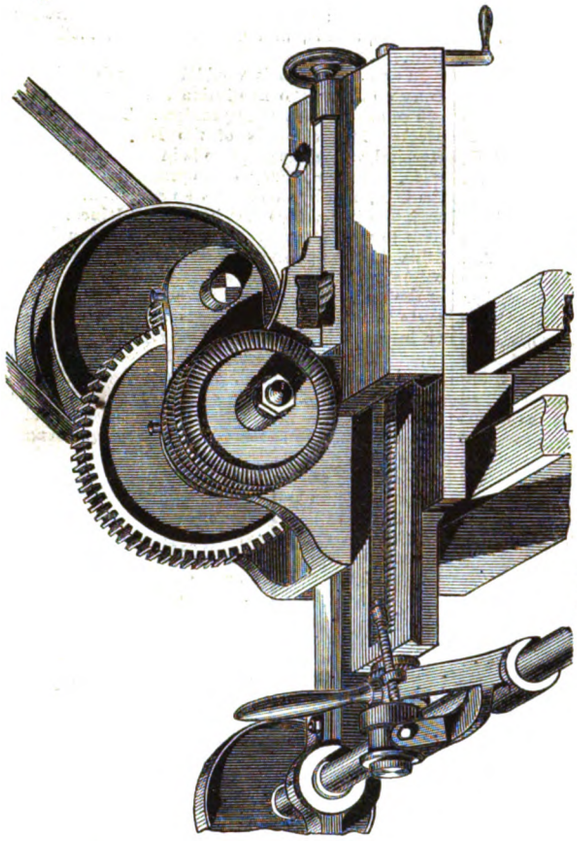

Fig. 1.—Machine for Gauging the Frames.

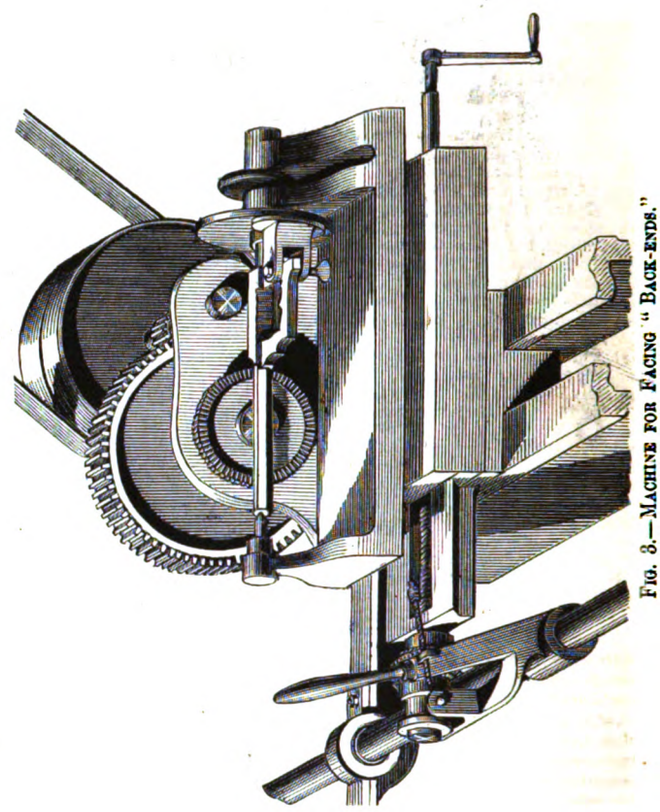

Fig. 3.—Machine for Facing "Back-ends."

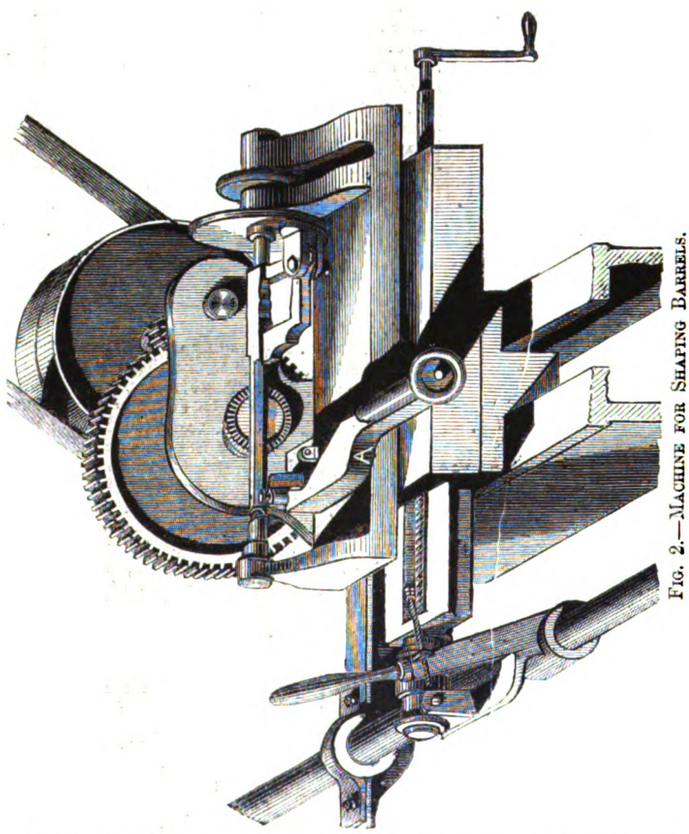

Fig. 2.—Machine for Shaping Barrels.

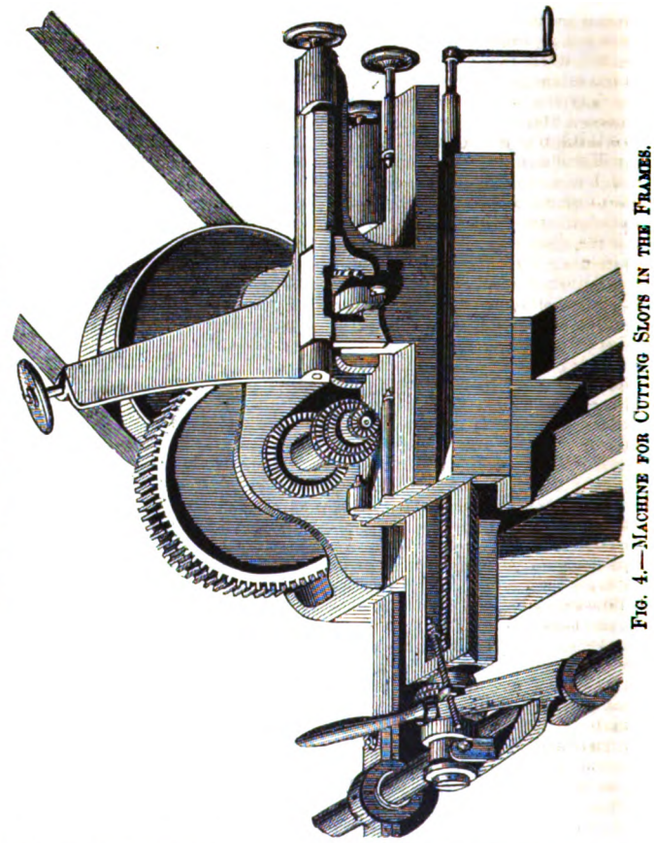

Fig. 4.—Machine for Cutting Slots in the Frames.

6. That it prevents smoky chimneys by the ample supply of warmed air to the room, and by the draught created in the neck of the chimney.

Mr. Galton believes that the principles adopted in these fireplaces are sound; they have been largely applied to military buildings, such as barracks and hospitals, and they have been recommended for introduction into workhouse wards. He recommends them to the attention of architects and builders, having the less hesitation in doing so, as there is no patent in question, and there is no one can claim any pecuniary interest in the manufacture of the grate.

THE GOVERNMENT BREECH-LOADING REVOLVER.

THE adaptation of the breech-loading principle to military rifles was very naturally followed by a general expression of opinion that the exigencies of the service required a similar change

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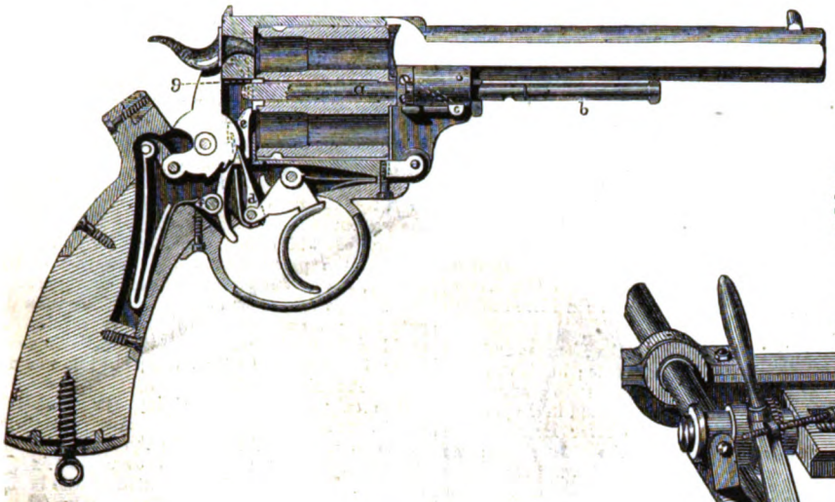
THE GOVERNMENT BREECH-LOADING REVOLVER.



MR. JOHN ADAMS' REVOLVER.

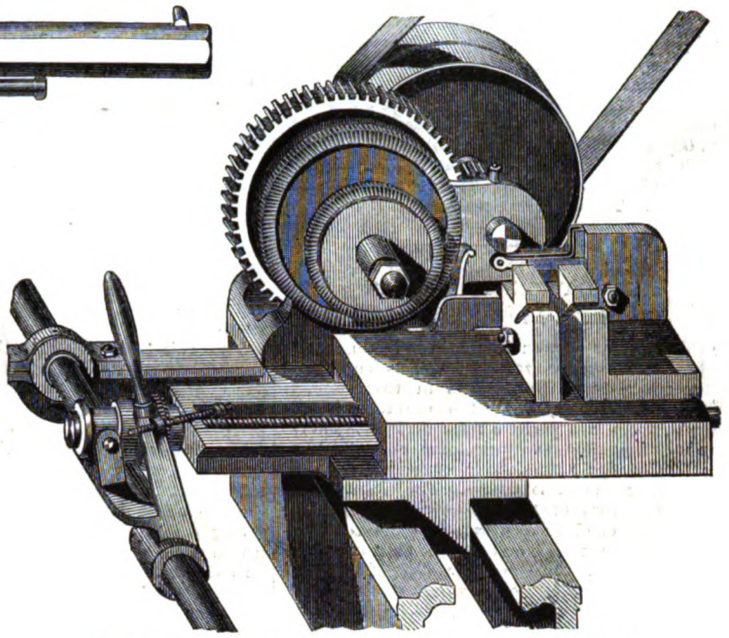


FIG. 5.—MACHINE FOR CUTTING SLOTS IN THE "BACK-ENDS."

in the revolvers in the hands of our navy. We have repeatedly pointed out the advantages which would accrue from such a change, and later on our popular contemporary, the "Pall Mall Gazette," went further, and while expatiating on the advantages offered by the breech over the muzzle-loader, commended the Government upon their choice of Mr. Adams' pistol, and the ammunition specially designed for it by Colonel Boxer. Since that time large numbers of these weapons have been made and many experiments conducted, all of which have proved the correctness of official judgment. We have much pleasure, therefore, in laying before our readers illustrations of the arm itself, and of some of the machinery employed in its manufacture, for the engraving and particulars of which we are indebted to the "Engineer" of last week.

We think that a mere inspection of our engraving will sufficiently explain the construction of the pistol, but we have nevertheless indicated some of the leading features by letters, thus:—*a* is the rod upon which the cylinder or breech chamber rotates, *b* is the ejector, *c* is the bolt for securing the ejector in its place when not in use, *d* is the lifting scear, *e* is the lifter, *f* is the scear, and *g* is the ratchet on the cylinder upon which the lifter acts. The cocking may be performed through the trigger or after the old plan; in the former case the trigger, when drawn back, raises the lifting scear *d*, which presses back the hammer until the point of the lifting scear escapes from its notch, and allows it full forward, the trigger at that moment pressing against the scear *f* and preventing it from engaging with the hammer. The rotation of the cylinder is performed by means of the lifter *e* engaging with the ratchet *g*, and the cylinder is locked during the instant of firing by the trigger, as shown in the woodcut. The cartridges are inserted at the side, and the opening is closed by a small shield hinged on to the "back end."

The barrel and frame are first forged together in one mass, best "Marshall's" being the iron employed. The blank is then centred at each end for a boring tool, and fitted in a template for the purpose of drilling out the square opening for the breech cylinder. The holes in the template through which the drill works are bushed with steel, and we understand they do not wear out so rapidly as might be supposed. The barrel is then drilled out by means of vertical drilling machines. Formerly ordinary horizontal drills were used, but they were not found to be nearly so satisfactory in their operation as the vertical, and required more lubricants.

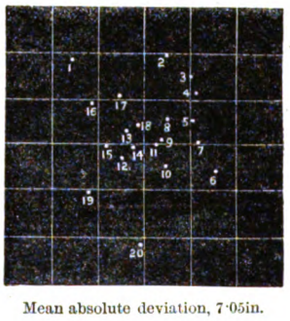
After it is removed from the boring machine the barrel is laid on its back on the table of the machine, shown in fig. 1, which shapes the sides of the frame by means of two rose-cutters, and of course gauges them accurately. Fig. 2, another tool of a somewhat similar kind, cuts the polygonal faces upon the barrel, the blank being turned on its axis as each face is cut. The same machine squares the end of the frame, to do which the blank must be shifted to the holder A. All these machines are self-acting, but they can be thrown out of gear and the feed motion performed by hand if desired. Fig. 3 is a machine very similar to the last, and although our engraver has represented a barrel in the process of facing, this tool is more generally used for facing the breech-pieces or "back ends." For this purpose a number of them are secured in a frame, which in its turn is centred in front of the rose-cutter. We now come to the machine for cutting out the recesses for the lock, hammer, &c., shown in fig. 4. The barrel is first securely clamped on its back on the table and passed gradually under one of the rose-cutters, which works out the cavity in the frame for the trigger; it is then removed to the vertical frame, where it comes under the action of another cutter, which similarly cuts out the hammer slot; and lastly it is placed horizontally, as shown in the engraving, in which position the last and smallest cutter removes a portion of the metal at the side of the frame, behind the cylinder slot, for the lifter to work through. The tool shown in fig. 5 cuts out the two slots in the "back end," the larger wheel cutting out the slot to receive the frame of the pistol, and the smaller the cavity for the action.

The barrels are then placed in the rifling machine, where they are grooved to a pitch of one turn in 2ft. There are five grooves each $\frac{1}{4}$in. wide, with lands of 1-16in. These grooves are very shallow indeed in the centre, but deeper at the angles. The breech cylinders are forged solid, and consist of sections cut from a round bar. The blank is centred somewhat similarly to the frame previously described and then drilled through with a small tool, finished with a larger, and ultimately turned up in a lathe. The hammers and triggers are forged in dies, and after placing them in "jigs," which are frames or guides of steel hardened in oil, they are filed up by hand. The smaller cylindrical parts, such as the rod *a*, and the ejector, &c., are also made with rose-cutting tools fitted into ordinary lathes. It follows, of course, from the construction of so many parts by machinery, that out of a large number of pistols so turned out there should be a very small proportion of wasters, and this was found practically to be the case. The gauge of the barrel, as prescribed by the Government, is ·443in., and if any finished arm be found to possess a barrel into which a gauge of ·446in. can be inserted, it is at once rejected.

The efficiency of all breech-loading arms is, moreover, much dependent upon the ammunition, and we have no hesitation in stating that we have not hitherto seen any pistol ammunition which could excel that designed by Colonel Boxer specially for this pistol in efficiency and certainty. Cartridges for breech-loading revolvers have been almost universally made either on the pin-fire or rim-fire systems, both of which are open to objections. In the first, the projecting pin is a source of inconvenience, the cartridge is open to the chance of accidental explosion, and it has to be inserted in a particular position in loading. The rim-fire cartridge is frequently either weak at the rim, and bursts, or becomes compressed at the point of impact with the hammer and jams in the chamber, and in neither of these systems is the gas check satisfactorily accomplished.

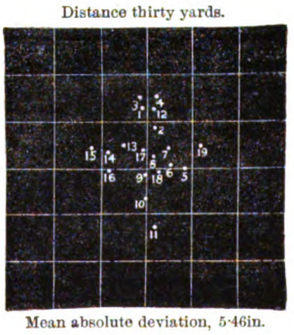
The central-fire system has, however, none of these drawbacks, and, independently of the other advantages peculiar to the Boxer system, the ammunition for a revolver is materially improved by the adoption of this principle alone. As will be seen from the full-sized section of the cartridge for the Adams revolver, shown in our engraving, the base closely resembles that of the cartridge for the Snider rifle; but the body instead of being constructed of coiled brass, is simply a thin copper tube. The bullet weighs half an ounce, and is projected with a charge of half a drachm. We also give two diagrams of targets made at Woolwich

SIZE OF TARGETS 3FT. SQUARE.
Distance sixty yards.



Mean absolute deviation, 7·05in.

Distance thirty yards.



Mean absolute deviation, 5·46in.

last month by Captain Majendie, R.A., Assistant Superintendent of the Royal Laboratory. These

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targets were made from a hand-rest with the service cartridge, "a very strong and gusty wind was blowing nearly across the range all the time."

We give the following extract from Captain Majendie's report:—"In making these targets the average time taken, including loading and knocking out the empty cartridge cases, was 45sec. for every six cartridges. Mean penetration of twelve shots at 30yds.—four ½in. elm boards 1in. apart; at 60yds., three ½in. boards. The revolver worked with perfect freedom throughout, and was no more fouled after firing 200 cartridges than after firing the first. There were no misfires."

IRRIGATION IN SPAIN.*

By MR. G. HIGGIN, M. INST. C.E.

THIS paper was on irrigation in Spain, chiefly in reference to the construction of the Henares and the Esla Canals in that country. It was stated that, of all the countries in the world, there was perhaps none that so much required irrigation as Spain, nor one which so gratefully repaid the labour expended upon it, by rich and valuable results. The climate of the south and east of Spain was suitable for the production of crops of almost all kinds: productions of the torrid and temperate zones here grow together. In the gardens of Murcia and Valencia might be seen wheat, barley, corn, maize, the orange, the lemon, the date palm, the olive, the citron, the peach, the pear, the apple, rice, pepper. In Malaga and Seville, in addition to these were the sugar-cane, the cotton-plant, the prickly pear, and, in sheltered spots, the plaintain, which was seldom found out of the tropics. The soil of most of the river plains was a rich alluvial deposit, from 3ft. to 10ft. in depth. Nothing was wanting but water; and this might frequently be seen a few yards off running to the sea, useless, and unproductive. A few charts of comparative rainfall and temperature had been prepared, which showed that, with the exception of Oran, Spain was by far the driest country. Thus, while Piedmont had a fall of 37in., Lombardy 38in., Algiers 27in., and Bône 25in., Spain had only an average of 17in; and in two cases, that of Madrid and Alicante, the mean annual fall was only 12in. and 13½in. respectively. The mean rainfall of Oran was 14½in. A comparison of the mean rainfall and temperature during the seven irrigating months from March to September, and the mean maximum temperature during June, July, and August, of Lombardy, Piedmont, and Spain, showed that, while Piedmont had a mean temperature of 63deg., and a mean maximum of 85deg., with a rainfall of 29in., Seville, with a mean temperature of 78deg., and a maximum of 111deg., had only a rainfall of 5½in. Madrid with a mean temperature of 65deg., and a maximum of 98deg., had a rainfall of only 5in. Alicante and Valladolid, though a little better than Seville and Madrid, were far inferior in rainfall, and superior in heat to either Lombardy or Piedmont. The vital necessity of irrigation was thus very apparent.

The earliest, and indeed almost all the, irrigation works in Spain were constructed about the year A.D. 800 or A.D. 900, when that country was under the dominion of the Moors. Perhaps the system of irrigation and the whole administration of the waters in Valencia and Murcia were as perfect as well could be, and the results were very surprising. It was not possible, however, within the limits of this paper, to give more than a cursory notice of these works; but such data were collected as would assist in the description of the new canals now in course of construction by the Iberian Irrigation Company. The areas of the several large irrigation districts in Spain were then detailed, amounting together to 680 square miles. According to the published Government returns, the total amount of irrigated ground in Spain was 4,439 square miles, so that it would seem that there was an area of 3,759 square miles irrigated from water wheel, small canals, tanks, &c., a quantity which was believed to be excessive. Admitting, however, that the returns were correct, even then only 4⅓ per cent. of the whole cultivated land was irrigated. While the rate of population in all Spain was only 81 to the square mile, in the irrigated garden of Murcia there were 1,681 inhabitants to the square mile, and in Orihuela 767 inhabitants per square mile.

The effect of irrigation was to raise the value of land ten, fifteen, or twenty times. Several illustrations of this were cited, and it was stated that, as a rule, all over Spain, good land in the valleys when unirrigated might be bought at an average price of from £6 to £10 per acre, while irrigated ground fetched from £80 to £120 per acre. In proportion to the value of the ground was the value of the water. Colonel Baird Smith gave the value of a cubic foot of water per second in Piedmont at £16 per annum, and in Lombardy at about £15 per annum. In most of the old systems of Spanish irrigation, the water was attached to the land, and was sold with it, and the value of the water could not, therefore, be ascertained. But perhaps the fair average value of a cubic foot of water per second in Spain might be taken to be that fixed by the Government for the Henares Canal, viz., £375 per annum, which was not considered a high price.

The projects for irrigating the Henares and the Elsa valleys were of very old date; but it was only during 1859 that the concessions were granted, and in 1863 that a company was formed in London to carry out the works. The river Henares rose amongst the mountains of the Somosierra: its course was extremely steep, and very rapid, the total fall of the river, from the weir of the new canal to Alcalá, a distance of 36 miles, being 407ft., giving a mean fall 11·3ft. per mile. The total length of the new canal was 28 miles. It received its water from the river at a point 16 miles above Guadalajara, just below the junction of the Sorbe and Henares, and ended at Alcalá. The area of ground capable of irrigation in this valley, after deducting that due to roads, streams, towns, &c., was 27,170 acres. For this purpose the volume of water conceded by the Government was 175 cubic feet per second for the nine months from October to June inclusive, and 105 cubic feet per second for the remaining three months. From accurate measurements made near the new weir since the commencement of the works, it appeared that during the months of July, August and September, the average quantity of water carried by the weir was 210 cubic feet per second, the lowest point which it had touched being 140 cubic feet per second. During the remainder of the year it carried an average of 300 or 400 cubic feet per second; but it was liable to enormous floods, and some came down during the progress of the works, which were estimated to amount to 8,000 cubic feet per second. The weir, it was calculated, would discharge 20,000 cubic feet per second.

The most difficult portion of the works was comprised in the first division—involving a rock cutting, 16ft. in depth, immediately after leaving the river; then a tunnel 3,171yds. in length through a high limestone cliffs, followed by a deep cutting in gravel. At the ninth kilomètre the canal crossed the Madrid and Saragossa Railway; and at the tenth kilomètre, a wide torrent bed. These were the ruling points in this section, and it was with reference to them that the actual height of the new weir was fixed. At the site chosen for the weir, the bed of the river was composed of compact clay rock, very impermeable, mixed with strata of excessively hard conglomerate. The front wall was built of rubble in hydraulic mortar, the foundation being benched into the rock. The main body of the weir was of hydraulic concrete; but in order to guard against filtration, a continuous line of cut stone was let into the rock in the centre of the concrete, all the stones being bedded in pure cement. The apron was entirely of cut stone, and from the top of the rubble wall to the crest, the weir was also of cut stone. The water for the canal was drawn off by five sluices, set in masonry arches, built of large blocks of rock-faced ashlar. At the entrance of the canal three sluices were fixed, for the purpose of scouring out any deposits which might accumulate in front of the gates. Immediately inside the head sluices, and forming a portion of the head works, there was an overflow weir, to provide for the discharge of any water which a sudden flood might admit into the canal during the absence of the guard. The weir was 130yds. long between the abutments, and its total cost, including all the head works and the waste weir, had been £17,343, or 50s. per cubic yard, as the mean price of the total cubical contents. Details were given of the prices paid for different classes of work, and of the materials employed. One flood, which came down when the weir was unfinished, tried it severely. The water rose 4ft. over the crest of the finished portion, completely filling up the gap, and pouring with great force on the exposed concrete hearting of the unfinished end. This flood was estimated to have a volume of more than 9,000 cubic feet per second, yet not a single stone was displaced.

The construction of the tunnel offered no engineering difficulties. About one-half of it was in a stiff, tenacious clay, the remainder being in limestone rock. It was found necessary to line the whole with brick, as the rock, though hard when first cut, crumbled under exposure to air and water. The bricks used were made in the valley, and, after a little trouble, they were obtained of a good quality, at a cost of £2 a thousand, delivered on the works. The whole of the brickwork was set in hydraulic mortar. As it was found, however, that the pure lime and sand set too quickly, the custom of the country was followed, and a percentage of white lime was mixed with the hydraulic, the proportions being one part of hydraulic, one part of white lime, and four parts of sand. This mortar was longer in setting than the pure mortar, and gave much better results. It could not be used where the work was liable to be immediately covered with water; but this was not the case in this tunnel.

The only other works of importance on this canal were an aqueduct over the Arroyo Tejada, at the entrance of the tunnel; the bridge under the railway; and the bridge over the Arroyo Majanar. The difficulties presented by the bridge under the railway were those due simply to the work having to be carried on without disturbing the passage of the trains. This was done by shifting the line, and building one-half of the abutments at a time. The railway was carried on wrought-iron girders sent from England. The canal was carried over the Torrent Majanar in a wrought-iron tube 66.6ft. span. When put together, complete, this tube was immediately filled with water to a depth of 5ft., and had since been kept full. It was perfectly tight, both at the joints with the masonry, and in other parts. With a load of 93 tons of water, it sank ¼in. in the centre. At the side of this tube were three sluices for discharging the canal, if necessary. The average prices paid for the smaller works, the manner in which the excavations were performed, and the class of labourers employed, and their pay, were then severally treated of.

The sections adopted for the first division of the canal had inside and outside slopes of 1½ to 1, and the banks were 6ft. wide on the top. The depth of water in the first few divisions was 5ft., and the velocity was 2ft. 4in. per second. This was rather high, but it was a matter of importance in Spain to avoid exposing the water in wide shallow channels, as with a less velocity weeds grew freely. Many of the old canals and watercourses of Spain had a mean velocity of 3ft. per second.

The Esla Canal, as regarded ease of construction, was perhaps one of the best in Spain. The whole estimated cost of the works, including a weir 191yds. long, was a little under £100,000; and for this amount 32,140 acres would be perfectly irrigated at a cost of £3 2s. per acre, while the cost per acre of the Henares Canal was £7 7s. The land in the Esla Valley was exceptionally rich; it was very thickly populated; and the only objection that could be made to it was its distance from any seaport.

One of the most interesting questions, in the construction of an irrigation canal, was the acreage which could be irrigated with a certain disposable quantity of water. Opinions varied very much upon this point. The amount supplied in different districts was given, and it was stated that, in Spain, the usual dotation for rice crops was considered to be 2½ litres per second per hectare. It had been found, by M. Ribera, from a series of experiments made near Madrid, that the quantity of water consumed in the irrigation of a nursery garden was 0·36 litre per second per hectare, and for a market garden 0·47 litre per second, in both cases the water being supplied without stint. The author had found, by experiment, based on the quantity of water actually employed by cultivators, also near Madrid, that ½ litre per second would irrigate one hectare every twelve days. This, it was thought, was quite sufficient for the cultivation of almost any crop except rice; and taking into account the fact that, in a large valley, such as the Henares, there must always be a great variety of crops, many of which would only require irrigation every twenty or thirty days, it was evident that ½ a litre per second was a good dotation for a canal. This, in English measure, amounted to one cubic foot per second for every 140 acres. The quantity allowed in India varied, it was believed, from 120 to 200 acres per cubic foot per second. The canon fixed by Government for the Henares Canal was equivalent to 3s. 9d. per irrigation of 450 cubic metres, and

*Read before the Institution of Civil Engineers.

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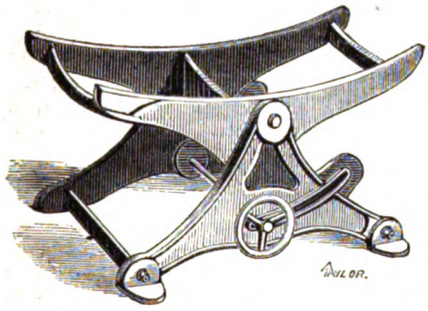
for the Esla Canal, 2s. 9½d. for the same quantity; the lower price, in the latter case, being due to the less expensive character of the works. Some particulars of the price of water in Spain were then furnished.

Several modes of measuring the water to be supplied to the land-owners were then described, including the system adopted by the Moors, the Milanese module, the plan followed on the Marseilles Canal, and a new method, by Lieutenant Carrol, of the Indian army, which had been tried on the Ganges Canal. The principal objects to be sought in a module were, simplicity of arrangement of the different parts, freedom from friction or any similar deranging cause, constant discharge under varying heads, and, of course, an exact measure of quantity. It was of great importance that there should be no concealed machinery, and also that the measure should be capable of being easily inspected by the landholders. The module adopted on the Henares and the Esla Canals could not lay claim to novelty; but it was believed it would fulfil its purpose practically. The water was measured by being discharged over a knife-edge iron weir, without any perceptible velocity, and when perfectly still. On the wall of the outer chamber was fixed a scale, whose zero point was at the level of the edge of the weir, and by means of this scale any person could satisfy himself that the proper dotation of water was flowing into the distributing channel. By arranging the sluice the guard could regulate to a nicety the height of water to be passed over the weir. Experiments were being made to ascertain the proper co-efficient for these weirs under varying heads.

As regarded the probable losses by filtration and evaporation, it was difficult to arrive at any reliable calculation, as different authorities gave such contradictory results. During the month of July, the water evaporated from the Henares Canal was equivalent to nearly ¾ per cent. of the whole volume. Another important point to the irrigation engineer was the principle followed in the distribution of the water. In the Henares Valley the ground was divided into plots of from 750 to 850 acres, each plot being served by one of the primary channels taken off direct from the main canal, one of the modules previously described being fixed at the point of departure.

NEW CASK STAND.

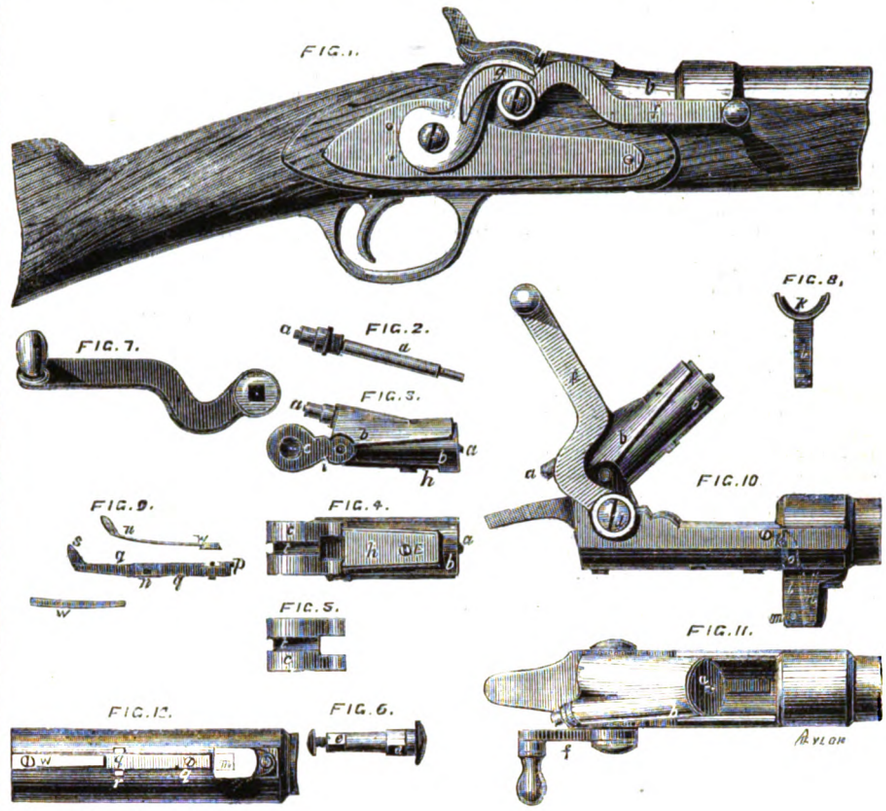
A VERY efficient cask stand has been invented by Mr. James Turnock, of Broad-street, Ross, Hereford, and which we show in the annexed cut. It is made of iron, and consists of



a lower and upper frame, the upper one being centred at the apex of the lower triangular frame, and fixed by the hand-wheel at the side. The upper frame is tilted over to receive the cask, which is easily lifted over into position for tapping, neither skids nor heavy lifting being required. The cask being on it is secured in position by turning the hand-wheel, which binds the two sides of the stand firmly together. For tilting the barrel the wheel is reversed, and the cask stooped over to the required position, and the wheel again tightened. This stand possesses many advantages; besides being small and compact, it enables the liquor to be drawn off clear to the last, as the motion of tilting causes no disturbance of sediment. It is also particularly adapted for cellars where room is an object, as it covers less space than the barrel it carries.

In the year 1867, 34,661 gallons of proof home-made spirits were removed from England to Ireland; and 1,115,766 gallons were removed from Ireland to England; 11,060 gallons were removed from England to Scotland, and Scotland favoured England with 3,600,440 gallons.

THE REILLY-COMBLAIN RIFLE.



THE competitive trials of breech-loading rifles has opened up a field for invention, of which due advantage has been taken. The result has been, and still is, the patenting of a vast number of ideas upon the subject, of which but few have found, or ever will find, their way into practice. Of the few which have been worked out, and have found favour with the public, the most recent example is the Reilly-Comblain rifle, which in its various details forms the subject of the accompanying illustration. It is a member of that system in which the breech-block is drawn back and turned up on a hinge. The hammer by the same movement is cocked or half-cocked by means of a lever at the side of the gun. There is also an arrangement for extracting the empty cartridge case. In our engraving, fig. 1 is a view of a portion of the right hand side of the gun with the parts in the position they occupy after the discharge; figs. 2 to 9 are views of various parts detached, to which we shall presently refer; fig. 10 is a side view; and fig. 11 a top view of the breech portion of the gun with the parts in the position they occupy, when the breech is open for the insertion of the charge; fig. 12 is a view of the underside when the gun is ready for firing.

The exploding pin *a*, fig. 2, is fitted in a breech-block *b* (shown in side view in fig. 3 and in bottom plan in fig. 4) similar to that used in the Snider gun; this block is, however, not hinged to the side, as in the Snider, but is hinged at the back to one end of a link *c* (shown detached in fig. 5). This link receives at its other end a square part *d* of an arbor or strong pin (shown detached in fig. 6) passed transversely through the stock, while another square part *e* of the arbor is received by the rear end of the lever *f*, which is shown detached in fig. 7. This lever is bent near its rear end to bear against a projecting part *g* of the hammer, as seen in fig. 1. As the lever *f* is being raised by its knob into a vertical position or a little beyond, as seen in fig. 10, its bent portion presses against the projecting part *g* of the hammer, putting it at full or half-cock. This movement of the lever moves the arbor (fig. 6) round, and consequently the link *c*, thereby drawing back the breech-block *b*. When the link *c* has moved a certain distance a projection or spring plate *h* on the underside of the breech-block takes into a notch *i* in the link, so that the block *b* partakes of the further movements of the lever and link, and is thereby raised into an inclined position, clear of the opening behind the barrel, as seen in fig. 10.

The arrangement for extracting the cartridge case consists of an ordinary curved extractor *k* (fig. 8) on the top of a vertical bar *l*, which is pivoted at its bottom at *m* (fig. 10), and is continually pressed upon in front by a spring *n*. A notch *o* at the top of the bar *l* receives, when the parts are in position, a projection *p* on the front of a bar *q* (fig. 9) pivoted at *r*, and lying in a longitudinal recess in the under side of the block chamber, as seen in fig. 12. The rear *s* of the pivoted bar *q* is turned upwards, and when the breech is opened a grooved part *t* of the under side of the link *c* presses upon the turned-up portion *s*, thereby lowering the rear of this bar and lifting up its front end *p* from the notch *o* of the extractor bar. The extractor *k* being thus released, it is suddenly moved back by its spring *n* a short distance, so as to eject the cartridge case, which then comes against a curved spring *u* on the upper side of the pivoted bar *q*, and is thus directed clear of the gun. This spring, however, is now done away with, and in the rifles now made by Messrs. Reilly the spring *u* and the pivoted bar *q*, instead of being in two pieces, are formed in the solid. This improvement simplifies the working parts, and does away with an objectionable spring. When the breech-block *b* is returned to its chamber, a spring *w* causes the pivoted bar *q* to again enter the notch *o* of the extractor bar.

It will be seen that the action of this rifle is exceedingly simple, and, having one of these rifles at hand, we can answer for its easy manipulation. There are but three motions—opening the chamber which cocks the piece, inserting the cartridge, and closing the chamber for firing. We have not yet tried the arm, but Messrs. Reilly, of 502, New Oxford-street (to whom we are indebted for our particulars), inform us that the trials made by them have proved highly satisfactory. Out of one rifle they have had 500 consecutive shots, the action working well, and no hitch occurring. We may add that these rifles are now being made in considerable numbers, and we think its merits entitle it to a favourable reception by the public.

THE Council of the Royal Society recommend the following gentlemen for election to the Fellowship:—J. Ball, H. C Bastian, M.D.; Lieutenant-Colonel J. Cameron, R.E.; Professor R. B. Clifton; M. W. Crofton, J. B. Davis, M.D.; P. M. Duncan, M.D.; P. Griess, A. G. V. Harcourt, Rear-Admiral A. C. Key, Rear-Admiral E. Ommanney, J. B. Pettigrew, M.D.; E. J. Stone, Rev. H. B. Tristram, W. S. W. Vaux.

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AERONAUTICS AT THE CRYSTAL PALACE.

WE have more than once drawn attention to the approaching aeronautical exhibition at the Crystal Palace, and we now append the latest detail particulars for the information of those of our readers who may intend to exhibit. For fuller particulars we refer our readers to the MECHANICS' MAGAZINE of the 30th of March last, page 217. The exhibition will be opened on Thursday, the 25th of June. There will be no charge for space. Each exhibited article must be accompanied by a large card or placard in duplicate, having conspicuously printed its name and object. Goods will be received at the Crystal Palace on and after the 1st until the 20th of June, unless the term be prolonged by special arrangement. A description of the articles intended for exhibition, not exceeding 100 words, must be sent to Mr. F. W. Brearey, the hon. sec., on or before June 1, for insertion in the catalogue. Fuller particulars will be charged for. Intimation should also be given within this date of any exhibitor's desire to explain his invention, either in person or by deputy. In addition to the prizes already announced, smaller prizes, as far as the guarantee fund will allow, will be given to exhibitors of other machines, according to merit. Two members of the Aeronautical Society, viz., Mr. Thos. Brassey and Mr. Stephen Ballard, C.E., have contributed £20 each to increase the prize for light engines.

During the exhibition, daily experiments and partial ascents will be made in a captive balloon, upon the plan lately pursued in Paris by Mons. Giffard. Messrs. Domange and Delamarne's "Ballon Captif" has been engaged for this purpose, under the management of Mons. Delamarne, who will inflate it with gas especially manufactured under his superintendence; and it is proposed to make successive ascents to at least 1,000ft. The car of this aerostat is 3yds. square, and will accommodate fourteen persons. Mr. Glaisher will largely avail himself of the opportunity here afforded for meteorological experiments during the captive ascents both by day and night. During the latter the power of the magnesium lamp will be tested, both as to the distance from which it can be seen at different elevations, and its own powers of illumination. Similar experiments not confined to the magnesium light will be conducted. Each member of the Society will be entitled to an ascent during the daytime free of charge. Applications for a ticket, to admit members only, to be made to the hon. sec., who will also, upon application, furnish a free pass to the exhibition. Balloons for free ascents, it is hoped, will also be held in readiness, under the guidance of experienced aeronauts, for the accommodation of visitors, who may engage to make an aerial excursion.

WATER-CART FOR THE CITY OF LONDON.

THERE are several defects in the water-carts at present in use; for instance, whether much or little water be required to be spread over a given space, and whether the level of the water be high or low, it always obtains exit by passages and holes of the same sectional area, and of dimensions that are unalterable to suit the circumstances of the case. The body, too, is placed at once on the frame of the cart, which is fixed to the axle of the wheels, thus affording no spring to ease any sudden concussion to which the cart is liable when in use. Further, the body of the cart is apt to rust, from its constant exposure to the joint influence of air and water, whilst the strains and concussions to which it is subjected during use, from rugged roads, the varying quantity of water, and from other causes, tend to loosen the rivets and to promote leakage. We, therefore, gladly draw attention to an improved water-cart, which has been designed by Messrs. Bayley and Rawsthorne (late Braby and Son), of the Patent Steam Wheel Works, Newington Causeway, Southwark.

Taking the above objections seriatim, we find, in the first place, the amount of flow from the body of the cart regulated by a simple arrangement. A main or branch pipe, bent in the usual quadrantal form, proceeds from the bottom of the body to the middle of the horizontal distributing pipes, of which there are two, one above the other. The main pipe is divided into two chambers by a longitudinal metal diaphragm, and the distributing pipes are each in exclusive communication with one of these chambers. Underneath the ordinary valve of the main pipe is a revolving disc valve, having nearly one-half of its area cut away, so that the opening thus formed may be over one or other of the two chambers. According to the position of the valve the water is admitted to the upper or lower distributing pipe, or to both, and as the upper distributor has double the number of holes the lower one has, the quantity of water distributed in a given time can be perfectly regulated within certain known limits. This is a very important feature, as it enables a larger supply of water to be delivered on newly-made roads, where it is most needed. In the next place, Messrs. Bayley and Rawsthorne have introduced springs. By this means the body of the cart is preserved, to a great extent, from the effect of blows and sudden concussions. By submitting the body of the cart to the process of galvanization oxidation is prevented.

Not only in details does this cart differ from the ordinary water-cart, but in general construction, the appearance being certainly greatly improved. The cart is hung on a cranked axle, which brings it very near to the ground, so that the flow of water lays the dust better than if thrown from a greater height. The driver sits on the top of the cart, and governs the flow of water in the usual way. The valve is regulated before starting on the journey from the interior of the cart, where it is set to either the slow or the quick flow according to the requirement. Altogether, the arrangement of this cart is most satisfactory, and a recent inspection at Messrs. Bayley and Rawsthorne's works of one of a number now being built for the City of London convinces us that the Corporation have taken a step in the right direction in adopting these improvements.

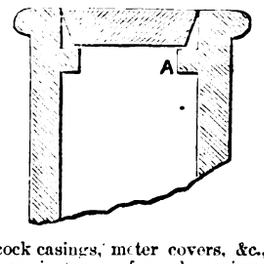
Whilst looking round Messrs. Bayley and Rawsthorne's works, we noticed the excellent patent wheel and axle with which they fit all the carts and waggons they turn out, which are not a few. In fact, the wheel is now universally adopted by leading firms in London, and is extensively supplied to the provinces and the colonies. The wheel is made with a cast-iron nave, the inner surface of which is case-hardened. The nave is cast in one piece, with the necessary sockets to receive the ends of the wooden spokes, and with chambers for the lubricating material. The axle passes through the nave, and is secured by a metal screwed nut. At the outer end of the axle a flanged hollow hemispherical cover is secured to the nave by screw bolts, and has a hole for the supply of the lubricating material to the axle. The hole is closed by means of a screw, and the cap-piece protects the nave from concussion. An india-rubber washer placed between the flange of the cap and the iron nave prevents leakage of the lubricating material. The wheel altogether is superior in appearance, durability, and ease of draught. The bearing being shorter than in the case of the wooden stock wheel, there is less friction on the axle, and as the iron nave does not project so far as the wooden stock, there is less liability to accident in narrow or crowded thoroughfares. As regards the improved draught, it is found in practice, by a large user of horse power, that the patent axles make a difference of half a horse-power in every van. We may add that the prize medal was awarded in 1862 for this axle.

Correspondence.

LINCOLN WATERWORKS COMPANY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In your report of the paper read before the Society of Engineers on the 6th of April, by Mr. Sydney A. Reade, I noticed, on page 293 of your current volume, the common complaint of the tightening of manhole covers by the grit being pressed down into the marginal space. I tried some years since to obviate this inconvenience with a projecting flange, and also by means of a cap, but neither method was at all satisfactory. I then adopted the method shown in the accompanying sketch for fire



plug and cock casings, meter covers, &c., and have never had an instance of one becoming tightened. The evil arises from the whole of the sides being parallel the entire depth of the cover, but by simply tapering the sides of the cover this evil is entirely prevented, and if a few slots are made in the interior projection A the space is kept comparatively clean. The reasons are obvious; the grit having passed through small spaces above is again free to fall from the tapered cover, giving more room. I have shown it more conical than is adopted in practice, for the sake of making it clear. Should you think the above useful for your numerous readers, in removing, at times, a very serious evil, you will no doubt give it publicity.—I am, Sir, yours, &c.,

HY. TEAGUE.

Engineers and Managers' Office,
May 6.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—W. B.—H. T.—E. H. C.—J. C. S.—A. J.—W. W.—E. C. P.—Messrs. G. and B.—J. E.—Messrs. B. and Son—F. W. B.—T. B.—J. B. T.—R. J. G.—J. H. W.—J. B. D.—S. K. M.—P. G.—J. H.—F. W. B.—J. F.—W. T. C.—J. T.—B. F.—R. T. B.—S. J.—J. R.—L. C.—H. L.—G. W. H.—G. H. L.—S. B. F.—T. B.—B. S.—J. F. T.—L. O.—H. G.—R. N.

Meetings for the Week.

MON.—Royal United Service Institution.—Mr. Samuel Mackie on "The National Defences of Great Britain, Especially with Reference to the Future Requirements of Floating Forts," at 8.30 p.m.

Royal Institute of British Architects.—M. Digby Wyatt on "The Foreign Artists Employed in England During the Sixteenth Century, and their Influence on British Art," at 8 p.m.

TUES.—The Institution of Civil Engineers.—Discussion on "Engineering Philosophy. The Durability of Materials," by Mr. Edwin Clark, M.I.C.E., at 8 p.m.

Royal Institution.—Dr. Foster on "The Development of Animals," at 3 p.m.

THURS. — Royal Institution. — Professor Grant on "Astronomy," at 3 p.m.

FRI.—Royal Institution.—Professor Odling on "The Rapid Decomposition of Water, and other Effects of the Heat of the Oxy-hydrogen Flame," at 8 p.m.

Royal United Service Institution.—Mr. Mansfield Parkyns on "Abyssinia," at 3 p.m.

SAT.—Royal Institution.—Professor Grant on "Astronomy," at 3 p.m.

Naval, Military, and Gunnery Items.

THE annual regimental dinner of the Royal Artillery is appointed to take place at Willis's Rooms on the 1st of the ensuing month, at which the Duke of Cambridge will preside.

IT is announced that an order has been received at New York from Athens for the construction of an armour-plated vessel for the Cretan Navy. The vessel is to be built at once, at a cost of 1,500,000 dollars.

A NEW battery has been erected at Shotley, Suffolk, and fourteen new Armstrong guns of 7½in. calibre have arrived from Woolwich. The erection of new barracks at Shotley is also understood to be in contemplation.

A RECENT letter from Bombay informs us of the death of Captain Young, C.B., at Kurrachee. We also learn that the two transport ships employed on the Bombay side have to undergo extensive repairs each time they return to Bombay. Who's to blame for this little expense?

A LARGE number of mechanics and other workmen are employed at Chatham Dockyard in preparing the turret ship "Monarch," for launching on the 25th instant. The whole of her armour-plating has been bolted to her sides and finished off, leaving only the 10in. armour plates to be fixed to her turrets.

A RECENT "Gazette" contains a warrant revising the Royal warrant of January 16, 1861, and ordering that officers of the land forces serving in India under the rank of regimental field officer, who shall have

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served two years with a regiment, of which one shall have been in India, shall be eligible to enter the Bengal, Madras, or Bombay staff corps.

ACCORDING to the "Moniteur de l'Armee," platoon firing with the Chassepot gives prodigious results. At 200 metres (220yds.) 70 per cent. of the bullets hit the target; and at 300 metres (330yds.) the proportion is 62 9-10 per cent. This is very good practice indeed, but it gives no clue to the real practice in action.

THE first of a fleet of small screw steamers, building for the Imperial Ottoman Government, was launched on Saturday from Mr. John White's shipbuilding-yard, at Medina Dock, West Cowes. The vessel, which is named the "Sahir," is 119ft. between perpendiculars, 20ft. in breadth, 11ft. 10in. in depth of hold, and measures 225 tons o.m. Her engines will have a combined nominal power of 50-horse, and have been made for her by Messrs. A. Day and Co., of Southampton.

AT the battle of Turin, fought on July 14, 1706, a Prussian regiment, part of the contingent which, under the orders of the Prince of Anhalt-Dessau, formed Prince Eugene's left wing, greatly distinguished itself, and by its valour, it is said to have greatly contributed to the capture of the French intrenchments, and the complete victory obtained. The colours of that regiment, in whose folds its old and gloriously traditions are still enveloped, are now those of the 1st Regiment of Prussian Grenadiers, of which the Crown Prince is the Colonel.

THE "Gazette" of last Friday notifies to the persons interested that the distribution of the award for salvage service rendered to the barque "Mewah," between the 3rd and 8th December, 1866, by her Majesty's ship "Wasp," will commence to-morrow, the 16th instant, in the Prize Branch of the Department of the Accountant-General of the Navy. Shares: Captain, £229 2s. 3d.; second class, £64 4s. 2d.; third, £55 0s. 9d.; fourth, £36 13s. 10d.; fifth, £22 0s. 4d.; sixth, £18 6s. 11d.; seventh, £12 16s. 11d.; eighth, £7 6s. 9d.; ninth, £3 13s. 4d.; tenth, £1 16s. 8d.

A BOARD of Trade return shows that in the year 1867 £34,850 was received from masters of vessels, collectors of customs in the colonies, and consuls abroad, for wages and effects of 5,547 deceased seamen. In the course of the year sums amounting to £24,269 were paid to the relatives and representatives of 2,732 deceased seamen. The amount unclaimed received before 1861 has been paid into the Exchequer, leaving an unclaimed balance to meet claims as they may be established, amounting to £81,124, partly in Exchequer bills, and partly cash, in the hands of Her Majesty's Paymaster-General.

THE twin screw gunboat "Bullfinch," 663 tons, 170ft. in length, and 29ft. beam, lately launched at Sheerness, was recently taken on a trial of her engines, off the Maplin Sands. The ship was in charge of Captain the Hon. A. Cochrane, C.B., of the Sheerness Steam Reserve. Several trials were made on the measured mile, giving a satisfactory speed of 11·011 knots. The engines are of the nominal power of 160 horses, but were worked up to 917 horses. The two screw propellers are of the Mangin pattern; diameter, 7ft. 3in.; pitch, 11ft. 4½in.; and immersion of the upper edge, 12in. The draught of water was 8ft. 10in. forward, and 10ft. 2in. aft. The revolutions were 132 per minute; vacuum, 24; pressure of steam, 28lb.

DURING the time the steam dredging machine was at work in Chatham harbour, clearing away an obstruction near the entrance to the third dock, in which the "Monarch" is building, the machine came in contact with the hull of an old vessel, which is believed to have sunk in the river upwards of a century since. Attempts have since been made to remove the obstruction by charges of gunpowder, for which purpose divers of the Royal Engineers have been down, and placed the charges beneath the vessel's bottom. The explosion of the powder has however, had very little effect on the hull of the vessel, as only a few of the timbers have been blown up, and attempts are now being made to raise the obstruction by means of large mooring lighters. It is a singular circumstance that the existence of a sunken vessel so near the outlet of one of the docks does not appear to have been known to any of the dockyard officials.

Miscellanea.

COLONEL W. H. Sykes, M.P., was, on Wednesday, unanimously re-elected chairman of the East India Company for the ensuing year.

VALUABLE coalbeds have been discovered in the line of Capetown and Wellington Railway. The Government has authorized explorations to be made.

THE number of visitors to the Patent-Office Museum, South Kensington, for the week ending May 9, was 2,819; total number since the opening of the museum, free daily (May 12, 1858), 1,295,712.

IN the week ended on Monday, upwards of 250 tons of mackerel were despatched from West Cornwall by rail, by far the greater portion of this immense supply being sent to London.

THE select committee of the House of Commons to which the Liverpool Tramway Bill was referred has declared the preamble to have been proved. The line passes from north to south of that borough.

THE trustees of the British Museum have appointed Dr. Cobbold, F.R.S., to hold the chair of geology for the next term of five years, and they require that the first annual course of twelve lectures be given in Edinburgh.

A SUM of £1,500 has been subscribed for the purpose of erecting a statue to the memory of the late Earl Rosse. The committee are about to communicate with Mr. Foley, the eminent sculptor. The statue is to be erected in Parsonstown.

AT a meeting of the Curators of the University of Edinburgh, held on Thursday week, it was resolved to proceed with the election of a Principal, in room of the late Sir David Brewster, on the 18th of June, the day on which the election of Professor of Moral Philosophy is appointed to be held.

AN extensive mountain slip took place a few days back in the village of Oberbilten, canton of Glaris, in Switzerland. The inhabitants, warned in time, had left their houses, which, for the most part, have been overwhelmed. Large masses continue to fall, accompanied by loud reports.

THE number of Cornish pumping engines reported for March is 22. They have consumed 1,758 tons of coal, and lifted 153·9 million tons of water 10fms. high. The average duty of the whole is, therefore, 53,300,000lb., lifted 1ft. high, by the consumption of 112lb. of coal.

WE have just received from Messrs. Turgan, of Paris, the 143rd and 144th numbers of "Les Grandes Usines," which contain some excellent practical remarks on the manufacture of woollen fabrics at Rheims, and to which we shall more specially refer in a future number.

THE annual conversazione of the president of the Institution of Civil Engineers will be held on Tuesday evening, May 26th, when the co-operation of members and visitors is requested, in order that a collection of models of engineering construction and of works of art, worthy of the Institution, may be obtained.

THE Ohio Legislature has passed a bill authorizing a bridge across the Ohio to connect Cincinnati with Newport, Ky. The span over the main channel is to be 500ft. in length, and the adjoining span 220ft. each, a height in the centre of 100ft. in the clear above low water. A company to build the bridge is incorporated.

ACCORDING to the "Liverpool Albion," about ten p.m. on the 4th inst., as No. 11 pilot boat was cruising off the Welsh coast, near Puffin Island, at the entrance of the Menai Straits, the pilots observed a star become blood red, and expand. The phenomenon continued for half an hour, and excited intense interest among the pilots, who were observing it through their telescopes.

HER Majesty's Government, with a view of constituting a separate Department of Science and Art for Ireland, analagous in its constitution to the existing Science and Art Department in London, and of amalgamating, as far as possible, all existing institutions in Ireland receiving State grants for science or art, have appointed a commission to report on the best means of carrying out this object.

THE council of the Royal Agricultural Society recently received three deputations—one from Liverpool, another from Manchester, a third from Preston—inviting them to make each of those several towns the site of the society's meeting in 1869. After listening to the representations of the several deputations, the council decided in favour of Manchester by twenty-five votes against eighteen in favour of Preston. No vote was given in favour of Liverpool.

THE "Moniteur de l'Algerie" says:—The subdivision of Aumale mentions the first appearance of locusts. The disposable troops have been directed towards the points threatened, and all the inhabitants have been put in requisition. A sum of 2f. 50c. is given for every 1cwt. of insects destroyed. The invasion in this quarter seems to be checked. Round about Boghar crickets are more or less numerous, and similar measures are adopted.

THE visitors to the South Kensington Museum during the week ending May 9, 1868, were as follows:—On Monday, Tuesday, and Saturday, (free), from 10 a.m. to 10 p.m., 9,521; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,879. National Portrait Exhibition, by payment, 2,738; Total—14,138. Average of corresponding week in former years, 11,494; total from the opening of the museum, 7,373,480.

IN Southern France the railways are seriously embarrassed every winter by snow drifts filling the deep cuttings, but the past season a section of the line of railway from Saint Etienne to Annoway has been kept open by the judicious planting along the banks on either side of the track, of pine trees, a system of treatment previously adopted in arresting the dunes, or inroads of sea sands, which in many parts of France used to annually cause great damage.

AT the monthly meeting of the committee of the Newspaper Press Fund, held at the offices in Cecil-street, Strand, on Saturday, the Right Hon. Lord Houghton, president, in the chair; Sir Moses Montefiore, Bart., F.R.S., Mr. Lionel Lawson, and Mr. Edward Levy were elected vice presidents. The secretary, Mr. Taunton, reported a preliminary list of 163 stewards for the anniversary dinner on the 6th June next, under the presidency of His Royal Highness the Duke of Cambridge.

A RETURN has just been issued which shows that in the year ending March 31st last the income of the British Museum amounted to £126,754 17s. 6d., made up as follows:—Balance from previous year, £25,889 3s.; parliamentary grant, £99,621; sale of old metal and soot, £52 1s. 10d.; dividends on stock, £900; sale of guide books, &c., £292 12s. 8d. The expenditure for salaries, purchases, printing, buildings, &c., amounted to £98,274 3s. 3d.; to continue excavations at Ephesus, £830; Abyssinian expedition, £174 7s.; for the Woodhouse collection, £1,360; the balance at the end of the year being £26,116 7s. 3d.

AT the close of the year 1866 there were in England and Wales 283 railway companies whose lines were open for traffic, with a total mileage of 9,701, of which 16 companies alone owned, leased, or worked 8,481 miles. In Scotland at the same period there were 31 companies with 2,244 miles of railway open for traffic; and in Ireland there were 39 companies, with a total mileage of 1,909. Nine bills have been introduced during the present session of Parliament, authorizing amalgamations which, if carried out, will add 540 miles to our present railway system; and it is proposed to add 85 more by 14 bills laid before Parliament containing provisions for working arrangements.

THE following gentlemen have satisfactorily passed the final examination in physical science, held in April last, under Sir William Thomson, in the order annexed, and have commenced the course of instruction in practical telegraphy, with the view to service in India. Messrs. Ayrton, University of Glasgow; Maclean, Hartley Institution, Southampton; Smyth, Trinity College, Dublin; Boyd, Hartley Institution, Southampton; Congdon, Hartley Institution, Southampton; and Landon, Hartley Institution, Southampton. Messrs. Ayrton, Maclean, and Smyth, having passed a distinguished examination, have been awarded a premium of £50 each.

FOR welding iron and steel a composition has lately been patented in Belgium, consisting of iron filings, 1,000 parts; borax, 500; balsam of copaiva, or some other resinous oil, 50; and sal-ammoniac, 75. They are mixed, heated, and pulverized. The process of uniting the iron and steel is as usual. The parts are heated to a cherry red, covered with the preparation, brought together, again heated and welded. Another composition for the same purpose is 15 parts of borax, 2 of sal-ammoniac, and 2 of prussiate of potash. Being dissolved in water, the water should be gradually evaporated at a low temperature.

A MOST interesting addition to the attractions of the Crystal Palace has just been made by an ants' nest, found within the last few weeks by Mr. Robert Holt, under the floor of his house at Lower Norwood. Mr. Holt, who is the lessee of the French Court in the Crystal Palace, has taken care to preserve this nest in its integrity, as found, and it is now placed on a marble pedestal, in front of the French Court, where it attracts great attention. The nest, which appears to have been formed of masticated wood, it is about 12in. square, and is full of perforations as the nests of other insects, and the ants who have created it may be seen swarming in and out of the nest, and up and down the pedestal with their proverbial activity.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3035, 3042, 3051, 3070
BUILDINGS AND BUILDING MATERIALS—3080
CHEMISTRY AND PHOTOGRAPHY—3057, 3064
CULTIVATION OF THE SOIL, including agricultural implements and machines—3022, 3043, 3049, 3052, 3067, 3073
ELECTRICAL APPARATUS—None
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3033, 3046, 3048, 3053, 3063, 3081
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—3069
FURNITURE AND APPAREL, including household utensils, fire-keepers, jewellery, musical instruments, &c—3044, 3068, 3077, 3079
GENERAL MACHINERY—3011, 3014, 3016, 3017, 3030, 3031, 3034, 3040, 3045, 3047, 3050, 3055, 3059, 3062, 3065, 3072 3076, 3078, 3087, 3090

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LIGHTING, HEATING, AND VENTILATING—3060
METALS, including apparatus for their manufacture—None.
MISCELLANEOUS—3015, 3018, 3020, 3021, 3024, 3032, 3036, 3037, 3038, 3058, 3066, 3074, 3082, 3083, 3084, 3085, 3086, 3088, 3089
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3026, 3054, 3071
SHIPS AND BOATS, including their fittings—3027, 3028, 3056, 3061
STEAM ENGINES—3012, 3023, 3025
WARFARE—3019, 3039, 3075

3011 B. COOPER. *Improved machinery for removing knots, burls, and other extraneous substances from woollen cloth, flannel, and other fabrics.* Dated October 25, 1867.

This invention is not described apart from the drawings. —Patent completed.

3012 J. A. and J. HOPKINSON. *Improvements in steam engine indicators.* Dated October 26, 1867.

This invention consists, in the first place, in the use of a continuously revolving barrel on which the diagrams are taken, such barrel being connected with any required part of the engine, and caused, by means of suitable connection, to make either an equal, or quarter, or less number, of revolutions than the engine, as may be required. The invention consists, in the second place, in an improved pencil holder, which contracts or expands by the motion of the piston or other part to which it may be attached. The invention consists, in the third place, in dispensing with the ordinary slide or slides in direct-acting steam engine indicators, by connecting the "lazy tong" pencil holder with the top of the piston rod, over which is fixed a bent pillar or support for fixed centre.—Patent abandoned.

3014 G. and E. DORSETT and J. B. BLYTHE. *Improvements in the mode of, and apparatus for, burning the gases arising from the distillation of liquid hydrocarbons, and also in economizing fuel by the said process.* Dated October 26, 1867.

According to one portion of this invention, the patentees burn the gases produced by the distillation, by heat of liquid hydrocarbons, such as coal tar, creosote, coal, and shale oil, petroleum, and other matters of a like nature, in the following manner:—They cause the gas produced from the matter under distillation (such as coal tar, at that stage of the process in which the heavy oil has commenced to run from the worm), to pass through a pipe commencing at the top of the boiler, generator, or retort, and terminating in the ashpit or furnace. They there burn it, either by allowing it to pass through the fire, on the gratebars, or through a burner formed with a series of holes, or upon a diaphragm, as in the case of the ordinary gas burners used for cooking. This part of the process is particularly adapted for application under tar and petroleum stills.—Patent completed.

3015 W. E. WILEY. *Improvements in holders for lead and other marking materials, part of which improvements is also applicable as holders for other articles.* Dated October 26, 1867.

This invention has for its object improvements in holders for lead and other marking materials, part of which improvements is also applicable as holders for other articles, and relates, first, to an improved holder for cedar or other wood pencils or marking instruments. For this purpose the patentee employs a case or holder having a longitudinal slit or opening formed therein as usual, and at one or both ends he forms a short transverse slit or opening, running into the aforesaid longitudinal slit, one or both of such transverse slits communicating with a cut running entirely to the end of the holder. In connection with such holder he employs a common cedar or other wood pencil or marking instrument having a pin or stud fixed in the end thereof. By these means the marking instrument may be readily inserted and removed from the holder, for renewal or otherwise, and when not in use the point of the marking material is protected by the holder. The holder above described is also applicable for holding pens, knives, toothpicks, and other articles in a somewhat similar manner. The invention consists, second, in the manufacture of holders for lead and other marking materials, whereby a cheap and effective ever-pointed pencil or marking instrument is obtained.—Patent completed.

3016 R. M. LETCHFORD. *An improvement in the manufacture of matches.* Dated October 26, 1867.

This invention consists in saturating match-wood in a solution of resin, previously to dipping the wood in the usual lighting composition.—Patent completed.

3017 W. R. LAKE. *An improved level.* (A communication.) Dated October 26, 1867.

This invention relates to the construction of an apparatus in which the surface-line of a liquid enclosed within a hollow disc of glass, or partly of glass, indicates upon a graduated circle or scale the angle or inclination of any surface upon which the apparatus is placed.—Patent abandoned.

3018 L. NEWTON and T. KERSHAW. *Improvements in bottles, in corks or stoppers for bottles, and in machinery for making corks or stoppers.* Dated October 26, 1867.

One feature of this invention consists in making the bottles with an eye at the top of the neck of the bottle, this eye forming the outlet from the bottle, and being at a right angle to the axis thereof.—Patent abandoned.

3019 F. M. SMITH. *Improvements in the manufacture of armour plates.* Dated October 26, 1867.

The patentee claims the manufacture of armour-plates from soft bar iron, by forming the bar into a single or double coil, welding such coils together, cutting open longitudinally the cylinder thus obtained, and flattening it out into the form of a plate, substantially as described.—Patent completed.

3020 J. J. PERRY. *Improvements in binding or covering books and other similar articles.* (A communication.) Dated October 26, 1867.

This invention has for its object improvements in binding or covering books and other similar articles, and relates to means whereby such articles are capable of being readily connected or disconnected with their bindings or covers. For this purpose the binding or cover is prepared separately from the book or other similar article, and in each side of the binding or cover a pocket is formed, the opening of which is towards that part of the binding or cover which is intended for the back of the book or other similar article, which is provided with two comparatively rigid flaps or leaves, one of which enters each of the pockets in the binding or covers. Thus, by pushing the said flaps or leaves into the pockets, the book or other similar article is firmly connected with its binding or cover, and yet capable of being readily removed therefrom.—Patent completed.

3021 J. BROOKS. *Improvements in obtaining motive power, and in apparatus employed therein.* Dated October 26, 1867.

This invention consists in applying the motion or power obtained from an endless screw, and a toothed or screw wheel, or from a worm and a worm wheel, as a motive power for driving locomotives, ships, railway and other carriages; for working stationary engines, cranes, and other apparatus, and for use generally where motive power is required, the said power being applied either alone or in conjunction with steam or other power.—Patent abandoned.

3022 C. E. HALL. *Improvements in reaping and mowing machinery.* Dated October 26, 1867.

The novelty of this invention is the employment of a rake or comb placed either above or below the platform, and working before the knives, then passing on to, or behind them, and it can be applied to all back side swathe, or any other existing reaping and mowing machinery. Its chief superiority over all others is that it can cut crops, however twisted and laid, which could not now be cut by and existing machine.—Patent abandoned.

3023 W. KENDALL. *Improvements in locomotive engines.* Dated October 26, 1867.

The object of this invention is to increase the facilities for starting locomotive engines, and also to give an available extra power to ascend inclines when required. For this purpose the patentee uses two outside cylinders working on cranks on the end of the driving axle, which has a single crank in the centre, and one inside the cylinder working on the single crank above mentioned. The reversing gear is so arranged that all three cylinders may be employed for starting, and for ascending inclines, and also for any emergency which may arise requiring extra power; and at other times, when running on a level road, or on favourable gradients, the steam can be shut off from the outside cylinders, so that the locomotive can be worked by the inside cylinder alone, whereby much of the resistance at present due from the blast pipe is saved, and the motive power being concentrated in the centre of the engine, increased stability is obtained. By regulating the "lap" of the valve, small quantities of steam can be admitted to the cylinder or cylinders which are thrown out of work, so as to keep it, or them, lubricated when not required to draw the load.—Patent completed.

3024 J. ASSER. *Improvements in croquet mallets.* Dated October 26, 1867.

According to this invention the inventor proposes to cover the striking faces or ends of the mallets with leather, india-rubber, cork, and gutta-percha, or their compounds. The covering is to be fixed to the mallets by means of any suitable adhesive cement, such as glue, or a cement impervious to water, or fixed by means of pins or other fastenings.—Patent abandoned.

3025 A. M. CLARK. *Improvements in steam generators.* (A communication.) Dated October 26, 1867.

The nature of this invention consists in forming a steam generator of a series of vessels, connected together and having tubes descending therefrom into a fire chamber, and providing each tube with an arrangement which insures an active circulation of water in it, and, at the same time, avoiding such joints as are difficult to make or repair by ordinary labour. The details of the invention are too voluminous to be quoted here.—Patent abandoned.

3026 A. M. CLARK. *Improvements in railway and other brakes.* (A communication.) Dated October 26, 1867.

This invention cannot be described without reference to the drawings.—Patent completed.

3027 W. PAYNE and A. B. FRASER. *Improvements applicable to ships' and other pumps.* Dated October 28, 1867.

This invention consists in certain improvements applicable to ships' and other lift pumps, the heads of the suction pipe or pipes of which open into an enclosed chamber, and the working barrel of which extends down through the top of the enclosed chamber to near the bottom of the vessel, at one side of the suction pipe or pipes, and also consists in dividing the chamber between the suction pipe or pipes, when one or more suction pipes are connected therewith by a vertical diaphragm, the lower portion of which is solid to a point above the lower valve in the working barrel, and above this it is perforated or formed into a grating, through which the water from the suction pipe passes to the working barrel. The object in making the lower portion of the vertical diaphragm solid is to prevent the pump losing its water, thus obviating the necessity of "priming," and the grating of the vertical diaphragm is used to prevent chips or other foreign matters passing into the working barrel and choking the valves. The invention further consists in the use or application of a short open-ended cylinder, which may be screwed to one or both ends, and which cylinder is screwed in, or fastened on, to the head of the suction pipe or pipes entering the enclosed chamber.—Patent completed.

3028 J. DE SILVA. *Improved compositions for coating the bottoms of iron, steel, and wooden ships, and other navigable vessels and marine works generally.* Dated October 28, 1867.

The patentee claims applying to the bottoms of iron and steel ships a coating formed of the following ingredients, namely:—Bridgwater paint (a fireproof paint, a mineral found in America, resembling oxide of iron), pure zinc, pure white lead, and strychnine, ground in boiled oil to a stiff consistency, arsenic, and lobelia inflata. These ingredients are combined in about equal proportions, except the arsenic, which is in excess to the proportion to the lobelia inflata. To the several materials is added chiefly bright varnish and tar oil, and, when required, a little spirit of genuine turpentine. The whole of these ingredients are thoroughly amalgamated, and are applied to the bottoms of the vessels to be coated, either in a hot or cold state, by a brush, in the same way as ordinary paint.—Patent completed.

3030 H. A. BONNEVILLE. *A new and improved machine for manufacturing paper sacks.* (A communication.) Dated October 28, 1867.

The principle of the invention consists in the continuity and simultaneousness of the different operations, and in the adherence arising from the use of an endless caoutchouc feed cloth, which carries along with it the paper with which the bags are manufactured.—Patent completed.

3031 W. E. DE BOURRAU. *Improvements in evaporators for concentrating saccharine fluids.* Dated October 28, 1867.

This invention consists of a rotating apparatus for concentrating saccharine fluids by means of steam, some of the principal advantages of which are as follows:—First as steam is the only heat employed, there is no risk of burning or discolouration. Second, economy, as the waste steam from the cane mill will suffice for the purpose. Thirdly, quickness of evaporation, owing to the constant rotation; and, fourthly, saving of labour, as when the apparatus is once set in motion it requires no further attention, and, if left a sufficient length of time, will evaporate the syrup to dryness. The apparatus consists, mainly, of a basin or open vessel to receive the syrup, and a rotating evaporator composed of four cupolas (forming two hollow dome-shaped ends) connected together by about twenty-eight tubes near the circumference, six intermediate tubes of the same diameter, and a master tube of a large size in the centre at each extremity of the tubes (which lie horizontally); two of the cupolas form a hollow dome-shaped chamber containing two funnels for collecting the water of condensation, and in one is a distributor of the steam as it enters through the hollow axes, all being made of copper. A ring of copper surrounding the central tube is provided with four (or more) arms, connected to a circle of about the diameter of the evaporator, and being placed midway between the two ends serves to give solidity to the apparatus. The basin or open vessel is supported on suitable wooden or metal frames, one at each end, and also one under the centre of the same. The end framings also support in suitable bearings the hollow axes through which the steam passes, and the necessary spur or other gearing for giving rotary motion to the evaporator.—Patent completed.

3032 J. YOUNG. *Improvements in the application of cannel coal slack to the manufacture of gas and coke.* Dated October 28, 1867.

The patentee claims, first, the application, preparation, and treatment, of cannel coal slack, by crushing, washing out the impurities, warming, drying, and combining with hydrocarbons as described, for the manufacture of illuminating gas and coke. Second, the compression of the purified cannel slack into blocks adapted for transport as a substitute for coal in making coke, and for other purposes, for which processes any ordinary and suitable mechanical means may be employed, no claim being made herein for the mechanism used.—Patent completed.

3033 C. E. BROOMAN. *Improvements in the manufacture of lace.* (A communication.) Dated October 28, 1867.

The patentee claims, first, the system or mode of numbering the running threads, by the aid of which system the warp threads intertwine while maintaining their twists; and, secondly, the arrangements of the bars which permit of realizing this numbering, with the view of manufacturing the lace called "Paris point," substantially as described.—Patent completed.

3034 A. J., W. B. and S. H. WATERLOW. *Improvements in machines for printing from copper, steel, and other metal plates, applicable also for printing from lithographic stones.* Dated October 28, 1867.

The patentee claims, first, the construction and use of machines for steel, copper, and other plate printing in which the printing surface is carried at one side or end of a box or frame, made to rotate or revolve along with a shaft, which shaft carries also a large tooth wheel operating through other tooth wheels, levers, and the other component (moving) parts of the machine; and, second, the peculiar conformation of that side or end of the box or frame which is opposite to the side or end carrying the plate or printing surface, by which, in conjunction with rollers on bed-plate, a gradual alternate up-and-down motion is imparted to the box or frame, so that the plate or printing surface is kept in uniform contact with, and with equal pressure against the printing cylinder during the operation of printing. Third, the slots or guides in the box or frame admitting of this motion, and the stops for preventing such motion taking place excepting at the proper time, all as described.—Patent completed.

3035 J. GLOVER. *Improvements in furnaces for steam boilers and other uses.* Dated October 28, 1867.

The patentee claims forming furnaces for steam boiler and other uses with bars having openings and blank spaces, alternating in the direction of their length, in manner substantially as explained. And, second, he claims the applying raised ribs next the sides of the flue, or of the furnaces, as described.—Patent completed.

3036 M. HENRY. *Improvements in balloons, and in apparatus employed in connection therewith.* (A communication.) Dated October 28, 1867.

This invention is not described apart from the drawings. —Patent completed.

3037 T. BENNETT. *Improvements in the manufacture of spoons, forks, and ladles.* Dated October 28, 1867.

The patentee claims producing, by rolling upon one or both sides of hoop iron at the required distances apart, several solid beads, ribs, or thickened parts, or producing, by rolling a continuous solid bead or rib on one side, and several solid beads or ribs at the required distances apart on the other side of the hoop iron, substantially as described and illustrated, which said solid beads or ribs or thickened parts, when the hoop iron is manufactured into spoons, forks, and ladles, give great strength to the handles of the said spoons, forks, and ladles. Also making the bead or rib by which the handle of the spoon, fork, or ladle is strengthened, separately from the blank, and fixing it in the blank, substantially as described and illustrated.—Patent completed.

3038 W. POTTS. *Improvements in making moulds for the manufacture of metallic screws.* Dated October 28, 1867.

This invention consists in making the moulds by first moulding a plain cylindrical mould of the required size, with or without a head, and afterwards moulding the screw threads in the interior of the plain cylindrical mould, by screwing a pattern screw through the said mould.—Patent completed.

3039 H. G. P. MEADE. *Improvements in firearms and ordnance, and in projectiles therefor.* Dated October 28, 1867.

According to this invention the inventor constructs a gun of a cylindrical form, both internally and externally; it is closed at the breech end, and has a capacity, little, if at all, exceeding that required to receive the largest charge the gun is required to carry. The projectile is also cylindrical internally, and adapted to fit over the gun; it is closed at the fore end, which is made of a suitable form for flight, and also for penetration; it may contain a bursting charge, and be fitted with a fuse if desired. The gun at its breech end is fixed in a trunnion piece formed to bring the trunnions so far forward that the weight of the breech end of the gun may preponderate, even when it has received the charge and the projectile. An elevat-

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ing screw, or other elevating gear, is fitted at the breech end of the gun. The trunnions are carried on a carriage, so arranged as to admit of the gun being trained. The muzzle of the gun, and the interior of the projectile, are mutually so shaped that the strain resulting from the explosion of the charge may not operate against the sides of the projectile until the projectile has acquired a considerable forward velocity; this may be effected by coning the muzzle of the gun on the exterior, and forming the projectile to fit closely to the mouth of the bore. The fore end of the bore may also be coned interiorally, so as to increase the area at the base of the projectile, on which the pressure resulting from the explosion of the charge is able to act, to start the projectile into motion. When a reduced charge is used with the gun, a wad or filling piece of suitable material may be introduced into the bore temporarily, to reduce its capacity. It is not essential that the gun should be cylindrical; it may be polygonal, or of other form exteriorly. The form of the bore may also be varied. In mortars or pieces to throw heavy shells, the inventor makes the bore of the piece of smaller capacity than is required to contain the charge; a portion of the charge is then contained within the cavity of the projectile. In order that the charge may be effectually consumed before the projectile leaves the gun, he may employ more than one vent; sometimes, in addition to the breech vent, he forms a vent, passing both through the side of the projectile, and through the gun, and he also forms a vent passing through the head of the projectile in advance of the muzzle of the gun. In some cases he employs well-known arrangements within the cartridge, and fires it from end to end. To give a rotary motion to the projectile, lands or grooves may be formed within it, there being also corresponding lands or grooves formed on the exterior of the gun.—Patent abandoned.

3040 V. V. DE CRESALLES. *Improvements in apparatus for obtaining power from rivers or streams of water, and for facilitating boats ascending and descending rivers or streams.* (A communication.) Dated October 28, 1867.

In constructing apparatus for obtaining motive power from rivers or streams of water, two parallel endless chains are employed, extended between, and gearing with chain wheels on two horizontal axes, at a distance apart from one another. The endless chains are connected to one another by numerous rods or bars, which pass transversely across the space between the two chains. These rods carry paddles or floats, which project out at right angles from the chains. The axes of the chain wheels supporting the chains are carried at such a distance above the surface of the water that the paddles or floats on the portion of the chain, below the chain wheels, dip into, or are immersed in the water, whilst the paddles on the portion of the chain above the chain wheels are raised out therefrom. The axes of the rollers turn in bearings carried by vessels, held at a distance apart from one another by suitable frames and tie bars, so that the endless chain of paddles work in the space between the vessels, or the axes of the endless chains might be otherwise carried. The fixed guide rails are employed to keep the endless chains from sagging or swaying down as they pass from one chain wheel to another; small flanged rollers carried on the ends of the transverse rods connecting the two chains run upon these rails, and thus the chains are supported. As the action of the stream of water upon the paddles or wings of the endless chains gives to these chains a continuous rotary motion, the chains, by gearing with the chain wheels, cause the axes of these wheels to revolve also. Motion may be transmitted from these axes to pumps carried by the vessels, and may then be used for irrigating purposes, or the power obtained may be employed to enable boats to ascend the stream, or it may be applied to other purposes.—Patent abandoned.

3042 E. B. WILSON. *Improvements in furnaces.* Dated October 29, 1867.

This invention is not described apart from the drawings.—Patent completed.

3043 G. W. B. EDWARDS. *Improvements in machines for dibbling and dropping seed and corn.* Dated October 29, 1867.

This invention has for its object the dibbling of holes in the land at regulated distances apart, and depositing the seed or corn therein by means of the machine hereinafter described. The machine for this purpose consists essentially of one or more dibbling instruments, constructed as hereinafter described, adapted to work in combination with a seed barrel, or barrels, in which the several cups are successively turned, so as to let the seed brought up from the seed box drop into a channel immediately over the hole made by the dibble. The dibble is of about the same form as the ordinary iron hand dibble, and has on its stem a screw or spiral, which works through a corresponding internal screw or worm fixed in a frame, by which means the dibble, on being moved vertically, has imparted to it a slightly revolving motion, similar to that given to the ordinary dibble by hand, for the purpose of making a clean and smooth hole. The dibble, or set of dibbles, may be worked up and down as required by a crank or otherwise, a spring being applied to the dibble if required, in order to give it elasticity in working. The seed barrel is furnished with cups fixed in the disc at equal distances apart, having their pivots passing through the disc, and being acted upon so as to give them a partial turn as they arrive in succession over the channel, immediately over the holes made by the dibble.—Patent abandoned.

3044 J. SMYTH and S. KIRBY. *Improvements in clarionets, flutes, bassoons, saxophones, sarrusophones, and other keyed wind musical instruments.* Dated October 29, 1867.

This invention consists of, first, a new double movement key with two levers or handles, one over the other, opening lengthways, and stopping or unstopping but one hole; the object of the double lever is to permit the action that raises the whole key and unstops the hole, viz., the ring over the third finger hole of the left-hand joint of the clarionet can be used without opening the double lever key, unless at the free option of the performer, and at the precise time and instant it is wanting, to produce the notes G sharp, D, and any others, on the upper or lower joint, thus giving those notes from new positions, with an entirely new description of key, and with a facility never hitherto obtained on the clarionet, flute, bassoon, and similar instruments. This key with two levers can be applied to any part of the clarionet, or to any kind of instrument upon which keys are used, for unstopping holes, or stopping open holes, for the production of notes or sounds. Second, single movement keys to the clarionets, to produce and perfect the notes on the upper or left-hand joints, such as F natural, F sharp, and others, without the use of the right hand to the keys on the left-hand joints. Third, new single movement keys to clarionets, for new fingering of notes, E flat, and others on right hand. Fourth, new single movement keys to clarionets for C sharp, low F sharp, and others on right-hand joint. Fifth, new single movement keys to clarionet for B natural, low E natural and others on the right-hand joint; and, sixth, new double movement key, the same as on the upper joint, for making D sharp with the first finger of the right hand on lower joint, and G sharp on upper joint.—Patent completed.

3045 E. T. HUGHES. *Improvements in machines for twisting lines, cords, ropes, and cables, and hanking and coiling the same.* (A communication.) Dated October 29, 1867.

This invention is not described apart from the drawings.—Patent completed.

3046 J. T. CARTER. *Improvements in the manufacture of circular webbing or gasket, applicable as packing for steam engines, as covering for telegraph cables, and other useful purposes, and in the machinery employed therein.* Dated October 29, 1867.

This invention consists in manufacturing circular webbing or gasket from several strands of hemp, wire, or other material which are secured to each other to form one circular piece, by means of one or more wires, threads, or cords, which are passed over one strand, under another, over the third, and so on continuously. The webbing or gasket may have a central core, or not, according to the purpose for which it is intended.—Patent abandoned.

3047 W. BISHOP and B. BURNINGHAM. *Improvements in apparatus for preventing effluvia entering tanks or cisterns from the waste pipe.* Dated October 29, 1867.

This invention relates to a means of preventing the admission of effluvia from drains entering cisterns by the waste pipe, as is commonly the case, and consists in the application of a lift-valve fitting in a socket let into the bottom of the cistern or tank, which socket communicates with a pipe for carrying away the surplus water to the closet or drain. The valve stem passes up through a bridge-piece and guide attached to the socket, a tube being fixed on the neck of this guide, supporting a float at the height to which the water is to rise. This float is connected to the valve stem by means of a rod or chain passing down through the said tube, the length of the rod or chain being regulated as desired by means of a nut and screw passing through the float.—Patent completed.

3048 J. H. JOHNSON. *Improvements in cleaning cotton and cotton seeds, and in the machinery or apparatus employed therein.* (A communication.) Dated October 29, 1867.

In carrying out this invention the cotton in the state in which it has been picked or gathered, viz., whilst still enclosed in the pod, is thrown into a receptacle provided with a discharging hopper which discharges the cotton pods into a wire, gauze, or perforated metal cylinder, along the interior of which there is disposed a rotatory shaft or spindle, carrying a number of blades or arms arranged in a heleodical manner along the surface of the same. On imparting a rotatory motion to this spindle by means of a strap and driving pulley, or otherwise, the cotton will be freed from the pods, which will fall through the cylinder on to an inclined spout, and be thereby discharged into a basket or other convenient receptacle, if desired. The cotton itself will be urged along the cylinder by the spiral rotatory blades, and will be discharged at the end thereof on to the inclined floor or surface of a chamber which is provided with a spiked or pegged roller, such roller reaching nearly in contact with the inclined floor, which latter at the part nearest to the roller is also provided with spikes or pegs, between which those on the roller pass when rotating. The action of the revolving spiked roller and stationary spiked surface is to disintegrate or open out the cotton, and remove therefrom any remaining portions of pods, husks, or other like extraneous substances still adhering to the cotton. After passing under the action of the spiked roller, the cotton enters another wire, gauze, or perforated metal cylinder, provided like the first with a revolving spindle and heleodical arms or blades, which finally act upon the cotton before it is collected in baskets or other receptacles. At this stage the cotton is freed from the cotton seeds which are still contained therein by any well-known or suitable arrangement of cotton gin, after which the cotton is ready for manufacturing purposes.—Patent abandoned.

3049 W. P. SAVAGE. *Improvements in machinery for excavating, raising, and depositing soil.* Dated October 29, 1867.

The patentee claims, first, the arranging a machine for excavating, raising, and depositing soil, with the endless chains of buckets to cut in advance of the travelling wheels at the sides of the machine. Second, the arranging a machine for excavating, raising, and depositing soil, substantially in the manner described. Third, the arranging a machine for excavating, raising, and depositing soil, with a central chain or chains of buckets, working in advance of the carrying wheels, and between them, and also other endless chains of buckets on either side, working in front of the travelling wheels. Fourth, the arranging a machine for excavating, raising, and depositing soil, substantially in the manner described. Fifth, the arranging a machine for excavating, raising, and depositing soil, and adapted especially for cutting trenches, with a chain of buckets working in advance of the travelling wheels, but between them.—Patent completed.

3050 L. PERKINS. *Improvements in water and other meters, and in engines for obtaining motive power.* Dated October 29, 1867.

According to this invention the use of tappets or cams acted on by the piston or piston rod is dispensed with, and the admission of steam or fluid to the cylinders which work the valve or valves of the engine or meter, or it might be the putting these cylinders in communication with the exhaust, is governed by a valve moving reciprocally with the piston of the engine—that is, that it shall both commence and end its stroke simultaneously therewith; it may either be that the piston itself is made to form the valve, or an independent valve making an equal stroke with the piston, or a stroke of any other desired length may be employed. The details of this invention are too voluminous to be quoted here.—Patent completed.

3051 G. DAVIES. *An improved mode of preventing incrustation in, and removing it from, steam boilers.* (A communication.) Dated October 30, 1867.

The patentee claims the application to steam boilers of hydrocarbons, either alone or in combination with other materials, for the purpose specified.—Patent completed.

3052 W. H. A. BOWHAY. *Improvements in the construction of horse ploughs* Dated October 30, 1867.

The patentee claims, first, the placing a wheel or wheels within the body of double or one-way ploughs, so as to destroy the balance of the plough, and keep the hinder share free from the ground, by means of the combination and arrangement of parts and mechanism, substantially as described. Second, the construction and arrangement of two simple bodies within one main longitudinal beam, the one right and the other left hand, substantially as described. And, third, the use of a wheel in the construction of single ploughs for the purpose of lightening the draught, and for varying the pitch or inclination of the share, substantially as described.—Patent completed.

3053 J. FEATHER. *Improvements in, or applicable to, cap frames employed in spinning worsted or other fibrous substances.* Dated October 30, 1867.

This invention relates to that class of spinning machinery technically known as "cap frames," and the improvements consist in the application of a small flyer, mounted, and capable of rotating on a pin at the top of each cap. The yarn to be spun is caused to pass through a tweezle in one arm of this flyer in its passage to the bobbin, by which the flyer is driven or carried around, and thereby a drag is put upon the yarn. By this invention the inventor is enabled to spin on cap frames, "lustre yarns," or yarns which hitherto could not be spun on cap frames.—Patent abandoned.

3054 J. MADDOCKS. *Improvements in the method of, and apparatus for, securing nuts and bolts employed on the permanent way of railways.* Dated October 30, 1867.

This invention is designed for the purpose of preventing the nuts used to secure fish-plate joints on railways from turning, and becoming unscrewed by the vibration of the rails caused by traffic. The improvements consist in the employment and use of a metallic plate, the lower side of which is straight and level, excepting a projecting piece occupying a relative position to one of the middle nuts, and the end of the plate near this projection is turned round so as to overlap it, and in this projecting piece a hole or vertical slot is formed. In making the joint, the first, third, and fourth bolts are to be passed through the "fish plates" and rail, and the nuts screwed thereon, each nut having one flat side uppermost. The lower edge of the metallic plate is then laid on the three flat surfaces of the nuts, which brings the slot or hole in the projecting piece over the second bolt, and the second bolt is passed through the fish-plate rail and the metallic plate, and the nut screwed on, which locks the first, third, and fourth nuts, and prevents them turning; the turned end of the plate is now so adjusted or bent as to overlap the flat surface of the second nut, which is thereby also prevented from turning. When required to unscrew the nuts, the overlapping end is sprung back or forced outwards, and the nut is liberated for the action of the wrench—Patent completed.

3055 J. B. FENBY. *Improvements in valves for hydraulic presses and for other purposes.* Dated October 30, 1867.

The patentee claims constructing the valves of a hollow cylinder, and a piston or plunger working therein, the said hollow cylinder and piston or plunger, and parts connected therewith, being constructed and arranged substantially as described, whether the valve be worked by the direct motion of the piston or plunger, or by a small supplementary valve of similar construction.—Patent completed.

3056 T. E. SYMONDS. *Improvements in the construction of ships and other vessels.* Dated October 30, 1867.

In ships and vessels propelled by two screws at the stern, one on either side of the stern, a system of propulsion, now well known as the "twin screw system," the portions of the screw shaft which are exterior to the ship or vessel are usually enclosed in trunks or tubes, the after extremities of which have been hitherto supported and attached to the bottom and dead wood of the ship or vessel by V or bracket frames carrying the bearings for the screw shafts. To give additional support to these trunks or tubes, and to the bearings of the screws which they contain, so as to promote the rigidity of the structure, and lessen vibration in single-keeled ships, the patentee fixes a strong web or plate, or gusset piece, to the trunk or tube from end to end, passing up until it meets the bottom of the ship, at an angle of about 45deg., or somewhere thereabout, with the vertical plane of the ship or vessel, or, in other words, he causes the web plate, or gusset piece, to pass in the shortest manner possible to the bottom. The second part of the invention consists in capping the outer end of the trunk with a metal cap serving to retain the outer ends of the planking or sheathing, and also to have an overlapping flange to cover or close the space or joint between the boss of the propeller and the bearing, so as to prevent objects being drawn in to stop or interfere with the action of the propeller. The fore side of the boss of the propeller should be so formed as to facilitate the object of the invention, and the overlapping flange may either be formed with the cap, or separately, and fixed to it by screws or otherwise.—Patent completed.

3057 F. PIERCY. *Improvements in the method of tinting or colouring photographs, engravings, water-colour and other drawings, or porcelain.* Dated October 30, 1867.

The patentee claims, first, tinting or colouring photographs, engravings, water-colour, and other drawings, or porcelain, by the several means and processes described. Second, he claims the use in the above processes of an intervening material or materials upon which is to be transferred by means of pressure, rubbing, and burnishing portions of colour not required in the finished work of art, as and for the purposes described. Third, he also claims obtaining an entirely novel effect in the process of tinting or colouring, by the employment of bread in the manner and for the purposes described.—Patent completed.

3058 J. H. JOHNSON. *Improvements in racks or holders for whips, canes, and other like articles.* (A communication.) Dated October 30, 1867.

This invention relates to racks for holding whips and other like articles, and consists, mainly, in the combination with a skeleton or perforated frame of wood, or other suitable material, of an elastic binding or holding device, arranged in the perforations of the said frame, in such manner as to hold any object placed or inserted in the perforated frame.—Patent abandoned.

3059 EARL OF CAITHNESS. *An improved mode of, and apparatus for, cleaning boiler tubes.* Dated October 30, 1867.

This invention consists in the employment of one, two, or more long screw spindles, which are temporarily introduced through holes made for that purpose in the tube-

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plate next to the smoke-box. These screw spindles, when introduced into the boiler, engage with one or more tube-cleaners inside the boiler, each consisting of a perforated plate through the perforations in which the tubes are passed when being secured into the boiler. The holes in the cleaners are sufficiently large to allow the cleaners to traverse freely along the tubes from end to end, for the purpose of removing any deposit therefrom.—Patent abandoned.

3060 A. V. NEWTON. *Improvements in the ventilation of buildings, ships, and carriages.* (A communication.) Dated October 30, 1867.

This invention relates to a mode of supplying fresh air to apartments, and to compartments of carriages, and withdrawing or discharging the vitiated air therefrom without producing drafts. In applying the invention to buildings, say, for example, to a hospital, which requires specially good ventilation, the internal walls are built hollow, that is, with vertical air passage in them. The portion of the wall between the air passages and the chamber or ward to be ventilated is built of bricks pierced with holes, which, as the bricks are laid, form small horizontal air channels for the air supplied to the vertical air passages. The passages are divided horizontally, at a height of, say, five or six feet from the floor, and distinct air flues connect with the upper and lower divisions thus formed, the larger or upper division being used for supplying cold, and the smaller and lower division for supplying heated air to the ward or chamber. The wall is faced with porous cement, which allows the air at a pressure to percolate through, in minutely divided streams, into the chamber, after the manner of tent ventilation. The roof of the chamber is also porous, and it forms between the girders, which may be of iron, air exhaust flues. Below the floor of the chamber, or ward above, are also air flues, separated from the lower flues by substantial laths enveloped with some material that is a good non-conductor of sound. These flues are connected with vertical exhaust flues built in the walls, and connected with a chimney shaft, or an exhaust fan, to quicken the withdrawal of the vitiated air.—Patent completed.

3061 C. and J. JOBSON. *Improvements in screw propellers.* Dated October 31, 1867.

This invention consists in increasing the length of the boss or axis on which the propelling blades are fixed, and arranging the blades on different parts of its length and circumference in such a manner that in cross section each part of the boss forms a separate propeller with a single blade.—Patent completed.

3062 R. CLEGG. *Improvements in the construction of pumps.* Dated October 31, 1867.

This invention consists in the employment of a cam or eccentric wheel working on an axis within a cage or frame in the interior of the body of the pump. At the lower or bottom end of this cage or frame is the piston. One revolution of the axis causes the piston to be raised and lowered three times. The cam or eccentric wheel has three projecting points, which press against small friction rollers at the top and bottom of the cage or frame, thus causing the piston to be raised or lowered for the suction and delivery of water or other liquid. The axis passes through the body of the pump, to one end of which is attached a crank and handle.—Patent completed.

3063 W. HALL, J. WREN, and J. BRANDWOOD. *Certain improvements in the method of casting, forming, or producing toothed wheels or gearing to be employed in machinery for preparing, spinning, and twisting cotton or other fibrous substances.* Dated October 31, 1867.

This invention relates to such wheels or gearing as are required to be made in halves, or two parts, in order that they may be secured upon any shaft without removing the shaft or other gearing therefrom. The improvements consist in casting the toothed wheels or other gearing in one piece having a hollow mid-feather, or double flange, with a slot or opening left between them, extending at the back from the boss to near the periphery. When the wheel is furnished in the lathe, a tapered wedge is inserted in the boring for the shaft, which, being sharply struck with a hammer, causes the casting to break through the boss, and the ends or junction of the mid-feather, and the periphery, which is the weakest part, and the wheel is thus broken into halves, leaving the uneven granulations of the metal as a fitting surface. When the wheel is to be secured on a shaft, the halves are placed one on each side, so that the boss encircles the shaft, and screw bolts or screws are passed through holes in the sides of the mid-feather or flanges, and the two halves are thus secured together, the fractured parts fitting so closely that the junction is scarcely perceptible, and the true pitch of the wheel is retained.—Patent completed.

3064 W. S. DIXON. *A new process of producing a blue dye or colouring matter.* Dated October 31, 1867.

In the lower carbonaceous stratification of the counties of Midlothian, Linlithgow, and Lanark, in Scotland, and elsewhere, and in working what is called slaty band, ironstone there is found, and thrown out, as waste, and exposed in heaps, a certain mineral or substance, commonly called in such counties "Maggie," from which heaps, and by the action of rain and atmospheric influence thereon, there proceeds or flows a reddish liquid, which contains more or less of the following:—Sulphate of ammonium, 873.01 grains per gallon; sulphate of iron (proto), 484.22 grains per gallon; sulphate of iron (per), 374.10 grains per gallon; sulphate of lime, 73.27 grains per gallon; sulphate of magnesia, 74.22 grains per gallon; chloride of sodium, 3,37 grains per gallon. Suspended matter:—Carbonaceous matter, 2.13 grains per gallon; carbonate of iron, 8.93 grains per gallon. Total, 5261.25 grains per gallon. This invention consists in the employment of a process of treating the above-mentioned reddish liquid by mixing therewith a saturated solution of yellow prussiate of potash, or its equivalent, and obtaining a dye, or blue colouring matter, which may be used for various purposes.—Patent completed.

3065 E. DONNER. *An improved method for clearing skins destined for hatters' furs from the coarse hair (kemp, bristles, or sleekcoats), by combustion.* Dated October 31, 1867.

This invention consists of a method for clearing skins from the coarse hairs (hemp bristles or sleekcoats), by a process of calcination or combustion. In order to perform this operation the skin is first carded and rendered flexible by moisture, then suspended by a hook upon a plane surface, inclined at an angle of 75deg., or any other suitable angle, that part of the skin corresponding to the tail of the animal being uppermost, so that the hairs on the skin have a tendency to stand erect by their own weight. The inclined plane should be placed before the operator, who combs the hairs from the tail towards the head, that is, from the highest part of the inclined plane, towards the lowest, thereby causing the said hairs to stand comple ely on end; the operator then applies a flame to the ends of the coarse hairs, which partly calcines them, after which he combs away the singed hairs, and applies the flame to those bristles that have not yet been removed. These two operations are continued, one after the other, till the whole of the coarse hairs are burnt away, and nothing is left on the skin but the down.—Patent completed.

3066 J. T. CAIRD and S. ROBERTSON. *Improvements in transmitting motive power, and in mechanism or apparatus employed therefor.* Dated October 31, 1867.

This invention is not described apart from the drawings. —Patent completed.

3067 O. C. EVANS. *Improvements in digging machinery.* Dated October 31, 1867.

This invention has reference to a previous patent granted to the present patentee, dated April 22, 1865 (No. 1124), and consists, first, in an improved method of arranging one or a series of endless chains, carried by a suitable framework, so that they can be caused to revolve or roll over the surface of the ground. These chains have teeth or digging forks attached to them as well as being so arranged on drum wheels and rollers that they will form an angle or inclined plane as they approach the ground, but will rise from the ground at a much more abrupt angle. The effect of this arrangement will be to cause the teeth or digging forks attached to the chains to enter the ground in nearly a vertical position, and again to turn at so short an angle as will suddenly lift the teeth or digging forks backward, upward, and out of the ground with force enough to upheave the soil. The invention is not fully described without reference to the drawings.—Patent completed.

3068 W. R. LAKE. *An improved cap for upholstery or furniture springs.* (A communication.) Dated October 31, 1867.

According to this invention the inventor prefers to construct his improved cap by stamping or pressing the same with suitable implements from sheets of iron, brass, tin, or other metal, but the same may be formed of cast metal. The said cap is constructed in a circular form, and has four long arms with eyes or holes in the ends thereof, so arranged as to connect easily with other caps used in the same frame, and with the sides of the said frame. The long arms are also extended to afford additional support to the mattress or other article of upholstery placed thereon.—Patent abandoned.

3069 W. R. LAKE. *An improved mode of, and apparatus for, exhausting or rarefying the air in vessels for food preserving, distilling, and other purposes.* (A communication.) Dated October 31, 1867.

This invention relates to a novel method of removing the air from vessels or receptacles for preserving food, and for distilling and other purposes, and consists, chiefly, in producing a vacuum, or partial vacuum, in a space above the surface of a body of water, enclosed in a cistern, which space is placed in a communication with the vessel or receptacle to be exhausted through an exhausting apparatus. It is well known to all who are familiar with the subject, that the proportion of air held by absorption in water has heretofore prevented the formation of a perfect vacuum by the use of water in what is known as the "Torricellian" process. In practising this invention the patentee uses apparatus in which certain parts are so proportioned and arranged that the air in a body of water is first separated from the water, which is afterwards used for producing a vacuum in other portions of the apparatus. The said apparatus is provided with a suitable arrangement of valves, whereby it is first filled with water from the cistern, then emptied through a pipe of such a length that the column of water contained therein will overcome the external pressure of the atmosphere. Air is then admitted from the vessel to be exhausted. The communication between the exhauster and the said vessel is then closed, and that between the exhauster and cistern opened. The air in the exhauster is displaced by the descending water, and ascends to the space at the top of the cistern, the operations being repeated till the desired vacuum is created in the vessel or receptacle. Where a sufficient height cannot be obtained, the exhauster may be emptied by the aid of an air chamber and pump.—Patent completed.

3070 I. KENDRICK. *Improvements in steam boilers.* Dated October 31, 1867.

This invention mainly consists in certain improved arrangements of water chambers or spaces (which the patentee calls circulating generators), in the flues or tubes of Cornish and other boilers, whereby the flame and products of combustion, or some of them, are caused to take a serpentine course, or from side to side, and up and down manner, in their passage from the furnace to the chimney. The patentee's circulating generators are preferably made with flat sides, and with a round tube, the top and bottom of suitable size to connect them to the tubes or flues of the boiler. The top and bottom connecting tubes may be flanged and riveted to the tubes or flues, but to facilitate their application or their removal in case of repairs being required, he prefers to connect them by the well-known method of expanding without flanges. These circulating generators, when for the flues or tubes of Cornish boilers, he makes of a semicircular form and flat-sided, or they may be made of any analogous form, and flat-sided to suit the flue or tube in which they are fitted.—Patent completed.

3071 J. WATKINS. *Improvements in axles for carriages.* Dated October 31, 1867.

The patentee claims, first, making the bed of the axle without the usual fixed solid collar, and the axle box without the usual reservoir in its head, and connecting the axle box to a loose collar or revolver on the cone of the arm, the said loose collar or revolver being secured in its place upon the cone by means of a screw lock, nut, or screw collar, the said loose collar or revolver and screw lock, nut, or screw collar being constructed and arranged or combined substantially as described.—Patent completed.

3072 A. CHAPLIN. *An improved portable distilling apparatus for producing fresh aerated water from sea water, part of which said apparatus is also applicable to the burning of hydrocarbon oils for other purposes.* Dated October 31, 1867.

This invention consists, mainly, of a steam boiler in combination with a condenser, tank feed chest, hand pump, and certain arrangements of pipes and cocks which render the apparatus self-acting, or nearly so, requiring only occasional attentions from the person in charge. The details of the invention are too voluminous to be quoted here.—Patent completed.

3073 D. SYKES. *Improvements in machinery or apparatus for decorticating, hulling, or husking pearl barley or other similar grain.* Dated October 31, 1867.

This invention consists in the employment and use of two cylinders, one enclosed within the other, having an annular space left between their surfaces, both cylinders being mounted on one common centre or shaft, the internal solid cylinder being keyed or secured to such shaft, and the outer hollow cylinder running loose on the same. The periphery and sides of the internal cylinder are composed of steel plates, having a burred or serrated surface, the outer cylinder being perforated. The annular space left between the surfaces of the cylinder is for the purpose of receiving the grain to be operated upon, which is fed thereto through a hopper or funnel, conveniently placed at the side. When the mill is in action, the internal serrated cylinder is driven at a higher velocity than the outer cylinder, by an arrangement of internal gearing or other equivalent, both cylinders being caused to revolve in the same direction. The grain, by this means, being constantly under agitation, the rubbing or bruising action, which effectually and thoroughly decorticates the grain, the husks or chaff being constantly expelled on becoming released from the grain through the perforations in the outer cylinder.—Patent abandoned.

3074 F. TEW. *Improvements in drawer suspenders and brace fastenings.* Dated October 31, 1867.

This invention consists in combining a suspender for the drawers with an ordinary brace buckle. This suspender consists of a strap of leather, webbing, or other material, provided with buttonholes, or other means of attachment to the drawers, which strap may be attached to the brace buckle in any convenient manner.—Patent abandoned.

3075 [illegible] B. RODEN. *Improvements in breech-loading firearms.* Dated November 1, 1867.

This invention relates to the construction of breech-loading firearms using self-ignition cartridges, and consists of a combination of parts constituting an improved mode of construction, whereby increased safety and security against accidents, and also a more efficient and ready mode of ejecting the expended cartridge case, are attained. The details of the invention are too voluminous to be quoted here.—Patent completed.

3076 J. STURGEON. *Improvements in machinery employed in getting coal, stone, and other minerals, and in apparatus connected therewith.* Dated November 1, 1867.

This invention has reference to a previous patent granted to the present patentee, dated July 2, 1867, (No. 1927), and relates, first, to an improved system of "opening out," or driving headings in coal and other mines by means of machinery worked by compressed air or other fluid. In "opening out" or driving headings, it is usual, first, to undercut or "hole" a certain portion of the work for the required width of road, and to cut nicks vertically at each end of the undercut portion, in order to break away and remove the material. This improvement consists in so arranging the machinery for cutting the said "nicks" so as to give them a curvilinear or arched direction upwards, instead of cutting them in a straight perpendicular line. By this means, when the material is broken out as above stated, the sides of the drift or cutting will be left of an arched form, thereby affording a better support to the roof than if the sides were left perpendicular to the base or floor of the mine.—Patent completed.

3077 H. and G. S. HUNTER. *Improvements in the construction of hats and caps.* Dated November 1, 1867.

According to this invention the inventors place between the body of a hat or cap, and its lining, a series of small tubes, or they coil, or lay in one long length of tube, made of elastic, gum, oiled silk, or other elastic or flexible material. These tubes, or the coil of tube, are made of a circular oval, square, or other form in section, and are either closed at the ends to prevent the air in them from escaping, or are left open to allow the air to leave and enter when the hat or cap is in use.—Patent abandoned.

3078 G. HAYCRAFT. *Improvements in apparatus for filling flasks, canisters, and other receptacles with gunpowder.* Dated November 1, 1867.

For the purpose of this invention, the inventor employs a circular stand, capable of holding a number of flasks, canisters, or receptacles; the circular stand is supported by, and capable of revolving around a fixed central pivot (by preference, of brass), projecting up from a table or bench. The revolving stand is composed of a wooden spindle, carrying two discs, one at its upper end, and the other at its lower end. A hole is bored upwards through the centre of the spindle, passing up from the lower end, nearly to the upper end thereof, and at the upper end of the hole is fixed a brass cup, which is to rest on the top of the fixed brass spindle. The wooden spindle is of such a length that the disc carried at its lower end shall be at a distance above the table or bench. The lower end of the hollow spindle is made to fit closely to the bottom of the fixed metal spindle, so that the frame may turn truly in a horizontal plane around the spindle, without swaying or oscillating. By this arrangement for supporting the revolving frame, all risk of explosion is avoided, as the metal bearing which supports the frame, and upon which it turns, is surrounded and enclosed by the hollow wooden spindle. The upper and lower discs of the frame are at a distance apart from one another, somewhat less than the height of the flasks, canisters, or receptacles to be filled. Through the upper disc holes are bored, at equal distances apart from one another, around its outer circumference. As many holes are bored through the disc as the number of flasks, canisters, or receptacles the frame is intended to hold. Above each of these holes is a funnel, with a descending tube, which passes down through the hole in the disc. On the upper surface of the lower disc are placed radial divisions, between which the lower ends of the flasks, canisters, or receptacles to be filled with powder are held. To place the flasks into the frame, the mouth of the flask is first placed over the lower end of the tube, descending from one or other of the funnels carried by the upper disc the lower end of the flask is then moved inwards towards the central pivot, to bring the flask into a vertical position; the bottom of the flask will then rest on the upper surface of the lower disc. The upper outer edge of the lower disc is bevelled off; a guard, ring, or hoop, is fixed around the hollow spindle to act as a stop to prevent any of the flasks being pushed in too far. When using this apparatus for filling flasks, the revolving stand is first filled with as many empty flasks as it is constructep

to hold, measured quantities of powder are then poured in succession into each of the funnels carried by the revolving stand, and this is readily done, as the person filling the flasks can bring them round in succession to receive their charge of powder.—Patent abandoned.

3079 J. GILMOUR. *Improvements in the construction of pianofortes.* Dated November 1, 1867.

This invention relates to improvements in the construction of pianofortes, and consists, in the first place, of a means for resisting or counterbalancing the great strain of the strings or wires upon the framing to which these are attached. The counterbalancing arrangement consists either of a plate, the full length of the frame, or the beam known as the "pinblock," or "rest block," into which the tuning pins or screws for tightening the wires are placed. In place of a continuous plate, several strips, bars, or small plates may be fixed on the upper and lower "pinblocks," and at the outer or back end of these plates, strips, or bars, eyes, or hooks are placed, to which are again attached metallic rods, with screw couplings. These arrangements are situated on that side of the framing opposite that to which the strings are applied, so that by tightening or loosening the screw couplings, the whole frame may be very effectually balanced, so as to resist the tension of the strings. In place of having the strain all on one side, as at present, the double strain produced by this arrangement is maintained constantly in a perpendicular direction on the upright posts, technically termed the "bracings," to which the "pinblocks" are attached. Thus, by providing resistance to the tension of the strings, by means of an opposing strain, the perpendicular "bracings" and supporting posts can be made of much less "scantling" than at present. In connection with this invention a hollow or belly-shaped soundboard may be used, resting against a wooden partition fixed in front of the bracings or upright posts; the soundboard is supported by a rim and sound pins, or posts, similar to those used in violins, and having openings of suitable shape cut in it to facilitate the reverberation of the sounds of the strings. The soundboard may be fixed by means of ligatures, or by the pressure produced through the tension of the strings, or by other convenient means, thus imparting great freedom of vibration, which, combined with the hollow formed by the back partition, affords additional power to the tone, at the same time adding to its quality. The mode of counterbalancing the strain described, has the advantage of enabling the uprights and rest plates or the pinblocks to be made wholly of iron, or the former of iron tubes of a light and, if desired, ornamental character; such construction is suitable for hot climates, where the temperature greatly affects timber. The second part of the invention relates to the tuning of pianofortes, and, in order to gain complete accuracy in this respect, and, at the same time, rigidity of tension, there are applied on the top of the pinblock bars, or strips (which may be made either of wood or iron), having a hook or hole at the front end, to which the strings are attached. At a short distance from the front end, a screw passes through each strip, the point of which pressing on an iron plate placed on the pinblock, so that when the screw is turned, the strip is raised or depressed, and the pitch of the string it at once regulated to the utmost nicety, and with the greatest ease. At the back these strips of metal may either be hinged or simply held down by a bent piece of metal.—Patent completed.

3080 S. PARR and A. STRONG. *Improvements in the construction of buildings, arches, bridges, coffer-dams, wharf walls, and such like structures, and in the floors and roofs of buildings, and floors in other situations.* Dated November 2, 1867.

The object and intention of these improvements is to cover, enclose, or divide floor buildings and open spaces with materials of different kinds, combined together in a novel manner, for insuring strength and economy in the construction, and for rendering them fireproof, and, further, to construct arches and bridges, and suchlike structures, of greater strength, with less materials than at present used.—Patent abandoned,

3081 J. WRIGHT and M. B. NAIRN. *Improvements in power looms.* Dated November 2, 1867.

This invention has principally for its object, by an improved construction, to render power looms suitable for weaving very wide and heavy fabrics, such as floorcloth, canvas, of, for example, eight yards in width, and the patentee's said invention comprises the following principal features of novelty, namely,—first, the actuating of the lathe by cams, which keep it back for a length of time sufficient for the passage of the shuttle, and allow it to beat up by the action of gravitation, alone or combined with springs. Second, the actuating of the picking levers by gravitation, or by means of weighted levers, which are raised and let fall by cams. Third, the arranging of the driving gearing in duplicate at the two sides of the loom. Fourth, the actuating of the lathe or shuttle, or both, by means of cylinders and pistons. Fifth, the actuating of picking shafts by cams or wipers, on shafts revolving more quickly than the latter cam shaft. The invention cannot be fully described without reference to the drawings.—Patent completed.

3082 M. A. SOUL. *Improvements in the mode and means of securing the metal bolts employed in the construction of timber ships and other structures.* (A communication.) Dated November 2, 1867.

This invention consists, first, in an improved mode of fastening the bolts. The bolt having been driven in the ordinary manner is, at its end, screwed or provided with a thread, by means of a suitable tool or instrument, and the wood surrounding the end of the bolt having been cut out by another tool suitable for the purpose, a metal nut is screwed on the bolt end, so as to fit the countersunk recess thus formed. Where the invention is to be applied to ships already built upon the system of clenching, the clencher and the washer ring are first removed. The invention consists, second, in the instrument or tool for cutting the thread on the bolts, which is a die stock of novel and peculiar construction, composed of two semicircular dies, held together and adjusted by suitable screws, springs, and collars. This instrument is used for the purpose of cutting the thread on the bolts, when in their proper position. The invention consists, third, in the instrument or tool for cutting or forming the countersunk holes in the wood, for the reception or admission of the metal nuts.—Patent abandoned.

3083 W. DARCEY. *Improvements in fastening and strengthening gates, and in the means employed therefor.* Dated November 2, 1867.

This invention relates, in the first place, to an improved latch and catch for securely retaining gates when shut, at the same time so arranged that the gate may be easily opened. The latch consists of an iron bar, movable, on a central pin, fixed into a socket in the end upright of the gate. The outer part of it passes into the catch and is firmly supported by a staple, and the inner end of the latch may be provided with a weight, so as always to maintain the latch in such position that it must fall into the catch as the gate is shut. The catch consists of an iron frame or staple, driven or otherwise fastened into the gate post. The under side of the catch is formed inclined, until the catch itself is met by the inclined portion, so that as the gate is being shut, the latch is depressed by the inclined part of the catch until the notch is met, into which the weight of the opposite end raises it, and by which the gate is then firmly secured. The staple in the gate that acts as a support to obviate the lateral strain on the latch also passes over the catch staple in the gate post, and thus adds to the security of the fastening. The second part of the invention relates to an application for strengthening gates. It consists of an iron strap fixed to the upper bar of the gate, and in the back end of this strap a bar is fixed by nuts. The bar is secured to the upper part of the heel of the gate, thus forming an efficient stay or support to the body of the gate, whilst, at the same time, if it is ever required to tighten the joint of the gate, this is effected by tightening the nuts on the screwed part of the bar.—Patent completed.

3084 J. SCOTT. *Improvements in shades for gas and other lamps, and in the mode of fitting or applying the same.* Dated November 2, 1867.

This invention relates to a peculiar construction of shades for gas and other lamps, and to the mode of fitting and applying the same to such lamps, the object being to obtain a continuous rotatory motion of the shade, so long as the light enclosed is burning, whereby an excellent medium is obtained for the display of advertisements and business announcements of all kinds, or for showing a succession of ornamental designs, views, or other devices, which are to be printed or otherwise produced on, or attached to, the surface of such revolving shades. In carrying out this invention it is proposed to manufacture a shade of any desired shape or configuration, and of any suitable material, whether opaque, transparent, or semi-transparent, or translucent, and to fit or mount into the upper end of such shade. A ventilator or horizontal fan, composed of a number of inclined blades of metal, &c., or in lieu thereof, an Archimedean screw or spiral blade, may be used. Through the centre of the said fan or spiral there is passed a pin or vertical pivot, upon or round which the shade is caused to revolve by the action of the ascending current of hot air from the flame upon the inclined blade or spiral. This pivot or centre is carried by a tripod or other conveniently shaped metal clip, which is made to fit the upper rim of the chimney or globe of the lamp.—Patent abandoned.

3085 A. G. AVENELL. *A new or improved frame or support for packing or carrying bottles in cases, together with a new or improved hinge for boxes and cases.* Dated November 2, 1867.

The patentee claims, first, the construction of a frame or support for bottles (fitting loosely into a case), whereby the bottles are supported either with their necks down or up, substantially as described.—Patent completed.

3086 W. E. GEDGE. *An improved hat cover.* (A communication.) Dated November 2, 1867.

The improved hat cover, which is the subject of this invention, is made from sheet india-rubber and in one piece, and by adopting this material a hat cover is obtained not only waterproof but tight and portable, in a very small compass, of any desired colour, and economical in manufacture (being of one piece), but also possessing an elasticity which will permit it to adapt itself to hats varying in size and shape, thus obviating the necessity of a particular cover to each different hat.—Patent completed.

3087 H. W. GRYLLS, H. NEVILLE, and J. HOLT. *Improved apparatus for obtaining and applying motive power.* Dated November 2, 1867.

This invention consists in an improved arrangement of drum coil or other springs for obtaining and applying motive power, for the propulsion of railway and other kinds of land carriages, ships, boats, and vessels for sea or river navigation; also for driving machinery for manufacturing purposes, and for propelling balloons and other aerial machines.—Patent abandoned.

3088 R. PARRY. *Improvements in corsets.* Dated November 2, 1867.

The inventor proposes to form the body of the corset in two parts, separated at the sides, the two edges on each side to be joined or laced being furnished with eyelets, through which the laces are passed as follows:—The lace is first passed through the top eyelets of the back of the body, through the corresponding eyelet of the front, then brought back through the next lower eyelet, and through the corresponding back eyelet, and the two ends are brought round together to the front, then a new lace is similarly passed through the next four eyelets, and so on all down the sides of the corset. The ends, or pairs of ends, are then attached to a tab or strap on each side of the corset; these tabs are provided with eyelets, when, by pulling the two tabs together towards the front, the whole series of laces will be simultaneously tightened, and the tabs are then secured to a hook attached to the lower part of the front or middle busk of the corset. The invention consists, second, in a new method of securing the ends of the busks from escaping from the corsets.—Patent abandoned.

3089 J. J. HICHS. *Improvements in the manufacture of backs and handles for brushes.* Dated November 2, 1867.

For the purposes of this invention, the patentee employs earthenware of a colour closely to imitate that of ivory, the colour being applied to the entire substance of the "body," or only to the surface thereof as will be well understood. The mode in which he prefers to make and apply the backs and handles for hair, and other similar brushes, is as follows:—He moulds or shapes the back and handle to any desired pattern, and in one piece of the "clay" or "body," such back being provided with an undercut recess in the face thereof. The bristles are inserted in a suitable foundation, and such foundation is placed in the undercut recess, where it is held by cement, or by other suitable means.—Patent completed.

3090 A. M. CLARK. *Improvements in apparatus for producing motive power.* (A communication.) Dated November 2, 1867.

This invention consists in arranging a series of hydraulic bellows around the perimeter of a vertical wheel, and operating them by means of cams on the spindle upon which the wheel runs, so as to force the water from one bellows into another, at certain points of the wheel's revolution. The weight of the water thus transferred from one point of the perimeter to another rotates the wheel, and furnishes the motive power.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated March 18, 1868.

916 W. Clarke, Gateshead, Durham, and E. Walker, Poplar, Middlesex. Improvements in capstans.

922 R. Townsend, King Henry-street, Ball's Pond, Middlesex. Improvements in breech-loading firearms.

Dated March 24, 1868.

996 R. A. Hardcastle, Rye Hill, Newcastle-upon-Tyne. Improvements in the manufacture of iron and steel, and in apparatus employed therein.

1000 R. Smith, Chorlton-upon-Medlock, Manchester, machinist. Improvements in machinery for winding cotton, silk, and other yarns or threads, on to spools, cards, or balls, and in additional apparatus to be used when winding balls for ticketing the same.

Dated April 4, 1868.

1148 J. Griffiths, Chesterfield, Derby, manager, and J. Jeavons, Sheffield, manager. Improvements in the manufacture of piles of iron or steel, or of iron and steel for the manufacture of rails, angles, axles, tyres, shafts, and other articles.

Dated April 9, 1868.

1202 L. Verstraet, Boulevart St Martin, Paris, chemist. Improvements in the means of, and apparatus for, storing and burning petroleum and other inflammable oils for heating steam boilers, and for other purposes.

Dated April 11, 1868.

1210 G. Clark, Northumberland-street, Strand. Improvements in the manufacture and production of explosive compounds, and in apparatus for their manufacture and use.

Dated April 14, 1868.

1229 A. and L. Braham, Manchester. Certain improvements in the manufacture of hats or coverings for the head, called sou' westers.

Dated April 15, 1868.

1240 R. Oxland, Compton Gifford, Plymouth. Improvements in the treatment of ores and minerals containing copper to extract copper therefrom.

Dated April 17, 1867.

1257 D. Smith, Southampton-buildings, Chancery-lane. An improved mode of securing tubes in steam boilers and other vessels. (A communication.)

1263 A. P. Price, Lincoln's Inn-fields, consulting chemist, and J. A. Wanklyn, Professor of Chemistry at the London Institution, Finsbury Circus. Improvements in the preparation and use of anæsthetics.

Dated April 18, 1868.

1264 T. Bradford, Argyll-square, London, washing machine manufacturer. Certain improvements in machinery or apparatus to be employed for churning, which is also applicable for washing textile fabrics and mixing liquids.

1265 G. Lister, Rivers, Dursley, Gloucestershire, manufacturer. Improvements in machinery or apparatus for feeding slivers of wool or other filamentous materials to carding and condensing engines or machines.

1266 E. T. Hughes, Chancery-lane. Improvements in the manufacture of hats and bonnets, and in the apparatus employed therein. (A communication.)

1267 J. Hargreaves, Darlington, Durham, analytical chemist. Improvements in obtaining phosphates and phosphatic manures.

1268 R. Scholefield, Leeds, mechanic. Improvements in brick-making machinery.

1269 A. Ashley, worsted spinner, E. Rawnsley and W. P. Waite, overlookers, Horton, Bradford, Yorkshire. An improved means or apparatus for lubricating the spindles and other parts of machinery used for spinning or twisting wool, cotton, mohair, alpaca, or other fibrous substances.

1270 W. Lund, Jewry-street, City. Improvements in machines for turning off cross-head wrist pins, crank pins, and similar work. (A communication.)

1271 N. Ager, Grosvenor-road, Pimlico. Improvements in fastenings suitable for window sashes and for other uses.

1272 H. W. Widmark, Tamworth-place, Bristol, engineer. Improvements in governors applicable to steam and other engines.

1274 R. Hill, Castle-street, Bristol, auctioneer, and J. F. D'Oyly, Oak Villa, Walthamstow, Essex, master mariner. Improvements in paddle and other wheels used in air or water for propelling or driving ships, vessels, and machinery.

1275 A. B. Childs, Mark-lane, City, engineer. Improvements in the grinding surfaces of millstones, and in apparatus or machinery for forming the same.

Dated April 20, 1868.

1277 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the means and appliances for press copying letters and other written documents. (A communication.)

1278 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the treatment of textile fabrics for consolidating them and rendering them impermeable. (A communication.)

1279 J. Cooke, Darlington, Durham, mining engineer. Improvements in the construction of rotary engines and pumps.

1281 J. and J. A. Fawcett, Wakefield, Yorkshire, corn millers. Improvements in steam boilers or apparatus for generating steam.

1282 J. B. Farrar, Halifax, machine maker. Improvements in spinning and doubling machinery.

1283 W. Malam, Old Kent-road, Surrey, gas engineer. Improvements in the manufacture of gas and in apparatus employed in such manufacture, part of the invention being also applicable to the manufacture of retorts, retort casings, crucibles, and melting pots for various useful purposes.

1284 J. McGhie, Glasgow. Improvements in apparatus for spinning or twisting.

1285 S. W. Worssam, jun., King's-road, Chelsea. Improvements in machinery or apparatus for planing and cutting wood.

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1286 W. W. Symington, Chard, Somersetshire, engineer. Improvements in machinery for sizing, tarring, dyeing, drying, and finishing laid and other twines, lines, yarns, threads, and fibres.

1287 J. J. R. Humes, Deptford, Kent, and J. G. Sullivan, New Cross, Kent. Improvements in machinery for making bricks.

1288 A. V. Newton, Chancery-lane. Improvements in the construction of rings for ring spinning. (A communication.)

1289 G. Coles, Gresham-street West, City, merchant, J. A. Jacques, chemist, and J. A. Fanshawe, engineer, Tottenham, Middlesex. Improvements in the manufacture of elastic bands.

Dated April 21, 1868.

1291 A. Cole, Erith, Kent, merchant's clerk, and J. Carter, Bexley Heath, Kent. Improvements in, and applicable to, lamps in use in railway carriages and in similar situations.

1293 W. Gorse, Birmingham, machinist. Improvements in the preparation of strips of iron and steel for the manufacture of flat-pointed cut nails.

1294 E. Kemp and H. Gourlay, Dundee, Forfarshire, engineers. Improvements in marine steam engines.

1295 A. Paget, Loughborough, Leicestershire, manufacturer. Improvements in apparatus for the hauling, tightening, or pulling of ropes, cords, chains, bands, and other mechanical equivalents, and for the holding or making fast such ropes or other mechanical equivalents, and loosing the same when desired.

1296 G. Coles, Gresham-street West, City, merchant, J. A. Jacques, chemist, and J. A. Fanshawe, engineer, Tottenham, Middlesex. Improved machinery or apparatus for producing thin strips or filaments from various substances.

1297 L. Bing, Bishop's Stortford, Hertfordshire. An improved mode of, and apparatus for, ascertaining the actinic power of light.

1299 A. D. Renshaw, Fetter-lane, City. Improvements in apparatus for shearing or clipping the wool or hair of animals, and in the means for operating the same.

1300 J. H. Johnson, Lincoln's Inn-fields. An improved mode or method of correcting the deviations of the mariner's compass in iron ships. (A communication.)

1301 J. and H. T. Fugl, Woodbridge-street, Clerkenwell, upholsterers. Improvements in curtain poles and laths.

Dated April 22, 1868.

1302 M. S. Maynard and R. Grime, Preston, Lancashire, cotton spinners. Improvements in machinery for governing the speed of motive power engines.

1303 J. Johnson, Levenshulme, near Manchester, millwright and engineer. Improvements in metallic packings for pistons, pump buckets, and valves.

1305 W. Clarke, Nottingham, lace manufacturer. Improvements in the manufacture of ornamental fabrics in twist lace machinery.

1307 C. B. Ingham, Manchester. Certain improvements in apparatus for stamping, dating, indicating, or otherwise impressing marks or designs. (A communication.)

1308 T. Whittaker, Manchester. Certain improvements in the manufacture of water or liquid-proof fabrics or surfaces.

1309 H. Howse, Lime-street, City, accountant. An improvement in the manufacture of safety matches.

1315 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for manufacturing small articles from sheet metal. (A communication.)

1316 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in carpet linings, and in machinery for manufacturing the same. (A communication.)

1317 H. Hill, Nottingham, brass founder. Improvements in water-closets, and in ball and other cocks, taps, and valves.

1318 W. E. Newton, Chancery-lane. Improvements in paddle-wheels for vessels. (A communication.)

1320 H. H. Murdoch, Staple Inn, Middlesex. Improvements in the construction of concaves or breasting for the beating drums of thrashing machines. (A communication.)

1321 R. F. Fairlie, Gracechurch-street, City. Improvements in railway carriages and waggons, and in the means of coupling them together to form trains.

1323 E. Samson, Little Anchor-street, Bethnal Green, Middlesex. Utilizing the hoop, rim, or frame, under the top of an ordinary loo, centre, or other table, whether circular, oval, or any other shape.

Dated April 23, 1868.

1324 W. Hamilton, Glasgow, engineer. Improvements in the generating of steam, and in the means or apparatus employed therefor.

1325 T. Hardcastle, Lancashire, bleacher, dyer, and calico printer. Improvements in the manufacture of bowls for mangles, washing machines, and other purposes.

1326 E. Rostron, felt manufacturer and printer, and W. W. Whittaker, mechanic, Waterfoot, near Manchester. Improvements in machinery employed in the manufacture of felt.

1327 J. Whitehouse, Tipton, Staffordshire, ironfounder. Improvements in the manufacture of tailors' or goose irons.

1328 J. Bush and H. Welchman, Aston-juxta-Birmingham. An improved spring fastening for brooches and other similar dress fastenings.

1330 G. F. and J. Stidolph and T. Simpson, Woodbridge, Suffolk. Improvements in brushing and sweeping machines.

1331 A. M. Clark, Chancery-lane. Improvements in apparatus for transmitting and multiplying motive power. (A communication.)

1335 J. Reid, Glasgow. Improvements in the manufacture of casks and other similar articles, and in the machinery or apparatus connected therewith.

1337 J. Casson, St. James's-street, Sheffield. Improvements in machinery for sawing wood.

1338 A. Carter, Birmingham, accountant clerk. Improvements in machinery for the manufacture of nails, spikes, and bolts.

1339 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in cartridge boxes or holders. (A communication.)

Dated April 24, 1868.

1343 C. Brown, Dublin. Improvements in apparatus for baking, also applicable to hot pressing, and to other heating and to cooling purposes.

1345 R. and T. Nuttall, Walmsley, Lancashire, and B. Barber, Manchester. Certain improvements in the manufacture of woven fabrics termed quiltings and toiletings, and for similar descriptions of fabrics.

1347 C. W. Harrison, Oberstein-road, Clapham Junction, Surrey. Improved means of preventing incrustation in boilers and other vessels in which water is heated.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated April 29, 1868.

1400 J. Booth, Gamble-street, Nottingham, draughtsman. Improvements in the manufacture of fabrics in twist lace machines.

Dated May 2, 1868.

1434 H. A. Bonneville, Sackville-street, Piccadilly. Apparatus for measuring and registering the flow of liquids. (A communication.)

1446 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in buckets and other vessels of wood of analogous form, and in means for producing the same. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," May 12, 1868.

3699 T. and J. Robertshaw and J. Greenwood. Looms for weaving.

3713 V. L. Daguzan. Construction of paving.

4 G. A. D. Goodyar. Machinery for propelling boats.

5 W. Stroudley. Re-railing waggons.

9 R. W. Morrell and P. Craven. Spinning fibrous substances.

11 J. Imray. Locomotion.

12 C. W. May. Metallic cartridges.

20 E. Izod. Stays.

23 T. P. A. Key. Scaffolding.

25 J. and B. Dellagana. Printing machines.

26 M. E. Roy and L. Prevett. Receptacle for containing needles.

29 W. W. Morley. Bag machines.

30 W. J. Blinkhorn. Manufacture of dip candles.

34 A. Albini. Cartridge belts.

37 J. Nixon. Apparatus for transferring coal from railway waggons into barges.

39 E. R. Southby. Separating paraffin from its solutions.

41 T. Stokes. Manufacture of piled fabrics.

47 E. Myers and G. A. Cannot. Permanent way of railways.

63 G. E. Donisthorpe. Construction of catches for brooches.

67 J. Tomlinson. Machinery for twisting flax.

68 L. Simon. Laying metal leaves on printed surfaces. (A communication.)

72 C. Pontifex. Presses for expressing wort from spent hops.

102 A. Budenberg. Steam hammers. (A communication.)

113 G. Ireland. Cruet frames.

118 W. Firth. Valves made from india-rubber.

126 T. Sagar and T. Richmond. Looms for weaving.

136 J. Williamson. Bolting one part of a ship to another.

146 C. E. Brooman. Cooking apparatus. (A communication.)

166 J. M. Napier. Apparatus for cutting metals.

183 B. J. Heywood. Manufacture of pencil-cases.

271 J. H. Johnson. Apparatus for melting metals. (A communication.)

329 W. E. Newton. Window sun blinds. (A communication.)

515 L. Mummenhoff. Compositions for the manufacture of building blocks. (A communication.)

885 W. and W. Arthur. Truss.

975 H. Paulus. Pile driving engine.

1270 W. Lund. Machines for turning off cross-head wrist pins. (A communication.)

1295 A. Paget. Apparatus for hauling ropes.

1308 T. Whittaker. Manufacture of waterproof fabrics.

1320 H. H. Murdoch. Construction of concaves for the beating drums of thrashing machines. (A communication.)

1345 R. and T. Nuttall and B. Barber. Manufacture of woven fabrics.

1400 J. Booth. Manufacture of fabrics in twist lace machines.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the lis of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed May 8, 1868.

3170	S. Simon	3264	C. E. Brooman
3173	C. Bedells	3273	R. Ward and T. Travis
3177	J. H. W. and A. W. Biggs	3292	J. Owens
3179	W. Payne	3321	C. E. Brooman
3181	S. Buxton and W. Gardam	3334	A. V. Newton
3185	W. R. Lake	3406	S. Sharrock
3187	W. R. Lake	3441	R. Hornsby and J. E. Phillips
3189	W. R. Lake	3444	F. R. Ensor
3191	F. L. de Gerbeth	3505	C. Conner
3893	F. and E. L. Ransome and H. Ressemer	3610	J. Atkins
3194	J. C. Bayley and D. Campbell	3611	J. Clay
3202	M. B. Westhead and R. Smith	3622	G. Davies
3215	U. P. Wurflein	3636	E. and A. Ludlow
3216	R. Adams	3702	J. Davison
3224	G. Kent	218	H. Brinsmead
3249	R. Holliday	393	H. Bunning
		830	C. Attwood
		891	W. E. Newton

Sealed May 12, 1868.

3210	F. Andrew, and E. Whittaker	3260	J. G. Tongue
3212	A. M. Clark	3262	R. Husband
3214	W. R. Lake	3324	J. H. Johnson
3220	P. E. Bland	3361	J. S. Smith
3223	P. de Bavay	3366	A. Mackie
3228	L. A. Wainman	3386	T. B. Jordan and J. Darlington
3229	A. M. Clark	3552	W. E. Newton
3231	W. R. Lake	3553	L. Christophe and J. Montigny
3234	P. M. Parsons	1	W. R. Lake
3235	G. R. Solomon and M. Bebro	84	W. R. Lake
3238	A. Airiau	111	J. H. Johnson
3240	L. B. Bertram	602	W. Krutzsch
3243	A. M. Clark		

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1262	J. M'Glashan	1345	H. Besley
1275	R. B. Cooley	1360	J. Worrall and T. Hughes
1313	A. Parkes	1625	J. Hartley
1319	H. Ransford		
1335	W. Clark		

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1134	T. Blackburn and M. Knowles	1190	J. F. L. Baddeley
		1221	R. Hornsby

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending May 9, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2630	1 2	2751	0 6	2766	0 10	2775	0 4	2789	0 4	2803	0 4
2687	1 2	2755	0 4	2769	0 8	2776	0 10	2790	0 4	2804	0 4
2699	1 4	2757	0 4	2770	0 4	2781	0 4	2793	0 4	2805	0 4
2713	1 4	2761	0 8	2771	0 4	2782	0 4	2795	0 4	2809	0 4
2724	1 2	2762	0 4	2772	0 4	2783	0 4	2797	0 4	2820	0 4
2742	1 0	2764	0 6	2774	0 4	2785	0 4	2801	0 4	2178	0 10
2744	0 10	2765	0 10								

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, MAY 22, 1868.

PROPOSED SYSTEM FOR GIVING INFORMATION OF STORMS.

WE have before us an explanation issued by the Meteorological Committee of their proposed system for giving information of storms. Whenever any of the daily telegrams of the weather, received at the Meteorological Office from the reporting stations, give information of an actual storm, that information it is proposed to transmit to the seaports by electric telegraph, and to announce it locally by a semaphore erected for the purpose. The objects of the system are to make known the direction from which a gale was blowing at 8 a.m. of the day in which the semaphore is in use; to indicate the district in which the gale is blowing, and whether within or without a certain defining circle; and to show the force of the wind. It seems intended more especially for the coasts of England and the adjacent seas, as Scotland and Ireland are beyond the centrical area. At all events, it does not appear to us that either Scotland or Ireland will derive much, if any, advantage from the proposed system, although the Scotch in particular were very clamorous for the renewal of Admiral Fitzroy's storm warnings, which they very highly appreciated.

To understand how these objects are to be carried out, the semaphore must be described. A circular frame, about 6ft. in diameter, is mounted vertically upon a stout pole 24ft. high. From its centre radiate two arms of unequal length, which can be revolved about its centre independently of each other by means of appropriate gearing, and can be fixed in any required position with respect to the circle, which carries upon its circumference letters corresponding to the eight principal points of the compass, N. being uppermost. Thus it resembles a clock face, N. standing in the place of XII., E. in place of III., S. in place of VI., and W. in place of IX., the long arm corresponding to the minute hand, and the short arm to the hour hand. The long arm is red, has the word "Wind" upon it, and shows the direction from which a gale is blowing. The short arm is green, has the word "District" upon it, and indicates the district in which the gale was blowing at 8 a.m. In connection with the fixed apparatus a movable black ball and a set of numerals (7 to 12 we presume) are employed. A numeral is to be exhibited on the post, just below the circle, to express the force of the gale, as—7, moderate gale; 8, fresh gale; 9, strong gale; 10, whole gale; 11, storm; 12, hurricane; being part of the well-known Beaufort notation for the wind's force. A ball, about 18in. in diameter, is to be hoisted immediately under the figure, showing the force of wind, whenever the gale is reported as blowing in a district within the defining circle. When the gale is outside that circle no distinguishing mark will be fixed on the post, under the force of wind.

The apparatus and mode of work require no further explanation. It is only necessary to bear in mind that the arms are to be viewed in front, when they show red and green, their backs being white; and that the mounted circle, or dial, has no reference to the points of the horizon or to compass bearings. Any seaman might readily sketch out the semaphore and understand its purpose—it is sufficiently simple. But the indispensable key to the whole thing is the map showing the districts. Such a map accompanies the official explanation; and, unless a copy can be supplied to the seaman, or he makes out one for himself, he cannot hope to understand the precise meaning of the signals. The seamen will find little difficulty in defining the districts upon a Mercator's chart, by following the subjoined directions. From Birmingham, as a centre, draw across the British Isles and adjacent seas the rhumbs NNW. and NNE., and name this the north district; NNE. and ENE. define the north-east district; ENE. and ESE. the east district; and so on similarly until the eight districts are defined. Then from Birmingham, as a centre, describe a circle to pass through Penzance. This circle will include England and Wales, the Irish Sea, the Channel, and part of the North Sea. Scotland, Ireland, France, &c., will be outside the circle. It will be well also to know the names and positions in the districts of the reporting stations, some thirty odd, which can be seen in the "Times" or "Shipping Gazette" any day.

We will now make a few remarks upon this proposed plan of signalling storms, which, while it looks imposing and comprehensive, and avoids apparently all chance of failure on the part of those charged with its manipulation, because it simply announces facts, and any approach to forecasts is carefully avoided, yet is far from perfection. Time being limited to 8 a.m., should a gale come on at any other hour, the interval till the next 8 a.m. may be sufficient time for it to extend itself all over the British Isles, and thus it will announce itself everywhere and no warning of it can be given. This we imagine will happen frequently. Even during the lapse of the two or three hours occupied in telegraphing, a gale may extend considerably from its position at 8 a.m. Thus a S.W. gale at Penzance in the early morning may be on the east coast before noon, and, indeed, may be felt in all the central districts by that time. Should a gale be telegraphed from two or more districts on the same morning two or more semaphores will be required to signal such information to any place. The expense of each semaphore will probably be twenty times as great as that of a set of Admiral Fitzroy's signal shapes. He availed himself of existing signal masts. The semaphores must have specially constructed posts; hence the expense of these semaphores will be a serious consideration, as a first outlay, and eventually for repairs. It does not appear that the arms are to be removed when not required; at least, it is not stated how they are to be disposed when not signalling. However, we must suppose there is an oversight here in the explanation. The apparatus must be viewed from the front or it is not intelligible, whereas such signals should be discernible from all possible positions within sight of it.

To announce to our principal ports the fact of a gale just commencing at Skudesnas, Cuxhaven, Helder, Brest, Corunna, Valentia, Greencastle, or Nairn, will, without doubt, be doing highly important service to shipowners, underwriters, and seamen. Coasters will be able to estimate the chance of making short voyages and getting near a safe port before bad weather overtakes them. Foreign-going ships from Liverpool or Bristol may be saved the risk of encountering a gale soon after leaving port. Ships would probably not be sent out from those ports, in the teeth of a south-wester, off the south of Ireland, and, on the other hand, ships would not be sent from our eastern ports to encounter a north-easter reported to the east of the North Sea. This system may gain favour among the seafaring community, especially in our large ports, and, if so, it appears to us it will be found to work better with less centralization. The arrangement of working from a central office can only result in delay, and that is of all things the most adverse to the utility of this system. In this matter the large ports can get the information direct for themselves, and so avoid delay. Thus Liverpool could receive by telegraph information of storms from the east, west, north, or south of the British Isles, just as easily as London, and effect a saving in time of two or three hours, which may sometimes prove of much consequence.

The semaphore supplies the defect of the drum which the Meteorological Office has been using since the commencement of the year, for the former indicates locality and direction of wind, whereas the latter does neither. The office steadfastly refuses to predict gales: it only undertakes to signal them from afar off. We cannot bring ourselves to deem their plan of operation better or equal to that of Admiral Fitzroy His system gave two or three days' notice, and warned all coasts likely to feel the coming gale. It was extremely simple and almost inexpensive. It is obvious that the semaphore can only be adopted at large seaports or in immediate connection with a telegraph station. Small ports and fishing villages will still have to make the most of the drum. On the whole, while we regard the semaphore as a costly improvement on the drum, we still think the latter might be replaced, where the former is not adopted, by cone "point down" for equatorial gales, and cone "point up" for polar gales.

THE SILVER COINAGE OF GREAT BRITAIN.

IN a previous paper on this subject* it has been shown that, even supposing the present inconvenient duodecimal system of coinage to be maintained in this country, it is highly desirable to cancel altogether three denominations of coin now in circulation, namely, crowns, half-crowns, and fourpences, There would then remain to us florins, shillings, sixpences, and threepences, and these, it must be admitted, would, if arranged correctly, and preserved in proper condition, answer all the purposes for which a silver currency is required. In order, however, to make these coins more useful, more creditable to the great community among whom they circulate, and more worthy of the mint whence they emanate, they should be made to harmonize with each other. At present there is apparent an absurd incongruity in the designs ornamenting the various denominations in question. The florin has no sort of family resemblance to the shilling either of George III., George IV., William IV., or Victoria, numerous specimens of which are in existence at this hour. The sixpence of the current reign certainly does present *fac similes* of the devices ornamenting the shilling of the same period, but its reverse is totally dissimilar to that of the threepence! We do not know who is responsible for these infelicitous arrangements, which are attended with great annoyance to the public, and reflect no credit upon British art, but somebody is to blame for them. Whilst, then, we suggest, and, indeed, strongly urge, the withdrawal altogether of the three effete coins previously referred to, we no less earnestly advocate the relegation to the Mint melting pots of all shillings and sixpences of a date anterior to that of the accession of Queen Victoria. Their places, of course, should be supplied by further and extensive issues of new coin with as much speed as possible. It is very unfortunate that the designs of the obverse and reverse of the florin are so totally different in character to those of all other English coins, and that so many millions of them are in circulation. The coin is, as it were, an exotic. Its origin may be traced clearly to German sources, and it will never be thoroughly naturalized. Had it borne a head of her Majesty, unadorned, like that which distinguishes the three lesser coins of silver, and a reverse presenting a wreath of oak and laurel enclosing its value expressed in plain Roman letters, it would have been far more appropriate and acceptable. The florin

* *Vide* MECHANICS' MAGAZINE, April 3, page 250.

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is, nevertheless, engrafted on the English stock of coins, and cannot now be separated from it. The evil is to be regretted, but it cannot be remedied—at present. It is too late or too early to recommend the withdrawal of the florin, but it never has been, and never will become, a popular coin in this country.

To return to those denominations of silver coin which are susceptible of improvement, we say that they should be forthwith remodelled. In removing from circulation all shillings and sixpences of past reigns, and replacing them with those of the present, two excellent points would be effected. Shabby and worn coins would disappear almost entirely, and uniformity of design would characterize those which remained to do duty. It must be allowed that there might be some difficulty in recognizing the "image and superscription" which originally figured upon many of the shillings and sixpences now in circulation, for attrition has nearly obliterated them. That difficulty could be overcome by including in the sentence of extermination such pieces as could neither be made "head nor tail of," or were denuded of all Mint marks. There are thousands of these ghosts of coins still haunting the busy highways and byways of public traffic, and creating no small amount of trouble to her Majesty's lieges. They "lag superfluous on the stage," and should be driven off, and consigned to the fiery furnace without hesitation or remorse.

By the introduction of sweeping measures of the practical kind now advanced, it is our belief that the silver coinage of Great Britain may at once be beautified, utilized, and simplified. It is not enough that the circulation of obsolete and worn coins should be gradually stopped as they now are. The operation should be effected sharply and suddenly under warrant of Royal proclamation. In plain terms, the silver coinage of these realms deteriorates at a more rapid rate than its reproduction at the Mint makes compensation for, and hence its disgraceful condition. This is not a discovery, however, for which exclusive credit is claimed by ourselves. The fact is, unfortunately, too well known—outside the walls of the Mint, if not within them.

The longevity of coins generally has been much reduced since railways came into being. They are in continual motion from the time of their birth, and the poor sixpence especially is shortlived, in consequence of being overworked. If "one man in his time plays many parts," assuredly one coin in its course buys many times its own value. A certain charge is made annually in the Mint estimates for covering the loss accruing from the purchase of worn shillings and sixpences. These are bought of the Bank of England at their nominal value, and, of course, are bad bargains for the coining establishment which recasts, and then recoins them into money of full legal weight. The last amount granted for the purchase of worn silver coin amounted to £15,000, or 300,000 shillings, and this was supposed to represent the extent of one year's (1867) abrasion and deterioration of the silver coinage of the United Kingdom. Experience demonstrates that the annual loss of silver by the attrition of coins is in these days of trading activity much greater in value than this, although the weight of the silver thus spirited away in one year by friction is set down at 56,362 ounces!

This heavy loss, the expense of which falls upon the public, suggests other questions in reference to the silver coinage. One of these has reference to the mechanical formation of the pieces of money. Is it not possible so to manufacture shillings, for example, as that they shall not suffer so greatly as they now do from the wasting effects of attrition? Cannot their engraved surfaces be better protected? Is it not within the compass of scientific skill to harden the metal of which silver coins are composed, without reducing its standard of fineness? These and other problems remain to be solved on a future occasion. They are of importance at present, and they will become infinitely more so should the decimalization of the coinage of Great Britain be one day agreed to.

SAFETY GUN COTTON.

NOTWITHSTANDING the vast superiority of gun cotton over gunpowder as an explosive agent, its general adoption for blasting purposes has been greatly retarded by the presence of one fatal drawback which it has hitherto possessed. This drawback has been the resistless energy developed in its combustion under all circumstances, and which has led to a well-grounded fear of its power in case of accidental explosion. The practical result of this defect has been a want of confidence in gun cotton by users of blasting materials, and the raising of difficulties in the way of its transit by railway companies and other carriers, for its excessive violence rendered it more dangerous even than gunpowder. The great difficulty, therefore, has been so to modify the manufacture as to produce a material which would be perfectly under control, that is, which would only burn if accidentally ignited in transit or in store, but which would give out all its energy when properly confined for work. This question has for long past been the subject of careful investigation by the Gun Cotton Company, whose works are at Stowmarket, and we are glad to find that they have satisfactorily solved it. They are now manufacturing an article which will not explode under any other conditions than those of actual use. The way in which this is effected consists in pulping the cotton upon Professor Abel's principle, and then compressing it under a pressure of 18 tons to the square inch. To the pulping mainly is due the safety attained, as it ensures uniformity in washing, whereby the cotton is thoroughly freed from all acid, and thus every chance of spontaneous combustion is removed. The compression causes combustion to proceed slowly in the open air, owing to the condensed condition of the fibres, which, in the loose state of cotton or rope, burn very rapidly. The gun cotton is made into small cylindrical charges, which are both portable and convenient for use. The principle of thus combining safety with force in a highly condensed form has produced invaluable results; a series of severe trials, extending over a considerable period, have proved gun cotton in its present improved form to be the safest and strongest, and, therefore, the most economical explosive agent.

The great point is, of course, to win public confidence, which has been greatly shaken by occasional explosions of nitro-glycerine. To do this it was necessary to demonstrate the existence of safety, and to prove the absence of all ground of alarm. To this end the North-Eastern Railway Company directed a series of experiments to be made, which were lately carried out by Mr. Prentice, the managing director of the Gun Cotton Company. Mr. J. Wilson, the goods manager of the Railway Company, directed these experiments, and we have his report upon them before us. First, a small box containing 125 charges of the gun cotton, and said to be equal in effect as a blasting agent to a quarter cask of gunpowder, was ignited by a fuse. When the flame reached the gun cotton, there was a great blaze like the burning of a heap of loose straw, but no explosion. In less than half a minute there was no flame, except from the burning of the brown paper in which the gun cotton had been packed inside the box. The box was of wood about ¼in. thick, and was nailed, but not bound with iron at the corners; it was one of the ordinary packages used for sending the cotton out.

After this a number of charges were laid on the rails near the coal depôts, and coal waggons were run over them, when some of them were ignited, others were not. Some charges were then placed so that an engine should pass over them, and they were all ignited. Mr. Prentice took an axe and chopped one charge into several pieces; there was no explosion or ignition. Small pieces of gun cotton placed on the iron rim of a wheel and sharply struck with a hammer, exploded, or rather, detonated. In all the cases where ignition was produced by concussion, whether of a hammer on iron, or of the wheels of an engine or waggon on the rails, it was very evident that only so much as was actually struck exploded or detonated, the part not struck firing from the explosion, and burning like straw or flax. In order to make sure that he was really dealing with the article which produces such an effect when exploded in close confinement, Mr. Wilson had a hole bored in a large block of hard tough wood, in which Mr. Prentice placed a charge of gun cotton with a fuse attached to it. He then filled up the hole with broken slate tightly rammed, and fired the fuse. When the gun cotton exploded the block of wood was shivered to pieces, and the fragments were blown several yards away. The result of these experiments have convinced Mr. Wilson that the company may safely carry gun cotton along with other goods in ordinary waggons, adopting the same rules as now apply to the conveyance of cartridges. It is, therefore, satisfactory to know that the North-Eastern Company, acting on Mr. Wilson's recommendation, now carry the gun cotton as ordinary goods in covered waggons. We have ourselves fired the compressed gun cotton, and find it perfectly inexplosive so long as the atmosphere has access to it, but in which all the active energy of gunpowder—but in a greater degree—is fully developed when fired in a confined space. The public have reason to thank Mr. Prentice for this excellent result, and we hope railway and other carrying companies will have the good sense to follow the example set by the North-Eastern Company. Unquestionably, we have in the compressed gun cotton a safer explosive than gunpowder.

The application of gun cotton to gunnery purposes is a question which has not yet been satisfactorily solved, but it is now being worked out by Mr. Prentice. As a charge for ordnance and small arms gun cotton is far too violent; its rapidly developed and resistless energy bursts the piece before the inertia of the projectile is overcome. To remedy this, the action of explosion must be retarded so that the ignition of the atoms shall be comparatively slow and progressive. This has been attempted in various ways, but not with any degree of practical success. We have reason to hope, however, that the time is not far distant when gun cotton will be fully utilized in this very desirable direction. In conclusion—reverting to the immediate subject of gun cotton transport—we will give the substance of a report as to the comparative risks of gun cotton and gunpowder in conveyance, which was made by Colonel Boxer. That officer is of opinion that no greater risk of an explosion attends the transport of the compressed gun cotton charges by railway or other modes of conveyance than is incurred by the transport of ordinary gunpowder. He further states that in the event of an accidental explosion of these charges the amount of damage to life and property would not be greater than that which would result from the explosion of the same bulk of ordinary gunpowder. Finally, he thinks that the mode of packing the charges in deal boxes is preferable to that of packing in strong iron cylinders. The expression with reference to the comparative safety in accidental explosion are, of course, guarded; but we have shown that the damage would be much less with cotton

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than with powder. This has in effect been certified by the North-Eastern Company in the course they have adopted with regard to its transport.

THE SMOKE INSPECTION NUISANCE.

THE Government inspector of smoke nuisances appears occasionally to be as great a nuisance as the one he is endeavouring to suppress, and to require suppressing in his turn. Not long since one of his feats was to compel a steam user to keep his furnace door shut and so cause smoke—for which he summoned the offender—although with the furnace door a little way open, as usually kept by the stoker, there was no smoke. Lately, Mr. Sandison has been pouncing upon fresh victims, some of whom have complained in the public press. Amongst others, we notice Messrs. Bayley and Rawsthorne, of the Patent Wheel Works, Newington-causeway, who have sent to the "Times" a letter of very justifiable complaint. Just a week, ago Messrs. Bayley and Co. were fined at the Southwark police-court for "unlawfully using a furnace not constructed so as to consume its own smoke." Now, these gentlemen express a "burning" anxiety to consume their own smoke. They have, at considerable expense, fitted up the best contrivance they know of to all their furnaces, and with careful stoking and with the good coals they use there need be no smoke. They have pressed Mr. Sandison to inform them what they can do more, or to state if he knows of any contrivance or patent invention that will be more effectual than their present means. He is unable to do so; the oracle is majestically silent. The injustice with which these smoke summonses are conducted is becoming notorious, and we trust will be represented in the proper quarter. Take the case under consideration as one in point. Messrs. Bayley and Rawsthorne were fined on the 15th of May because a policeman deposed that their chimney smoked for four whole minutes on the 11th of March—only two months previously! Now, how is it possible for defendants in such cases either to deny or to plead guilty after a lapse of time like this? Messrs. Bayley very properly submit that if the Government insist on all manufacturers using a smoke-consuming apparatus to their satisfaction, they should be prepared to adopt what they consider the best invention, and fine all manufacturers who do not use it. If, as the authorities state, one system will answer at one place and another at another, then the Government inspector should be a competent man authorized to bring his vast experience to bear in advising manufacturers on the best system each can adopt in abating the common nuisance. But we don't believe the smoke inspector to be a competent man, and the present procedure is nothing better than a farce. The sooner this anomalous condition of things is amended the better for all parties concerned. It is a crying shame that the innocent are made to suffer equally with the guilty, and that those who are doing their best to remedy the evil complained of are fined because they cannot compass an unattainable object. Let competent men be set to deal with the question, and to find out a remedy, the non-adoption of which should then be visited with pains and penalties.

MANUFACTURING AND MINING INDUSTRIES OF BELGIUM AND FRANCE.

THAT the technical education of workmen is more sedulously promoted in some European states than in the United Kingdom is not to be disputed, nor may it be denied that such culture gives a decided advantage to the continental manufacturer. The shipbuilding interests on the Thames, and the concerns of machine makers and other metal workers in the metropolitan counties, are, and have been for a considerable time, in a languishing condition, whereas shipbuilders and mechanical engineers on the Clyde are comparatively prosperous. The contrast is not, we believe, attributable to any single influence, but to a combination of several elements. The difference in wages paid in the two localities may have something to do with the matter, the difference in the price of coal delivered at the yards and works on the Thames and the Clyde respectively has certainly much to do with it, and it would be unwise to ignore the fact that Scotland, as well as Ireland, enjoys far greater facilities than England for the sound education of the great body of the people. If it be so, that the shipbuilders and engineers of Glasgow have cheaper coal and more intelligent workers than those on the Thames, it need not be wondered at if they can take contracts at lower prices and still realize good profits. It is late in the day to say anything concerning the money—as well as the moral—value and importance of education to both master and man. Everybody admits it now-a-days. We have discovered what we need in order to hold our own against all competitors, and we have good grounds to hope that the awakening will not exhaust itself in mere talk, but in the fulness of time bring forth an abundant harvest, of which Mr. Joseph Whitworth's princely offering may be regarded as a first fruit. While ground may have been lost in this country, and gained, comparatively, in certain localities on the Continent, we have not as yet any occasion to write "Ichabod" upon the portals of our yards and factories. The fall of England and the rise of foreign competitors are not as yet so remarkable as to excite the degree of alarm that has been expressed in some quarters. It is true that in the matter of technical—and, indeed, of general elementary — instruction, France, Prussia, and Belgium are ahead of us, but a few years may, with the adoption promptly of efficient means, enable England to take the front rank which her mineral resources, the energy and perseverance of her sons, and their developed intelligence, should command.

An interesting official return has just been published by the Board of Trade, giving the trade accounts for 1865, 1866, and 1867, of Belgium, Holland, and France. The returns of exports and imports exhibit various eccentric fluctuations, but prosperity in the main, although nothing comparable to the vastness and rapidity of the development of various branches of industrial enterprise in England. The Belgian imports of coal for the three years may appear to belie these observations, inasmuch as the consumption of coal may seem to indicate the condition of manufacturing industry. But this is not the case; the coal importations of Belgium do not represent consumption in Belgium, and are only, in fact, equal to a small fraction of the exports of coal and coke from the country. The total imports of coal were—Tonn. 73,931 in 1865; in 1866, tonn. 179,427; and in 1867, tonn. 423,005. In 1867 Belgium exported, chiefly to France, tonn. 4,487,762, the increase, as compared with the exports of 1866, being tonn. 417,546, or very nearly the same as the quantity imported. The imports arose from the high prices that ruled in Belgium.

As regards machines and machinery, the Belgian imports and exports for the three years respectively were :—

	1865.	1866.	1867.
	Kilogs.	Kilogs.	Kilogs.
Imports	4,908,078	5,437,699	5,114,305
Exports	14,447,753	11,992,201	10,841,993

Of the machinery exported only 290,161 kilogs. were to the United Kingdom, the remainder being sent to France, Holland, and the Zollverein. France and Holland are the best customers to Belgium, each taking considerably less in 1867 than in each of the two preceding years, and the Zollverein considerably more. The imports and exports of iron, in various conditions, was as follows for the three years :—

IMPORTS.

	1865.	1866.	1867.
	Kilogs.	Kilogs.	Kilogs.
Iron, ore, and fillings	340,591,769	307,799,921	322,890,778
Pig and old iron	24,864,110	32,508,242	56,233,219
Rails, sheets, &c.	1,555,576	1,579,999	2,136,652
Steel, bars, sheets, and wire	...	4,320,429	2,484,240

EXPORTS.

Rails.....	...	65,549,360	80,875,014
Sheets	...	16,884,769	12,583,376
Other kinds	...	56,328,603	55,897,705

Notwithstanding the proximity of Belgium, the greater part of the machinery, and some classes of metals, imported by Holland, are from the United Kingdom; as, for instance, of machinery imported of a total value of 2,255,000 guld. in 1867, a smaller quantity than in either of the two preceding years, the proportion sent by England was of the value of 1,206,000 guld.

Turning to France, we find that the machinery of different classes and metals imported was of the values annexed :—

	1865.	1866.	1867.
	Francs.	Francs.	Francs.
Steam engines, fixed and marine	474,409	845,850	503,532
Locomotives	100,012	117,280	326,350
Other kinds for spinning, weaving, &c.	6,106,686	8,524,827	6,004,943
Agricultural machines	263,361	368,630	513,058
Of which from the U.K....	232,551	327,326	449,067
Detached pieces of all kinds	2,624,908	2,789,931	2,134,032
Machine tools	2,044,978	2,268,622	3,079,603
Iron, ore	9,543,748	9,005,465	9,831,105
„ pig	5,887,854	6,480,693	6,690,246
Steel	283,768	997,343	2,097,811

The increase in the imports of machine tools, and of steel, are amongst the most significant figures in the return, and more distinctly than any others utter the warning, "Look to your laurels." The total value of the imports for 1867, apart from bullion and specie, was 3,155,689,000f. against 2,793,484,000f. in 1866. The total exports of France, 2,972,306,000f. value, show a decrease as compared with 1866, when they amounted to 3,180,609,000f.

THE BRITISH HOROLOGICAL INSTITUTE.

IN the present day, when the arts and sciences, exact and applied, are so fostered, promoted, and cared for, it would be difficult to point out any branch or department which has not its representative body or institute. But it would not be difficult to point out some of these institutes which are neither so well known nor supported as they deserve to be. It therefore becomes our duty, as scientific journalists, to make known these facts whenever we meet them, and to draw attention to scientific bodies which are doing the public a practical service, but which, from circumstances, in some instances beyond their immediate control, are silently but yet resolutely working on in comparative obscurity. Amongst such we may certainly class the British Horological Institute, which, although known to our readers through our columns, is not so widely known as it ought to be, nor so fully appreciated as it merits. Another opportunity offers itself for bringing this Institute before the public, inasmuch as the annual dinner took place last Tuesday evening, at the Guildhall Hotel. The chair was taken on the occasion by Mr. M'C. Torrens, M.P., the member for Finsbury, in which borough the watch-making interest is essentially located. The chairman

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was supported by Sir John Gray, Bart., and E. D. Johnson, Esq., F.R.A.S. The vice-chairs were occupied by J. C. Klaftenberger, Esq., John Jones, Esq., and D. Glasgow, Esq. Amongst the company present were Professor Tennant, Messrs. Jackson (treasurer to the Institute), Holdsworth, Mylne, Schoof, Strachan, and Moore (secretary to the Institute). A goodly company sat down to an excellent dinner, and the toasts, which were of the usual loyal and patriotic character, were interspersed with songs by professionals, the evening altogether being a very pleasant one.

It is not, however, so much with the proceedings of the evening that we have to deal, but with the aim and objects of the Institute, and this with the view of bringing it more prominently before the public and of assisting it into that position it ought to, and no doubt will, one day occupy. First, then, its object is to promote the cultivation of the science of horology. It aims at making a watchmaker something more than a mere mechanical worker—master of his craft though he be. It points to loftier things, and desires that its members should view their work from the highest standpoint—that of pure science. To effect this it makes known the laws which govern the present methods of manufacture, and the direction in which improvements may be made. It arranges for the delivery of lectures and the reading of papers on horology and cognate subjects, and organizes classes for the study of mechanics as connected with the art. Then, again, there is a collection of models, and specimens of horology—some of which have been presented, whilst others are on loan—and there is a library of useful works. Besides these matters, it gives prizes for essays, and issues a journal, from which we occasionally abstract valuable information. This journal is ably edited by Mr. R. Strachan, who gives his services gratuitously, and who does his work well—two conditions of things which we rarely find combined. We are happy to learn that a movement has been set on foot, and which, we trust, will be well supported, to present Mr. Strachan with a tangible recognition of his valuable services. Finally, we may mention that the Institute building, which is situate in Northampton-square, Clerkenwell, is in electric communication with Greenwich Observatory, and Greenwich mean time is taken several times daily. We should not omit to state that, connected with the interests of the Institute, is the Clock and Watchmakers' Asylum, which is supported by voluntary contributions, and to which the members subscribe. This, too, is an object which we cannot too warmly commend to the notice of all, as none can say what adversities may lie in wait for them in the future. Now, with all these, and many other, advantages which the Institute offers to horologists, and, through them, the public, we certainly must express our great surprise that it does not occupy a more prominent position than at present. As we know our pages are read by many who are directly interested in the Institute and its working, we will point out how its interests may be best promoted.

First, then, its lectures, which though few in number, are always sound and practical, should be well attended, and their number increased. The subject-matter of the papers should be freely discussed from a purely scientific point of view, all commercial considerations being left for occasions specially appointed. Members should use their best exertions to secure the regular attendance of their apprentices and others at the classes, and it would have great effect in promoting study if premiums, either of books or of money—preferably the former—were given for proficiency. The world is now alive to the great necessity of technical education, and each in his sphere can, if he will, promote this important movement. We are not all Whitworths, nor need we be to help in this direction. There are members of the Horological Institute, who, either by means or position, can lead a hand, and to them we earnestly commend the matter; let them remember that on them the world throws the onus of responsibility. What is the practical result of technical education abroad amongst watchmakers? Why, the fact that in the collection of the Horological Institute are two watch movements, perfect specimens of work, executed by two youths at Besançon, aged respectively 14 and 16 years. And this brings us to the acquisition of knowledge by specimens and models. We believe every member, if he chose, could contribute something, great or small, to the collection now forming, either on loan or as a gift. So with regard to the library, that wants extending, and many hands here would make light work. Of course, in all this, we do not forget that there is a directing body—the Council of the Institute—to whom the members depute the management of matters. To these, first, do our remarks apply. But the members are bound to aid and assist them, and to strengthen their hands to the utmost of their power. Let them show a little less apathy and indifference to matters which are occasionally placed before them through the executive. Let them infuse life and energy into their position of membership, and we will answer for their highest expectations of success being exceeded in the end.

So far, we have endeavoured to show what the Institute owes to itself, and to point out the advantages which will accrue by a due adjustment of the debt. But there is a wider view of the question, without the consideration of which our remarks would be incomplete. The public is indebted to the Horological Institute for promoting and perfecting the science of horology, and it, too, should do something by way of acknowledging its indebtedness. Now, it is a fact that no other nation possesses a society that equals this Institute in the amount of good it is effecting for the science of horology. If any would ask in what the benefits conferred on the public consist, we would select for answer the circumstance that the Institute has succeeded in obtaining a better and cheaper system of assaying and stamping watch cases at Goldsmiths' Hall. It has also appealed to the Board of Trade for a revision of certain commercial treaties, by which the foreign tariff on English watches and clocks will be more fairly adjusted, and has interfered in many other ways for the public good. Let these facts, then, be made known in proper quarters and let such influence as can be used in its behalf be brought to bear upon the subject, with a view of bringing about Government recognition. The Royal, the Astronomical, the Chemical, and other societies, are aided either with grants of money or with a place of meeting and offices, in both which respects the Horological Institute is at great disadvantages. It supports itself by subscriptions, donations, and the sale of its journal, and its library and meeting room are ridiculously small and inconvenient. Let us, then, urge upon Mr. E. B. Denison, its esteemed president, himself a distinguished horologist, to represent the matter in its true light, in the right quarter, and not to rest until he has obtained for it some privileges which shall lighten its burden, promote its interests, and be a recognition of the services conferred upon the people. This, with the hearty co-operation of the members, will in time place the Horological Institute amongst the foremost of the scientific societies of Great Britain.

NOTES ON OUR NAVY.

I HAVE promised to enter more into the details of what our men-of-war should be, as a great maritime nation like England requires two descriptions of ships—one to fight her battles around her own shores (the Mediterranean, or perhaps America), and the other to defend her commerce from the countless privateers which France or the United States so well know how to organize. The latter, whenever we have a little trouble on our hands with any other nation, kindly threaten to sail their rovers under our opponent's flag, a piece of disinterestedness which will meet with the attention it deserves when they think fit to put their threats into execution. I will, however, pay them the compliment to admit that in any future war their inroads on our commercial marine, by means of their privateers, will cause England more anxiety and trouble than those of France, or any other nation. Apart from the scum and rascality of Europe, which would sail under their flag, the natural lawlessness and love of adventure of a large class of the people of the United States would induce them to equip and man almost any number of vessels whose object was plunder.

I have before stated that we are paying too much attention to the thickness of the iron plating, at the expense of other qualities. The magnificent "Hercules" carries but three days' coal—too little for a ship to act offensively at any distance from a coaling port. To be thoroughly efficient for all purposes, she ought to carry eight at least. For a guard ship at any of the Channel ports she is all that can be desired, but we require such a one to be in the van at all times. There has lately been a great discussion on the superior handiness of short ships, and the consequence is that many essential points have been sacrificed to secure that supposed end; and in February last I read a leading article in the "Army and Navy Gazette," advocating shorter ships than the "Bellerophon" and "Hercules," and more power than they now have, to enable them to keep up the same speed as at present. The writer was evidently afraid that a ship so long as the "Bellerophon" would take too long in turning. Now, for many years I have handled the largest classes of ships, and I really find very little difference between one of 350ft. and one of 200ft. when you understand your profession. The writer also appears to forget that in action any ship which was required to take up a particular position would have to go over a large space of ground to reach it, thus making the enemy's vessel the centre of a circle while he ran down the circumference, so that a few turns of the screw of the former would preserve their relative positions. It is reasonable to suppose that the longer ship would in this case be the swifter, and if fitted as a ram would take the other at a considerable disadvantage if that mode of attack were contemplated. I have, in a former article, stated that a ship armed with the most formidable artillery and under the most favourable circumstances would have no chance against a well-handled ram. The rude outline of the class I would build has already been given in the MECHANICS' MAGAZINE. All guns are there shown on the upper deck between strong traverses. I do not consider that men run much risk from above, as the motion of a bursting shell is always forward when the initial velocity has not greatly decreased, and a wire rope netting stretched overhead from side to side would keep out all ordinary splinters from the masts and yards which might be shot away.

As the stability of all our ships is much beyond what is required, I should reduce it in all classes. This would enable the builder to have less breadth of beam and increased steadiness in bad weather. The horse-power, and, consequently, the weight of engines, boilers, &c., might be reduced without impairing the present rate of speed. I feel certain that a ship so constructed would be able to keep the sea in all weathers, and cross the Atlantic in a reasonable time. Now, no man can say how long a fleet would be

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in reaching Bermuda or Halifax, places which must be our rendezvous, if ever we have a war with the United States. Should that evil day ever come, what we undertook to carry out must be done quickly, or our chance of success would be much impaired. In perusing the naval history of the civil war, I see no evidence of any superiority of American ships for offensive purposes. Their monitors, as sea-going cruizers, are gigantic failures. They trotted one across the Atlantic as a lure for the bellicose nations of Europe to purchase the others. Thanks to the interference of a landsman in France the bait took, and that power now possesses two of the most worthless war ships afloat, so worthless, indeed, that it will never be safe to send them to sea without convoy, and, when there, a Cunard steamer with her strong stem would make short work of both, without inflicting fatal injuries on her own hull. I am of opinion that we are aiming at too high a power of resistance in ironclads, and by this sacrifice many of the most essential qualities of a seagoing ship. I admit that one cannot have too much shelter from dangerous missiles, but, like the knights of old, we may heap on iron until the efficiency of the whole machine is impaired, and it becomes unwieldy and dangerous to its possessor. For simple coast defences put on as much as you list, but the ocean fleet should possess speed, seaworthiness, good stowage, and the power of acting together. This can only be acquired by reducing the enormous beam of our present ships, and by removing the guns to the upper deck, whether in turret or broadside, I care not, although as guns increase in size it is evident that the turret will stand a greater chance of injury from heavy shot and become disabled.

The light ships for protecting commerce should be built with more consideration for their speed than fighting qualities. It is against privateers that we must guard, and the Americans have, as I have before remarked, a wonderful facility for constructing vessels of that class. Now, what could our "Danae" and "Niobe," which are now the models for such ships, do against a few active privateers. Their top speed is not sufficient to insure confidence, and how many days' fuel do they carry? The "Icarus," "Cordelia," and others of that class, are totally inadequate for such a purpose, and would be a source of weakness in the event of a sudden war breaking out. Whenever that day comes it will neither be ironclads or monitors which will ruin our commerce, but light-built corvettes or frigates, commanded by active restless men, who will hunt their quarry in every part of the globe where a keel can float. These vessels will not be loaded with heavy guns to strain their topsides or impede their sailing, but simply carry one or two of great power, as their speed would enable them to escape from any heavy cruisers which might cross their track. I therefore hope that before long we shall possess vessels of this class with greater length than the "Niobe," and beam reduced to the minimum amount of stability. It makes one smile to read all that is said about the handiness of short ships in action; one would imagine that it was necessary to keep turning round, like a cockchafer on a string, to get the guns to bear. Such an opinion is absurd. The winner of the next naval battle will be the man who, with a clear head and iron nerve, is able to warily watch the motions of his antagonist and take advantage of circumstances, for there is no plan of naval tactics which may not be checkmated by a skilful antagonist. A captain should know exactly what his ship will do under every circumstance of wind and sea, as one may often be backed in a few minutes to a position which would take a long time to do by any other method.

It is satisfactory to find that my views are finding advocates amongst the leading journals of the day; the "Engineer" is already recommending us to pause in adding a greater thickness of iron plating to ships' sides, since the penetrating power of guns bids defiance to all armour at a reasonable distance. The "Army and Navy Gazette," which affects to publish official information, says that a ram is to be laid down this year, and the "Times" ridicules the greater number of our small vessels on foreign stations as worse than useless. In speaking, however, of that squadron which is to dash off to any part of the world at a moment's notice to uphold the honour of our flag, I want to know where the ships now are; and echo answers, where? Before this wild proposition can come to pass, ships must be constructed on the plan I have recommended; at present, the most formidable do not carry sufficient fuel to carry them by easy stages across the Atlantic, and should they start together on such a tour they would reach the goal like hunters after a hard day's run across country. No greater test of the efficiency of the fleet could be given than to make a signal, when ready for sea, "Rendezvous at Halifax, Nova Scotia."

Since my first article, in which I mentioned the rig of the "Minotaur" as not being applicable for such a ship, her rig has been altered, not, however, in the manner I should wish, or as science would point out. This vessels plunges dangerously in a head sea, if we are to credit the published reports, and the aim should be to lighten her forward, as the tendency of a vessel to scend under the influence of any given weight increases as the square when moved from the centre of motion. Now, it is evident that the weight of a heavy full-rigged mast must have a great effect when placed near the bow. If there were any commensurate advantage for so doing such a proceeding would be reasonable, but I know of none, as she will never be able to manœuvre under sail alone whatever her rig may be.

In concluding these notes, I think it right to express my admiration of Mr. Reed as a constructor; such a man would design and build ships which would be incomparably superior to any afloat, if he thoroughly understood the nature of the service on which they were to be employed. At present, all his energies are concentrated on one point, viz., to place the greatest possible thickness of iron armour-plating on the hull at the expense of the most essential qualities of a sea-going ship, a defect which at some future day will bear its fruit. X.

PHOTOGRAPHY.

DR. GLADSTONE'S NEW EXPERIMENTS ON LIGHT —USEFUL LIMELIGHT SAFETY VALVE—SMALL CAMERAS FOR TOURISTS.

At a recent Friday evening meeting of the Royal Institution, Sir Henry Holland, Bart., F.R.S., in the chair, Dr. J. H. Gladstone, F.R.S., gave an experimental lecture relating to some new discoveries of his own on the subject of light. He pointed out that the indices of refraction of liquids are lowered by increase of temperature, and, by means of a hollow glass prism filled with oil of nutmeg, he showed that the more the oil was heated the less could it bend a ray of light from the electric lamp out of its primary direction. This law holds good with all liquids. Solids, on the other hand, as they are heated, have their power of refraction very slightly increased, with the exception of crown glass, which is not optically influenced by temperature, and fluor spar, which behaves like a liquid, and has its power of refraction diminished by an increase of heat.

One optical property alone, the Rev. Pelham Dale and Dr. Gladstone discovered to be common to the solid, liquid, and gaseous conditions of bodies, namely, "the specific refractive energy," that is to say, the refractive index, minus unity, divided by the density. The most general law discovered was, that the refraction equivalent of any substance is the sum of the refraction equivalents of its constituents. The specific refractive energy multiplied by the atomic weight of the substance gives its refraction equivalent.

On these principles he pointed out that the refraction indices of some substances may be ascertained by calculation. For instance, bisulphide of carbon consists of one atom of carbon combined with two atoms of sulphur. Now, the refraction equivalent of crystallized carbon or diamond is 5, and of sulphur 16, so that the refraction equivalent of one atom of carbon (5) and two atoms of sulphur (32) united make 37. The index of bisulphide of carbon, as shown by experiment, is 3·73, and by calculation 37, as above, so it will be seen how closely the results tarry. Calculation and experiment do not always exactly agree, but are usually within a small decimal point of each other, or near enough to prove the truth of the general principle. Dr. Gladstone expressed the opinion that the double refraction of Iceland spar may be caused by the crystal being in a state of unequal tension in different directions, so as to permit light to pass more freely in one direction than in another.

In the use of large quantities of oxygen and hydrogen gases for the lime light, for photographic enlargements and other purposes, it is desirable to provide against the possibility of explosions, whether from accident, carelessness, or design. Mr. J. T. Taylor first adopted the plan of putting a light valve at the mouth of the gas reservoirs, so that the gases could flow out but could not run back if by any accident pressure acted in a wrong direction. An improvement upon Mr. Taylor's valves, which we have already engraved, has just been made, tested, and published by Mr. W. H. Harrison. The valve consists of a glass tube, 3in. in outside diameter, and 2in. long. In the bottom of this tube B B, fig. 1, the brass plug D with

FIG. 1.

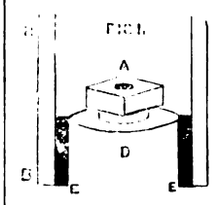
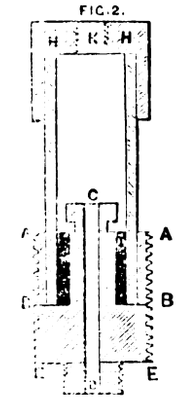


FIG. 2.



the square head A, is inserted, the plug being made air tight by the band of vulcanized india-rubber tubing E E placed between it and the glass. A sectional drawing of the whole of the valve is shown in fig. 2, where H H is a brass headpiece fixed upon the top of the glass tube with plaster of Paris, and has a screw thread at K to take a metal tube to receive the india-rubber piping. The brass plug is represented by C D, and a slip of oil-silk is tied across the orifice C, to act as a flexible valve. A B is a brass ferule, cemented on the outside of the glass tube. The outside of this ferule, as well as the outside of the broad part of the plug B E, is corrugated in circles, so that a piece of india-rubber tubing may be slipped over it, if necessary, as a further protection against the leakage of gas. This precaution, however, is not likely to be practically wanted. The small end of the plug D screws into the tap of the gasometer or gas bags. The advantage of this arrangement is that the valve has no hinge or spring to get out of order, that its working part is always in sight, that if anything goes wrong the plug can be pulled out, and the valve put right in an instant, and that it utterly prevents the gas of one reservoir from flowing into the other to make an explosive mixture.

Mr. C. D. Smith, one of the officials of Messrs. Negretti and Zambra, has written to a photographic contemporary to "rectify," as he says, "a few errors," in the description recently published in the MECHANICS' MAGAZINE, of a portable camera manufactured by that firm. As our original notice contained no errors, the letter by Mr. Smith is rather cool. We pointed out that the camera was too bulky for the pocket. Mr. Smith says it is not, but further on he states that the camera, with dark slides for six pictures, will go inside a case

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9¼in. long by 5in. square. If Mr. Smith will carry a log of wood 9¼in. × 5in. in his pocket for a week, he will soon find out whether this is a convenient size for a pocket camera. The fact is, that in calling it a "pocket camera" Mr. Smith omits consideration of the dark slides and lenses whilst we included both, for a tourist cannot take pictures with the camera alone, without lenses and photographic plates. Then, he says, our description of the stand is incorrect, but as we had then never seen the stand, or described it at all, the alleged error was never made. We described some faults commonly found in portable stands, one of which faults, we learn from Mr. Smith's letter, belongs to his stand, a picture of which has since been engraved in the MECHANICS' MAGAZINE, of May 8, page 355. Stands of that description are not steady in a breeze, and, under such circumstances, will so "blurr" the lines of the picture, as to render good photography impossible. We have practically tried all kinds of portable stands for tourists, and find none more convenient or certain than one with a very small triangular top, permitting the legs to lie so close to each other that they can be carried attached to the triangle, without giving the operator the trouble of screwing and unscrewing the parts over each view. The whole point in Mr. Smith's letter lies in its closing sentence, as follows:—"The above camera and stands are now on sale at Messrs. Negretti and Zambra's, 135, Fleet-street." This fact might have been published without charging the MECHANICS' MAGAZINE with errors it never made.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

THE INDUSTRIAL PRODUCTION OF HYDROGEN—A NEW MODE OF PROCURING PHOSPHORUS—GERANOSINE, A NEW ANILINE DYE.

MM. TESSIE DU MOTAY and Mareschal have patented in France a mode of preparing hydrogen for industrial purposes. Water has been regarded by many enthusiastic people as a cheap source of fuel, and several modes of decomposing it and separating the hydrogen have been proposed. Steam has been passed over red-hot coke, by which a mixture of hydrogen, carbonic oxide, and carbonic acid is procured. The last was separated by means of lime, and the two former were then available for heating purposes. But in this case the amount of coal expended in procuring the combustible gases exceeded in heating value that of the gases produced. More recently, it was ingeniously proposed to make water indirectly decompose itself by employing water-power to drive large electro-magnetic machines and using the stream of electricity generated to decompose water, and thus furnish a continuous supply of gaseous fuel. In this case also the amount of fuel obtained is altogether insignificant when compared with the force expended in procuring it. Thus the question has been left until now, and although it cannot be said that the inventors named above have solved the difficulty, they have perhaps, as the phrase goes, made a step in the right direction. Their process is really the decomposition of the vapour of water by red-hot carbon, but they do not use steam ready generated, and thus save the expenditure of coal in one furnace. They take alkaline or earthy hydrates, mix them with coke-dust, and heat the mixture in retorts. The heat expels the water from the hydrates, and the vapour coming in contact with the carbon produces hydrogen and carbonic acid. The latter is removed by passing the mixture over an alkaline carbonate, which is thereby converted into a bicarbonate, and the hydrogen passes on. The bicarbonate, when re-heated, gives up the extra atom of carbonic acid, and the neutral carbonate is regenerated for another operation. Another mode of procuring pure hydrogen is to drop hydrocarbon (petroleum oil) upon lime heated to cherry redness. In this case, they say, pure hydrogen is set at liberty, and carbonate of lime is formed, but the source of the oxygen necessary for this is not obvious. There is an apparent economy in the first process of these inventors, but still the hydrogen will be a very expensive fuel, while, for lighting purposes, it would require to be "carbunetted," which would make it dearer than coal gas. The inventors evidently do not realize all the obstacles in their way. Hydrogen, it is true, weight for weight, gives four times the heat of coal; but hydrogen is so extremely light, that, bulk for bulk, it is calculated that the gas will give only one five-thousandth part the heat of coal. The loss in storing and distributing, too, would be enormous. We mentioned last week the extraordinary facility with which hydrogen passes through cast-iron, which shows what would happen in gas-holders and pipes. We fear the day is very distant when hydrogen will be directly available for fuel, and can only recommend these processes to the attention of the Aeronautical Society.

Another new process which recommends itself by an appearance of simplicity is one for the manufacture of phosphorus. Silica, it would appear, has the power of displacing phosphoric acid from its combination with lime, and the acid is decomposed and phosphorus set free by contact with red-hot carbon. The inventor, therefore, mixes apatite with twice its weight of sand or ground flints and some charcoal, or animal charcoal with the silica, and heats to orange redness, when phosphorus distils over, and may be collected in the ordinary way. If this process answers, it is a decided improvement on the old mode of procuring phosphorus.

The various shades of red procurable from the aniline dyes are not yet, it seems, exhausted. We find another new one under the name of *Geranosine*. It is prepared by making first a solution of one kilogramme of any salt of rosaniline in 1,000 litres of boiling water; this solution is allowed to cool to 45deg. Centigrade. Another solution is made by first mixing 4½ kilogrammes of binoxide of barium with 35 litres of cold water, and then adding 10 kilogrammes of sulphuric acid. The two solutions are then mixed. The mixture instantly becomes of a lemon-yellow colour, and in a short time is nearly colourless. It is then filtered to separate the sulphate baryta. The filtered solution is afterwards gradually heated, and as the boiling point is reached it assumes a red colour, which arrives at its greatest intensity after two minutes' boiling, and is then ready for dyeing. The shade of colour produced is that known as *ponceau*, and in brilliancy it nearly equals the same shade produced from cochineal. The use of acid brightens it; ammonia discharges it. The composition of geranosine is not given, but it is evidently an oxidized product of rosaniline. When precipitated from its solution the new compound is soluble in alcohol, and partially so in acids.

ON CERTAIN POINTS IN THE MANUFACTURE OF MALLEABLE IRON, WITH SPECIAL REFERENCE TO THE RICHARDSON PROCESS.*

By MR. ST. JOHN VINCENT DAY, C.E.

SINCE the year 1784, when Cort introduced the process of puddling, there has not been any really great advance made in improving the general results obtainable from the conversion of crude or pig into malleable iron in the puddling furnace until very recently. By no means do I here intend to arrogate for Cort the raising of the puddling process to its present state of comparative efficiency, for no matter how very imperfect that process yet remains, still it is well known that the results produced by it were not generally to be depended upon until long after the inventor's unfortunate career terminated with his death—indeed, the first quarter of the present century had nearly passed away ere the puddlers' manipulations could be relied upon continuously, and it is highly probable that even then the uncertainties of production would not have been largely removed but for the careful attention of some of the North of England ironmasters who perceived a wide field opening up for a high class of manufactured material in the iron canal and river boats, and railways then coming into vogue; and, later still, in supplying that required for our great tubular and girder bridges and lines of Transoceanic steamships.

During the present century, however, innumerable attempts at improving the process have been made at home, on the Continent, and in America, still with no good effect generally; indeed, the value of what has been done, taken on a broad, practical, and, therefore, commercial basis, has been extremely small. It is, however, perfectly true that the failures which have been encountered have increased our stock of information as to the peculiarities, or rather specialities, of the compound we have been treating in the puddling furnace, and in this particular view recorded failures, when accompanied by a faithful declaration of what took place, are of the highest importance. As a very striking instance, I may allude to the most recent and gigantic failure that has, and, probably, ever will occur in a future time in the metallurgy of iron, I allude to the impossibility of making good commercial iron out of the ordinary ores of this country by the Bessemer process. Mr. Bessemer has himself on several occasions openly confessed that he could not succeed in making good malleable iron by his process purely on account of the impossibility of removing sulphur, but more particularly phosphorus, in the converter; his early experiments showed distinctly that whilst the highly oxidizing effect of the blast injected into the converter was most efficient in removing carbon and silicon and some of the lesser impurities, still the phosphorus and sulphur remained untouched, the immediate consequence of which has been that his process has never come into practice for making iron from the ordinary run of British ores—by far the larger portion of which contain notable quantities of these two elements, of which phosphorus is the greater enemy, its presence rendering the iron coal-short, whilst sulphur has the opposite effect of rendering it red-short.

I have before referred to Cort's process, and prior to directing attention to the more immediate subject of this paper it will be an advantage, in a casual way, to refresh our memories by considering what has been done successfully towards the improvement of puddling since his day up to the present time. Before doing so, however, I wish to remark that although the invention of puddling is usually ascribed to Cort, there exists very grave reasons for withdrawing from him the origination of it, as a reference to the specification of a patent granted to Thomas and George Cranage in 1766 will easily show.

The Messrs. Cranage were workmen employed at Colebrookdale, and it is recorded that puddling was practised there prior to Cort's invention, for when the latter applied to Mr. Reynolds, at that time the manager of the works, he replied in his Quaker tongue, "If thou wilt come with me to the works I will soon show thee the thing done." Cort went, and, at the command of Reynolds, Tom Cranage made a puddled ball in their presence It appears, however, that the process was not carried out on a large scale at Colebrookdale until after Cort had been there, so that it is probable some practical difficulty existed in what the Brothers Cranage had done. The fact would show that to Cort must unquestionably be attributed the high distinction of being the perfector rather than the inventor of the process called "puddling."

The process of puddling, too, was very completely set forth in the specification of Peter Onions in May, 1783, about a year prior to the date of Cort's patent; indeed, it appears extremely probable that ironmasters at that period, hearing of the partial success of the Cranage process, had begun to set themselves the task of perfecting it, hence the inventions of Onions and Cort so close one upon the other. The question of Cort's invention has, however, been so frequently discussed elsewhere, that I need not further allude to it here; the deplorable tale connected with it is so well known to us all that it need not be again enlarged upon.

The next great step of improvement that presented itself was that of Mr. Samuel Baldwyn Rogers, of Nante-y-Glo, who substituted the "iron bottom" for Cort's sand bottom. This, like every other really valuable discovery, was condemned by the Welsh ironmasters, and after it had been derided at by Mr. Hall, of the Rhymney Ironworks, Mr. Hill, of the Plymouth Ironworks, Mr. Homfray, of Tredegar, Mr. Crawshay, of Cyfarthfa, Mr. Forman, of Pendarron, and others, it was ultimately tried at Ebbw Vale by Mr. Richard Harford, who, on discovering its advantages about or shortly after the year 1818, adopted it, since which time others followed his course until wherever puddling is now practised the cast-iron bottoms are used. Rogers' fate as an inventor was as sad as his unfortunate predecessor Cort: both lived for years, and ultimately died, in absolute penury.

The "boiling process" was the next great stride; it is generally attributed to Mr. Joseph Hall, of the Bloomfield Ironworks. "Boiling" is produced by charging certain oxidized compounds of iron on the puddling hearth, from which, as soon as melted, some of the oxygen begins to separate, and, uniting with some of the carbon of the iron, forms carbonic oxide, the presence of which may always be detected by the well-known bubbling about of the metal, attended with endless escaping jets of

* Read before the Institution of Engineers in Scotland.

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blue flame. Until the charge is melted the solid oxide is covered with liquid cinder, composed in great part of protoxide of iron; this being combined with silica, constitutes a silicate of protoxide of iron, which, after melting, combines with additional silicon in the pig, and some of the iron of the charge forming the tribasic silicate of protoxide of iron ($3\,Fe\,O, Si\,O^3$), without the presence of which the process of puddling could not be carried on, this silicate possessing the peculiar property of not further oxidizing iron at the most exalted temperatures employed, and being easily separated from it, so that although the granules of iron in the puddling furnace after the boiling stage is over, and the temperature of the furnace is lowered, are lying scattered about in it, still, on being pressed together, they unite, the fluid silicate being easily squeezed out from between the surfaces of contact by means of the puddlers' balling rod; whilst that portion which still clings to the iron after the balling is over is what we see extracted from the mass under the shingling hammer and between the roughing rolls. Boiling, then, along with the use of roasted tap cinder, or "bull-dog," as it is generally termed, constitutes the last great step in the chemistry of the process since the time of Cort.

In the mechanical operations of puddling and in the construction of the furnace several attempts towards improvement have been and continue to be made. In the furnace itself the use of water-troughs through the bridge, and in some cases forming the sides of the puddling hearth, have come into practice, but their value in a sense of effecting ultimate economy, for several reasons, appears to me to be very questionable. Double furnaces, too, have been tried—that is to say, furnaces capable of containing a double charge of metal, and with a puddler working at both sides, but it is a striking fact that they are being given up, and the old-fashioned single furnace, still obtains. I am informed by some of the Scotch ironmasters, that the iron from the double furnace is never so good as from the single furnace, and the charge is generally longer in melting. The chief object intended by their introduction was a diminution in the fuel consumed per weight of iron manufactured; this to some extent is obtained, and probably herein consists the reason why the charge is longer in melting. Considerably less than twice the weight of fuel has to melt exactly twice the weight of iron, but the furnace is not twice as large, generally not more than 10in. or 11in., or less than a foot broader than a single furnace, the height and length being the same, so that the space occupied by the heat from the fuel in the double is nearly proportional to that of a single furnace, but as the charge of iron therein is proportionately very much greater than the fuel, it follows that a longer time of melting should obtain. At least, the question having been submitted to me for consideration, this is the only reasonable view I have been able to arrive at.

As to the quality of the iron produced in double puddling furnaces being frequently inferior and of indifferent nature, I cannot account for that in any other way than by looking at the cause as inherent in the difficulty of geting the two puddlers to work the two portions of the charge in concert with each other. It is almost certain that one will work his part of the charge more or less than the other, thus producing iron in the same furnace necessarily of dissimilar quality. However, the cause of inferiority of double puddling furnaces against single is a question by no means thoroughly investigated, and it forms a topic which I think this Institution might discuss with obviously great advantage. It is probable that when a perfect system of mechanical puddling is devised, that then, provided such is effected by the movement of rabbles, double furnaces may be generally adopted, as certainty of similar action of the two instruments may then be insured by their being placed under the control of properly arranged machinery.

Speaking of mechanical puddling, numerous expedients have been tried but with no practical success, generally, in Great Britian. At Dowlais, almost every hitherto conceivable means for doing away with the puddler has been resorted to, but with what result? I have no doubt that many of the members of this Institution will remember the singular paper read by Mr. Menelaus to the Institution of Mechanical Engineers who met at Paris during the past summer; a paper I say singular, because it was so very dissimilar to what papers read before such institutions usually are. We generally and naturally find ourselves and others recounting our and their successes, but here Mr. Menelaus, in the most laudable manner has placed on record everything that has been done at those gigantic works under his control—all of which has ended in failure, and he has not attempted to hide the failures either.

At Dowlais, too, Mr. Anthony Bessemer's revolving puddling furnace has been used, but it has failed, as well, I believe, the injection of steam by a tube or plast-pipe, according to Mr. Nasmyth's plan; also air and steam combined, after the process of Guenyveau, and, I am told, even the introduction of a blast of air alone through a blast-pipe, still all ended in absolute failure.

The most successful experiments in connection with mechanical puddling that have come under my notice were those conducted by MM. Dumeny and Lemut, at the Clos-Mortieur Forge, in the commune of St. Dizier (Haut Marne). I will not now take up your time in describing the various mechanical arrangements they have adopted, but merely state that I some time since received a report in which they assert the practical results of their apparatus are—1st. That the consumption of fuel is greatly reduced per ton of metal produced; 2nd. The work is accelerated and the production of the furnace increased, from which economy in the general and working expenses has resulted; 3rd. The obviating the necessity of workmen in stirring the cast-iron lowers the price of labour, whilst at the same time it enables the wages of the regular puddler to be augmented, although their labour is lightened; 4th. The waste is about the same as in the system of ordinary puddling, which is equivalent to saying (in others words) that the yield is the same as under the hand system; 5th. The improvement in the quality of the iron is undoubtedly the effect of the mechanical puddler.

Having now drawn a sketch of puddling from its earliest date down to the present time, I proceed to direct your attention to some remarkable facts connected with a new process, viz, "The Richardson Process," which I am sure will be of great interest, as it is of the gravest importance to nearly every member of this institution, being particularly interesting because the chief practice with it has taken place in the neighbourhood of Glasgow. Of this process and its results some facts have lately appeared in the engineering journals, and I am happy to be able to state that, in the views which I originally formed, my conclusions have since been fully borne out by the remarkably accordant results we have obtained at the Glasgow Ironworks, but more particularly at Parkhead Forge.

Generally, I have no doubt the members of this Institution are aware in what the "Richardson Process" consists. I will presently, in few words, explain its chief feature, but first wish to mention what has been previously attempted in a similar direction. Reuben Plant was among the first to introduce blasts of air and steam into the puddling furnace, and, provided he had continued his experiments to completeness, there is little doubt but that what is now known as the "Richardson Process" would have been an established mode of manufacture twenty years ago. As it is, to Mr. Richardson, who was associated with Plant at that time, the credit is due of having made the first recorded experiments of blowing air below the surface of fluid pig-iron; when he obtained that peculiar series of changes which we daily see produced in the Bessemer converter. Had Mr. Richardson continued the blowing of air long enough there is no doubt he would have succeeded in making worthless malleable iron, as Mr. Bessemer has done, through not being able to eliminate the sulphur and phosphorus. Other circumstances, as Mr. Richardson informs me, interfered, that a stop was put to the prosecution of the experiments, and thus it became reserved for Mr. Bessemer to follow up that same line of triumphant investigation by which he has immortalized his name—the process for making "Bessemer steel."

At Dowlais, in particular, as well as it Cwm-Avon Ironworks, in Glamorganshire, blasts of air were blown into the metal on the puddling hearth, but for a very different object to that which the "Richardson Process" seeks to effect. In all the experiments, as I am informed, that were made prior to Richardson's, the blowing was continued for a long time after the iron had been brought to the boil. Now, it is perfectly clear that in an ordinary furnace such continuous pouring in of oxygen would boil the metal to such an extent that it must run rapidly away with the slag from the stopper-hole, and being continued long after the desilicatization and decarburization of the charge were effected, would oxidize the iron to an enormous extent, thus diminishing the yield so much as to reduce the ironmasters' profits to a degree that could not be tolerated. But these are not all the defects of such a constant in-pouring of oxygen. The powerful attack upon the carbon and silicon, and after that the combination with the iron itself, must raise the temperature of the furnace to such an extent that the bricks usually employed in the construction of such furnaces would melt away, and the life or duration of the furnace would therefore be reduced to a comparatively brief existence; and I may here remark what is a singular fact that although persons originally engaged in such experiments did not discover a remedy for this evil, it is well known that for puddling furnaces common soft bricks are employed, the higher limit of temperature employed for puddling not requiring the use of the harder and more durable kinds which are used for furnaces wherein the temperature ranges higher. The same defect of the more rapid destruction of the roof has been met with in recent processes for making steel, but that has been entirely overcome by the use of harder bricks and a higher roof.

(To be continued.)

THE NATIONAL ARTILLERY ASSOCIATION.

THE council of the National Artillery Association has just drawn up its programme for the ensuing prize meeting at Shoeburyness for the "great gun" prizes, contributed by Her Majesty, the Prince of Wales, Lord Longford, the National Rifle Association, and the various artillery corps. The work of the meeting will this year be compressed into one week, and the camp at this noted school of artillery will be for the volunteers who visit it and take up their quarters there not only a camp for artillery practice, but one for general instruction in military duties and discipline. A new feature will this year be introduced by a movable target being arranged at the 1,000 yards' range, to be fired at with the Armstrong rifled ordnance; the target will be moved by aids at the disposal of the Royal Artillery, at the rate of seven miles an hour, and the competitors in the one competition will fire as many rounds as possible in a given time. In the general competitions the council hope to give as many prizes as will enable the batteries in camp to have three competitions a day. The prize meeting will open on August 3 At a meeting held a few days ago by the council when Colonel Harcourt, Lord Hardinge, Colonel Cox, Major Innes, Captain Darby, Captain Sankey, Captain Staddert, Captain Rutley, and Mr. A. Beattie were present, it was agreed that Lord Hardinge and Captain Welby Pugin should form a prize committee. The Association, by the support it has received from the most active volunteer artillery corps and from the National Rifle Association, has nearly overcome the great monetary difficulties thrown upon it by the heavy Government charges for camping material.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the closing business meeting for the present Session, held on Tuesday, the 19th inst., Mr. Charles Hutton Gregory, President, in the chair, nine candidates were balloted for and duly elected, including, as members, Mr. Thomas Login, F.R.S.E., executive engineer of the the first class in the P.W.D. of the Government of India; Mr. William Teasdel, resident engineer, Great Yarmouth Port and Haven; and Mr. Edward Williams, general manager, of the Mines, Collieries, and Iron Works of Messrs. Bolckow, Vaughan and Co., Middlesborough; and, as associates, Mr. Henry Samuel Ellis, Exeter; Mr. Charles Higgins, surveyor, Islington; Mr. William Hurst, Paddington; Mr. Samuel Joseph Mackie, Bayswater; Mr. John Palmer Smythies, assistant engineer, Furness and Midland Railway; and Mr. Arthur J. Whalley, Monte Video. It was also announced that Mr. Nicholas Charles Szorelmey had been admitted a student. The total number of elections during the session 1867-68 has been 150, viz., 45 members, and 105 associates. The register of the Institution now contains the names of 16 honorary members, 641 members, 914 associates, and 123 students, in all 1,694, as against 1,449 of the various classes, at the same date last year, including, at that time, 20 honorary members, 591 members, 834 associates, and 4 graduates. The class of students has been created during the sessions just concluded, to take the place of the old Graduate Class, which is now abolished.

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SCREW PRESSURE PIPE JOINTING MACHINE.

BY MR. H. T. HUMPHREYS.

FIG. 1.

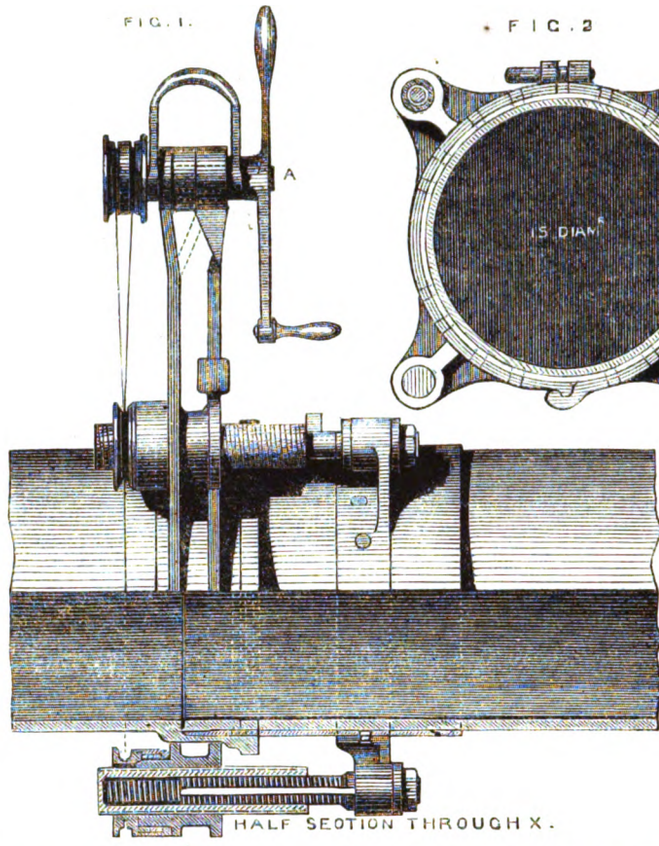


FIG. 2.

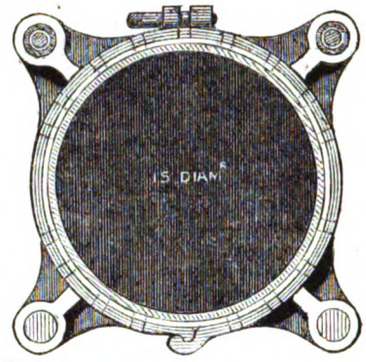
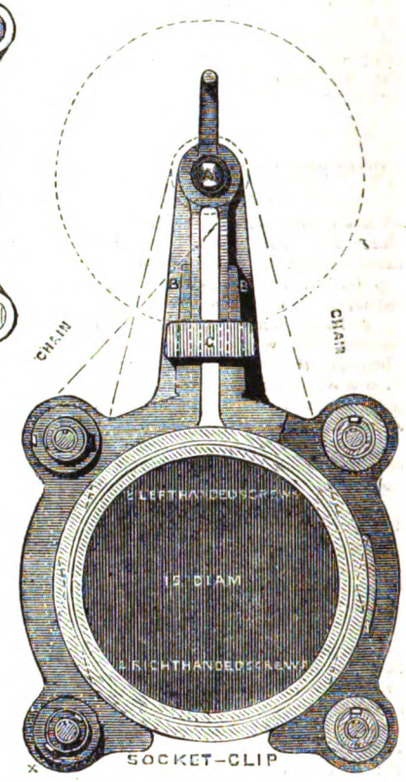


FIG. 3.



SCREW PRESSURE PIPE JOINTING MACHINE.

THE accompanying engraving shows a ready and simple means of jointing pipes with cold lead, pressed in by machinery, instead of with molten lead, "set-up" by hand. The machine has been invented by Mr. H. Temple Humphreys, Westminster. By using cold lead in the form of a rolled rod or wire, served round the joint after the fashion of a rope, and then pressed with a great pressure until it becomes ductile enough to fill every crack and cranny of the socket, a perfect joint will be made, and at the same time the following advantages over the old process obtained:—First, the possibility of jointing under, or partially under water, in a wet soil and trench, where the pumping often becomes a heavy item, before the molten lead can be run into the socket. Secondly, a saving of coals, and oxidation of lead, together with waste through spilling the same; the repeated removals of furnace, the cartage of coals, and the services of the furnace attendant, are also all rendered unnecessary. Thirdly, the manufacture of a better and more uniformly reliable joint, in a shorter time, by machine, than can be done by the same number of hands with setting-up hammers.

The process is as follows:—The joint to be made is clipped round the socket with a socket clip, which hinges at A, and clips by means of the wedge blades B B, and wedge block C, which is driven down the wedge blades by one blow of a hammer. A sufficient amount of rod lead wire, unrolled from a hank of wire off a drum upon a pair of wheels, is now coiled round the spigot, and pushed into the joint by hand as far as it will conveniently go. A ring of wrought iron plates, in segments of suitable sizes and thicknesses, corresponding to the varying thickness and shapes of the joint to be made, having been placed round the spigot, the spigot clip is then put on over this ring, and the four differential screws entered into their respective nuts on the socket clip, for which purpose they are each made a little shorter than the first entering screw in order to engage threads consecutively, and not all at once. By turning the handle, the light pitch chains and pulleys drive the two right and two left-handed differential screws uniformly alike, quite independently of each other, or of any movement of either half of the socket clip in opening and clipping round the socket, so that the machine is always ready for use, as soon as adjusted to the pipe to be jointed. The revolution of the screws forces the ring of wrought iron dies into the joint, with a very great pressure, proportionate to the sizes of the pitches of the screws; this squeezes the lead like so much clay into the closest contact with the surfaces of the pipes, and by simply repeating the above operation, after coiling more lead wire round the spigot, the requisite depth of lead is obtained, and a sound and rapidly made joint insured. The joint may either be yarned or not, as found most convenient, but in either case the yarn can be forced in by the machine, and, in order to increase the speed of the dies for this purpose, or for pressing the first strands of wire into place—both of which operations do not require the exertion of the whole power of the screws—keys are provided to insert between each differential pair, thus making them revolve together, and, consequently, to resemble a simple screw. Arrangements have been made, we believe, whereby these machines can be produced at a price sufficiently low as to render their use most economical upon any contract for laying gas or water mains over half a mile in length.

COMBINED ANVIL AND PRESS.

THE invention illustrated in the accompanying engraving consists in combining with an anvil for forging and other smithing purposes a power press, punch, and shears for convenience in cutting metals. It is the invention of Mr. J. E. Emerson, of New Jersey, and has just been patented in England. Fig. 1 is a longitudinal vertical section through the improved anvil, and fig. 2 is a perspective view of the combined anvil. A is the anvil; B is a horizontal shaft, having a pinion C keyed upon it, and having a square head on each end, which is received in a corresponding opening in the end of the lever D. The pinion C gears into the toothed segment E on the long end of the lever F, which has its fulcrum at G. At the short end H of the lever there is also a toothed segment, the teeth of which gear into those of the rack K, which moves vertically in guiding recesses, and carries at its lower end a punch L, which may be of any form, to act as a slotter or a gummer for saws, or for any punching or pressing purpose, or it may be used for a former. The die L' for the punch is in a block let into a groove in the bed of the anvil, and is dovetailed on one side, and secured by a key M driven between the other side of the groove and the block. The sides of the groove are made parallel, while the block is made wider at one end than at the other, and the key has a corresponding taper.

FIG. 1.

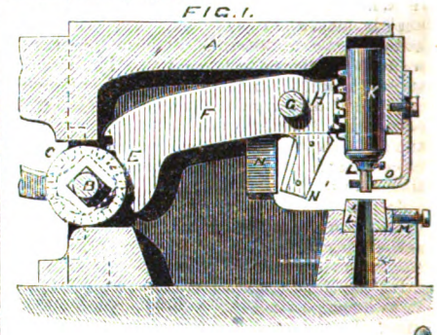
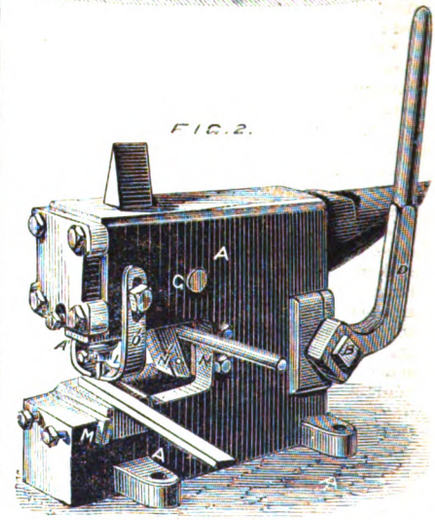


FIG. 2.



The metal, after being punched, is cleared from the punch by the device O which is common to punching machines, and consists of a fork having its prongs horizontal, and one on each side of the punch a short distance above the die, and secured by a set

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screw to the end of the anvil. One of the blades N of the shears N N¹ is secured to one side of the recess which contains the lever F in the body of the anvil, and the other blade N¹ is secured to a projection from the short end of the lever F, so that its edge shall form an angle with that of N in the manner common to shears for cutting metal. When the lever D is vibrated the pinion C on the shaft B causes the lever F to vibrate and give motion to the punch with great power by means of the segment H and rack K. The same movement of the lever D also causes the shears to perform their work through the medium of the pinion and segment E in the lever F. The workman at the anvil thus has no occasion to lose time and heat in seeking to have these offices performed, oftentimes at some distance from the forge.

ON THE CONSTRUCTION OF STEAM BOILERS.

IN noticing lately the report of Mr. Henry Hiller, the chief engineer to the National Boiler Insurance Company, we expressed our intention to notice further Mr. Hiller's remarks on the construction of boilers, and we now redeem our promise. A large number of the boilers proposed for insurance are so weak in construction, or otherwise so defective, that some general remarks, based on extensive experience of the construction and working of all kinds of steam boilers, will doubtless be found useful to many owners and makers. Of the numerous varieties, none are more generally used than the Lancashire, or cylindrical two-flued, and the Cornish one-flued boilers, and where these are well constructed, properly fitted up, and carefully attended, their performance is generally satisfactory. There are various modifications of these forms, some of which are valuable. In designing such boilers, excessive length as compared with the diameter should be avoided. Long boilers strain considerably, and frequently give great trouble by leakage at the riveted seams. A fair proportion is when the length is about three and a-half times the diameter. The staying of the end plates, and the attachment of the flue tubes to the ends, should be so arranged that the tube may expand freely, unless there be some special arrangement in the form of the flue tubes to attain the same object.

Many boilers, otherwise well made, have given considerable trouble by leakage and fracture, owing to the severe strains of unequal expansion: to which their rigid construction exposed them. In some of the boilers inspected, the ends were so heavily stayed, and so rigid, that considerable leakage, and occasionally fracture at the ring seams of the lower part resulted. In others, the staying was so slight, that the ends were bulged outwards, and serious risk of explosion thus occurred. Flue tubes should never be stayed to the shell, but be attached at the ends only. Many boilers have given serious trouble through being thus stayed. The shell should be made quite circular, and the longitudinal seams, which should break joint, be so arranged that, when the boiler is set, all those below the water line may be accessible for examination in the flues, and be clear of the brick seatings. Many makers now double-rivet these seams, thus materially increasing their strength, and when the work is well performed, reducing liability to leakage.

Flue tubes are now constructed in various ways, some makers preferring to use thick plates not strengthened in any way, whilst others prefer comparatively thin plates; but by flanging them at the ring seams, or by welding each ring of plates, and connecting them by solid T-iron hoops, form a much stronger and more reliable flue tube. The liability to leakage, fracture, and excessive expansion, is thus much reduced; as the heat is more freely transmitted through the thin plates. The cross tubes and water pockets introduced by some makers in that part of the flue tubes beyond the furnace bridge, are of great value, chiefly from the manner in which they improve the efficiency of the heating surface by the diversion and breaking-up of the current of the gases; whilst they much increase the strength of the tubes to resist collapse. All large tubes exposed to high pressure should be strengthened by some of the means described. Where the tubes are formed with the ordinary lap-joints, the longitudinal seams should break joint, as a tube thus made is much stronger than where those seams are in line, and at the furnace end all longitudinal seams should be below the fire-grate level.

The plan of forming tubes with the plates laid longitudinally in narrow strips is very objectionable, as the tube cannot be made so circular, and the seams above the bars are injured by the action of the fire; whilst such tubes are much weaker than those made in the ordinary manner. Multitubular boilers should, as far as practicable, be so constructed that every part of the interior may be accessible for cleaning and examination; and it would be a great improvement if those of portable and locomotive engines were so constructed that the tubes could be drawn without difficulty, so as to allow occasional inspection of the internal surface of the plates. External flues are necessary to stationary cylindrical boilers of this class; otherwise the lower seams are strained, and become leaky through excessive unequal expansion of the boiler. Plain cylindrical externally-fired boilers, with egg or saucer-shaped ends, are preferred by some owners, chiefly on account of their simple form. Such boilers can never work so safely as a properly constructed internally-fired boiler, as they are so liable to fracture at the seams over the furnace, through the excessive alternate expansion and contraction to which they are exposed. The application of stout longitudinal stays would add materially to the safety of such boilers.

A large number of cylindrical vertical boilers are used in various ironworks. These boilers are generally heated from the puddling or similar furnaces, the heat first entering the external flues, and passing thence by an internal descending flue-tube to the chimney. They are especially liable to starting and fracture of the riveted seams opposite the furnace necks, owing to the intense heat at that point; and where the feed water deposits much sediment the solid plate is sometimes fractured. To avoid this liability, the part referred to should be protected by a screen of brickwork, or the boiler set at a higher level, that brickwork may may be so arranged as to spread the heat before it reaches the boiler. The bottoms of these boilers are frequently quite inaccessible for examination, and serious corrosion may go on unknown to those in charge. If the boilers were supported by brackets at the sides, or by wrought-iron plate standards riveted to the bottom, so that a thin wall of brickwork would suffice to form the flues, the condition of the plates could be occasionally ascertained without much difficulty.

As the safety of boilers depends so much on the sufficiency and condition of their fittings, a few remarks thereon will be useful. It is well to have two safety valves to each boiler as a check upon each other; one of them should be a deadweight valve, loaded externally, and the other a lever weight valve, or a compound valve, which would allow the steam to escape if the water were allowed to fall below the proper level. Safety valves are frequently met with the levers of which are of such length, that the usual working pressure for which the boiler was made, would be much exceeded if the weight were fixed at the end of the lever. The weight should always be calculated and adjusted to hang at the end of the lever.

All boilers should be provided with correct pressure gauges, for the guidance of the attendants. The glass gauge is undoubtedly the best and most reliable water gauge, and it is a good plan to attach two gauges to each boiler. Where floats are used, there should be two, one of them fitted with an alarm whistle. Boilers with internal tubes should always be fitted with glass gauges. Fusible plugs should be attached to the furnace crowns of all internally-fired boilers. The feed regulating valve, which may be constructed to act also as a back pressure valve, should always be placed at the front end of the boiler, within the reach of the attendant, and where boilers work in connection, each should have a back pressue valve attached. The feed water should be delivered (a few inches below the surface of the water in the boiler, and above the level of the tube crowns) in a horizontal direction, or by means of a horizontal perforated pipe. Where the feed is delivered near or at the bottom of the boiler, it cools and contracts the lower plates, whilst those of the upper part are heated and expanded by the steam, frequently (especially in boilers rigidly stayed) causing fracture at the ring seams at the lower part of the shell. It is always preferable to heat the feed water before it is forced into the boiler.

The blow-out tap at the bottom of the boiler should be so placed that it may be examined at any time, and so that any leakage thereat would be at once noted. Valves should never be used, double-gland taps made altogether of brass are far preferable. Stout seatings with planed joint faces suitable for each fitting should be riveted to the boiler. All manholes should be strengthened by a faced mouthpiece, riveted to the boiler, so that the joint may easily be well made, and leakage with corrosion be avoided. Steam domes are unnecessary on stationary boilers; a perforated pipe placed in the upper part of the steam space is quite as efficient to prevent priming, and the boiler is not weakened. Where domes are preferred, they should never be of large diameter, and the shell plates inside them should not be all cut away.

The setting of stationary boilers is too often entrusted to men quite ignorant of what is necessary for their safe and efficient working, and Mr. Hiller has frequently had to point out serious errors in plans prepared by engineers and others, whose mistakes probably arose from a want of practical experience of the working of boilers. When boilers are about to be set, special care should be taken to thoroughly drain the ground, that no dampness may exist in the flues to cause corrosion of the plates. All the flues should be quite large enough to allow a man to pass through, so that every part may be accessible for examination. Midfeather seatings are very objectionable, and no boiler should be so set except those of very small diameter, and in such cases, thick but narrow iron plates should be placed on the top of the brickwork to protect the boiler. Cylindrical boilers, internally fired, should be set on side walls, the boiler resting on fireclay blocks made for the purpose, and so shaped that when built in place the bottom of the side flues may be much lower than the point where the boiler rests on the blocks. If the blocks be properly fitted to the plates, that the bearing thereon may be equalized, the total breadth of both side walls where in contact with the plates, need not exceed one inch for each foot of diameter of the boiler. The top of the side flues should be level with the crown of the flue tubes.

All boilers should be roofed over to protect them from external moisture, otherwise the sides in contact with the flue brickwork will be weakened by corrosion. Where flues are properly arranged as described, no serious corrosion could exist in the seatings, which could not be detected on a careful examination by a trained inspector. The laws for the prevention of smoke are now being enforced in many districts, but boiler owners should be cautioned against too readily adopting any form of apparatus which may be pressed upon their notice, as many are unnecessarily complicated and expensive.

It frequently happens that good boilers are injured and serious risk is incurred through neglect and carelessness. Where the feed water contains much sediment, and no cleaning apparatus is in use, frequent internal cleaning is indispensable, or the plates may become overheated and injured whilst the efficiency of the boiler is reduced. The external flues are in many cases allowed to become almost choked before being cleaned, and the boiler plates so thickly coated with soot, that a wasteful consumption of fuel is the result. Some firms, on the other hand, clean their boilers thoroughly about once a month, and are thereby considerable gainers, as the efficiency of the heating surface is retained, whilst any defects are at once discovered and made good, which if neglected might entail expensive repairs, or even lead to serious disaster. When boilers are being re-started after stoppage, they should be heated very gradually so as to avoid as much as practicable the severe strains of unequal expansion, and when at work the feed supply and the firing should be as steady and regular as possible. Frequent and extreme alternations of pressure, especially with high pressure boilers, or irregularity of any kind is most objectionable and sometimes really dangerous.

Steam users are strongly cautioned against the purchase of second-hand boilers. Many instances have come under notice where such boilers have required very extensive alterations and repairs, costing nearly as much as new ones, to which they were, after all, much inferior. Where it is proposed to purchase old boilers, a thorough inspection should be made by some person of special experience in such matters, whose report would be a reliable guide to the purchaser. In constructing new boilers the very best materials and workmanship should be employed. Low priced boilers made with inferior material and workmanship are unreliable, and as a defective boiler must be a source of annoyance or danger, and the consequences of explosion are frequently so terrible, it is evident that in no case is special care more necessary than in the construction and fitting up of boilers.

A REMARKABLY steady proportion is maintained in England and Wales between the number of males and females born each year. That proportion, with hardly any variation in a long period of years, is 104 males to 100 females.

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MULES FOR SPINNING AND DOUBLING.

BY MR. B. DOBSON AND MR. HALLIWELL.

(For description see page 394).

FIG. 1.

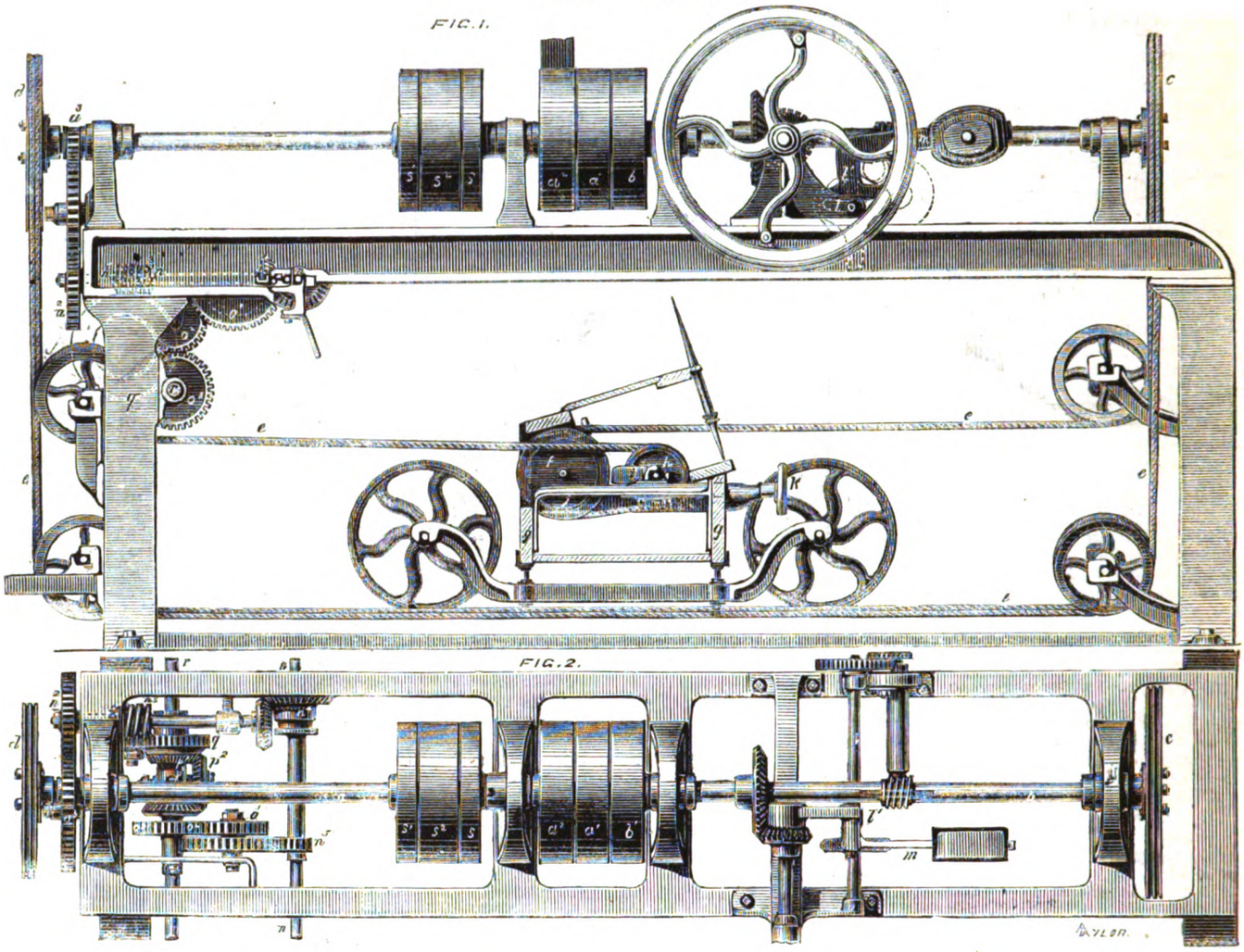


FIG. 2.

EXCAVATING APPARATUS AT THE CLYDE BRIDGE WORKS.

BY MR. JOHN MILROY.

FIG. 1.

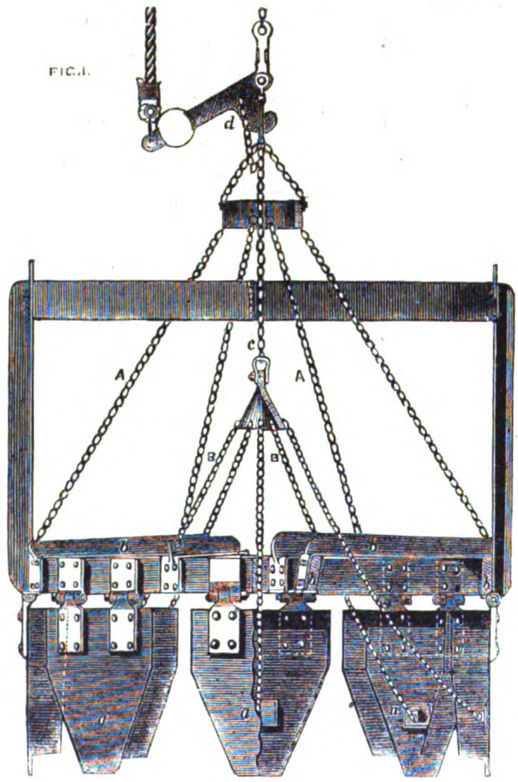
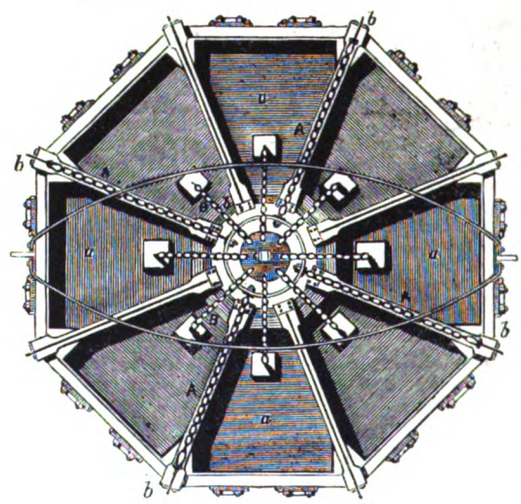


FIG. 2. PLAN.



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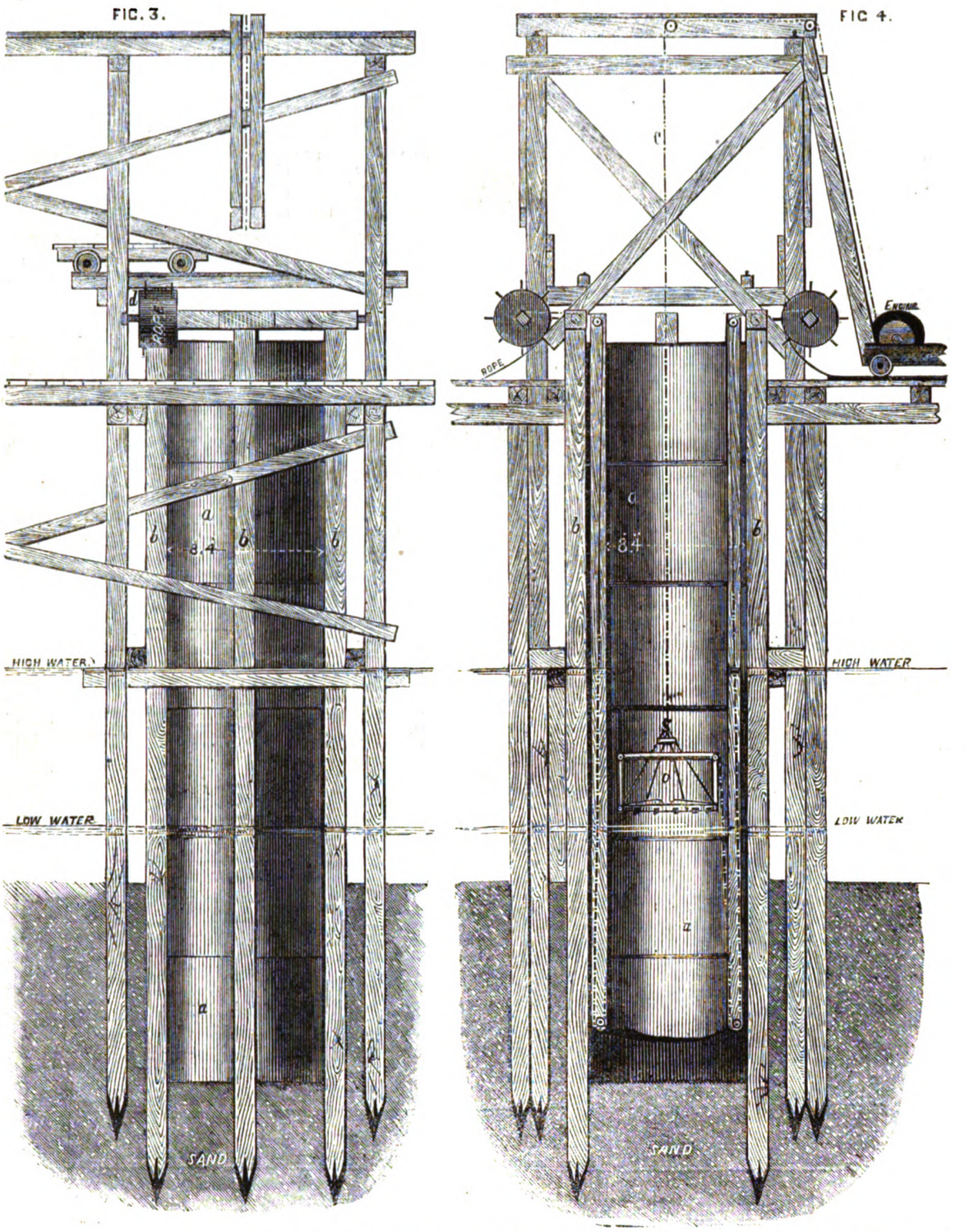
EXCAVATING APPARATUS AT THE CLYDE BRIDGE WORKS.



MILROY'S EXCAVATOR.

A RAILWAY bridge of some magnitude is now in course of erection at Glasgow, for carrying the City of Glasgow Union Railways over the River Clyde. The bridge, which is on the wrought-iron lattice girder principle, will consist of five water spans, each 75ft. in the clear, and two land spans of 65ft. each. The girders will be 8ft. deep, and the bridge will be laid with a double line of way. The girders will rest upon granite columns, and the abutments will be of masonry. The superstructure will be carried on cast-iron cylinders 8ft. 4in. in diameter, some of which have already been sunk to a depth of 85ft. through the sand down to the solid rock which forms the bed of the river. When down to the necessary depth, the cylinders are filled in with concrete to about the ground level; the water is then pumped out and brickwork is built up to high-water level, at which point the granite columns commence. The process of sinking the cylinders has been shortened and the operation greatly facilitated by the adoption of an excavating apparatus, the invention of Mr. John Milroy. This apparatus is shown in the accompanying engraving, in which fig. 1 represents a side elevation, partly in vertical section, of the principal part of the machine, which is termed the excavator; fig. 2 being a plan view. A series of spades or digging and lifting blades *a* are hinged to an octagonal iron framework *b*, into which they exactly fit when closed. The spades are hinged to the outer side or rim of the frame, and are formed with sides projecting inwards, which enable them to take better hold of the earth. When the apparatus is being lowered over the spot to be excavated, the spades are open, and hang in the position shown in fig. 1. With the spades hanging thus, the apparatus is lowered as far as it will go, and the spades having entered the soil are drawn inwards through the ground each into its own opening in the frame, bringing the earth with it. The frame and spades thus brought together form a close vessel, and in this condition the apparatus is drawn to the surface full of the soil. To prevent leakage and to make good joints, strips of india-rubber are attached to the under side of the inner octagonal portion of the framework, and the T-iron arms connecting the inner and outer framing. Against this india-rubber the edges of the spades press, and, when working in soft soils, leakage is thus prevented.

We now come to the working of this apparatus as carried out on the Clyde Bridge works, to illustrate which we have shown at fig. 3 in the engraving a side elevation of one of the cylinders now being sunk, and the necessary timber structure, and at fig. 4, a vertical section through the centre of fig. 3. The cylinders *a a* are 8ft. 4in. in diameter, cast in 6ft. lengths, and are kept in position by four guide piles *b b*. The outer piles are for carrying the platform, gantry, &c., in the usual manner. The main chain *c* is worked by

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an engine placed as indicated in fig. 4, which is employed to raise or lower the apparatus. The excavator is attached to this main chain by two sets of chains A and B (fig. 1). The chains of set A, all of equal length, are each fixed to the outer frame of the excavator, and after uniting upon a ring are joined to the main chain a short distance above its junction with the other set of chains B by a length of single chain *d*. When the apparatus is descending, this length of chain is looped up by the monkey hook. There are eight chains to set B, all of equal length, and attached at their upper ends to the main chain in the way we have shown. These last chains are for the purpose of pulling in the spades up to the frame with the soil which they drag with them, and for raising the apparatus bodily to the staging above. When lowering the excavator, the connecting chain *d* of the outer set of chains A is looped up by means of the monkey hook, the chains of set B being thereby rendered quite slack—until the excavator reaches the bottom. The monkey hook is then thrown out of gear by means of the rope shown at *e*, which slackens the outer set of chains, and upon the hoisting being commenced, the inner set of chains is brought into tension, the spades drawn in, and the whole machine raised to the surface.

In order to ensure the excavator being both kept and forced down at the moment when the spades are being drawn into their places in the frame, a very effective arrangement, shown in fig. 4, is adopted. Two holding-down chains are fixed to opposite sides of the spade frame, and which pass under pulleys held down near the bottom of the excavation, and thence up to winding axles placed on the staging above. These winding axles are formed with enlarged drums, and also with handles for turning them by, and the holding-down chains are hauled up quickly by drawing ropes off the drums, on which they are re-wound by the operation of drawing up the excavator. The bottom pulleys for the holding-down chains are carried by timber spars or leaders, placed vertically, and which are held inside the cylinders. They are kept apart at their lower ends by a stout iron hoop, to the opposite sides of which the leaders are fixed, whilst their upper ends are made fast to the cylinder itself. As the excavation proceeds these leaders move downwards with the cylinders, being lengthened from above. The holding-down chains are hauled tight as the excavator descends, and when it has reached the ground surface, sufficient strain is put on them to force the spades into the earth, to keep the frame from rising whilst they are being drawn inwards, and to ensure their taking hold of the ground. As soon as the workmen feel that the spades are drawn close in, the holding-down chains are released and the excavator is raised up to be emptied. This is effected by running a lorry under the excavator and on which it rests; the outer set of chains A are then hooked up, and the excavator being raised a little, the spades fall open, and the soil is discharged into the lorry. Mr. Milroy's apparatus has been found to effect considerable economy in the Clyde Bridge works, from the simple and expeditious manner in which it performs its duties. Mr. J. F. Blair, the engineer of the works, has expressed to us his high appreciation of this excavator, and his thorough satisfaction with the results of its working.

MULES FOR SPINNING AND DOUBLING.

MR. B. DOBSON, of the firm of Messrs. Dobson and Barlow, of Bolton, and Mr. R. Halliwell, have just patented some improvements in spinning mules, which we make the subject of the accompanying illustration. The invention refers to mules when two speeds are required, and consists in making the horizontal rim pulley shaft in two parts, extending nearly the whole length of the headstock. The rim band pulley for the slow speed is on the end of one shaft, and that for the quick speed on the other shaft. The driving pulleys are placed at the junction of the above shafts, one pulley fixed to each shaft, and a loose pulley placed between the above pulleys. An endless band passes from one rim band pulley to the other over suitable guide pulleys to the pulleys inside of the mule carriage for the purpose of driving the spindles at the required speeds, and the band is tightened by making the guide pulley inside the carriage adjustable, this latter pulley being supported in a frame actuated by a screw. By this arrangement the speeds can be easily varied to suit the counts required by changing the rim band pulleys. The other portions of the mule are arranged to suit the above object, the twist or cam shaft being placed at right angles to the headstock, and the balance lever actuated by a tappet on the twist or cam shaft. The drawing rollers are driven by gearing from the horizontal rim pulley shaft at the back of the headstock. The carriage is drawn out by the differential motion which is driven from the shaft by which the drawing rollers are driven.

In our engraving (page 394), fig. 1 is an elevation, and fig. 2 a plan of the principal parts of a hand-mule constructed according to these improvements. *a* and *b* are the two parts of the horizontal or rim pulley shaft extending nearly the whole length of the headstock, the shafts *a* and *b* are supported in bearings, and their ends nearly touch each other in a line with the rims of the loose pulley a^1, and the quick speed pulley b^1. The pulley a^1 is loose on the shaft *a*, and the pulley b^1 is keyed on the shaft *b*; to the shaft *a* is keyed the slow speed pulley a^2. To the other extremity of the shaft *a* is fixed the slow speed rim band pulley *d*, and to the other end of the shaft *b* is fixed the quick speed rim band pulley *c*; both the rim pulleys *c* and *d* are capable of being taken off, and others of a different diameter put on in their stead; the endless band *e* passes from one rim band pulley to the other over suitable guide pulleys, and around the pulley *f* on the axle of the tin roller in the carriage *g*, as in mules of the ordinary construction. This endless band is tightened by means of the pulley *h*, which is mounted in an adjustable bracket *i* fitting on the frame J in the carriage, and the position of the bracket *i* is regulated by a screw and hand-wheel *k*, the screw passing through a nut fixed to the bracket *i*.

The other portions of the mule are constructed in the usual manner, but they are arranged to suit the peculiar disposition of the rim band pulley shafts, the twist or cam shaft *l* is placed at right angles to the headstock, the balance lever *m* is actuated by the tappet l^1 fixed on the shaft *l*; this tappet acts on a projection from the balance lever *m*, and lifts it up so as to relieve the rod to which the strap fork is fixed of the weight of the lever *m*; consequently, when the rod is unlatched in the ordinary manner, the strap which is now supposed to be on the pulley a^2 is moved from the pulley a^2 to the pulley b^1. As the twist shaft *l* continues to rotate, the tappet l^1 leaves the projection on the lever *m*, which is thus set at liberty, to act on the strap fork rod, and when the second tappet on the shaft *l* unlatches this rod, the weighted lever *m* moves the rod back, and brings the strap from the pulley b^1 to the loose pulley a_1, when the carriage has run into the roller beam, the strap rod is again unlatched in the usual manner, and the balance lever *m* changes the strap from the loose pulley a^1 to the fast pulley a^2.

The drawing rollers *n* are driven from the shaft *a* by the pinion a^3 gearing into a carrier wheel which drives the wheel n^2 fixed on the shaft n^1, at the other end of which is a bevel wheel gearing into another wheel on the usual coupling shaft of the front drawing roller *n*. The carriage is drawn out by the pinion n^3 on the coupling shaft of the front drawing roller *n* gearing into the carrier wheel *o* to which is fixed the change wheel o^1 gearing into another carrier o_2, driving the wheel o^3 fixed to the wheel *p* forming part of the differential motion. When the clutch box n^4 is disconnected, the train of wheels above described is at rest, and the carriage is taken out at a slow speed by means of the worm n^5 on the shaft n^1 gearing into a worm-wheel, on the boss of which is attached a change wheel gearing into the wheel *q* fixed to the bevel wheel p^2 forming the other side of the differential motion, the carrier bevel wheel p^2 then turns on its stud fixed to the socket p^3 fast on the usual drawing-out shaft *r*. The pulleys *s* s^1 and s^2, on the shaft *a*, are used for the purpose of assisting in backing off and winding on in the usual manner.

EXPORTS OF RAILWAY IRON.

THE year has opened well as regards the shipment of railway iron made to foreign countries and the colonies. The navigations to the north of Europe being closed, the returns of the exports made to Russia and Sweden are all but a blank for the first two months of this year, but very considerable deliveries were made to February 29, to the United States—viz., 32,942 tons, as compared with 20,321 tons in the corresponding period of 1867, and 6,995 tons in the corresponding period of 1866. British India also took 15,732 tons of our railway iron to February 29 this year, as compared with 11,494 tons to the corresponding date of 1867, and 10,395 tons to the corresponding date of 1866. The total exports of railway iron from the United Kingdom to February 29 this year were 74,853 tons, against 46,326 tons in 1867, and 53,358 tons in 1866 (corresponding periods). When the navigations of the north of Europe are reopened, Russian deliveries will no doubt largely swell this year's figures. It may be added that the value of the railway iron exported to February 29 this year was £585,817, as compared with £394,197 in the corresponding period of 1867, and £425,480 in the corresponding period of 1866.

THE DARDANELLES CANNON.

ONE of the giant cannons of the Dardanelles has, we understand, with a quantity of its shot, lately arrived at Woolwich Arsenal. This curiosity in the way of ordnance has been presented to our Government by that of Turkey, and will be placed in the museum of artillery in the repository grounds at Woolwich. The gun is of bronze, and in two parts; the hind part, or powder chamber, screwing into the fore part, or shot chamber. The screw in the hind piece is a curiosity in itself. It is 14in. long, and has five threads about 3in. wide and deep; the diameter of the screw is 24in. The hind piece itself very much resembles in form a windlass or capstan, having hand or lever holes all round at both ends for the purpose of screwing it to the front piece. The gun is without any trunnions, being intended to be laid on sleepers on the ground, as other similar guns are now placed in the batteries on the Dardanelles. It is evidently of great age, and similar to that described by Gibbon in his "Decline and Fall," as employed by Mahomet II. at the siege of Adrianople in 1453. The powder chamber in the breech part is 6½ft. long and 10in. in diameter. The bore, or shot chamber, is 25in. in diameter. The shot for this monster are round and of white granite; they weigh 650lb. each. The following are about the weight and dimensions of this interesting piece of artillery:—Breech part, 9 tons 18cwt.; length, 7ft.; front part, 8 tons 17cwt.; length, 10ft.

AMERICAN LOCOMOTIVES.

THE following annual statement of the performance of locomotives on the Illinois Central Railway for the year ending December 31, 1867, has just been issued in America by Mr. S. B. Hayes, the master of machinery on that line:—

1867.	Chicago branch.	South division.	North division.	Total.
Miles of Road	252·5	230·75	225	708·25
MILES RUN.				
By passenger trains	403,532	303,496	289,779	996,807
By freight trains	1,005,469	585,538	893,070	2,294,077
By other trains	251,007	149,372	85,313	484,332
Total miles run	1,660,008	1,038,406	1,066,802	3,765,216
RUNNING EXPENSES.				
Pounds of waste used	23,504	15,601	17,738	56,813
Gallons of oil used	13,139	9,906	8,333	31,379
Cords of wood used	20,891	1,516	1,096	4,701
Tons of coal used	48,714	28,026	29,042	105,782
Cost of wages	103,538	68,426	61,288	233,253
Cost of repairs	227,538	149,538	166,930	544,007
Cost of stores	...	...	...	...
Cost of fuel	123,160	73,187	72,318	268,665
Cost of cleaning engines ...	21,290	13,555	8,713	43,559
Total cost	486,074	312,692	316,735	1,116,102
COST PER MILE RUN.				
For oil, waste, and tallow, cts.	·67	·78	·72	·71
For repairs, cts.	13·70	14·43	15·63	14·45
For fuel, cts.	7·41	7·04	6·77	7·13
For wages, cts	6·23	6·55	5·74	6·18
For cleaning, cts.	1·28	1·30	...	1·15
Total, cts.	29·3	30·11	29·69	29·64
AVERAGE MILES RUN.				
To one cord of wood	...	...	...	...
To one ton of coal	33·24	36·23	36·75	34·98
To one pint of oil	14·84	13·10	15·09	14·76
Average number of cars p. train	14·07	13·84	10·65	12·35

The above oil includes that used in head-lights and in lamps of engineers; wood is rated a 7·00 dols. per cord, and coal at 2.50 dols. per ton, loaded on tenders; oil, 55 cents per gallon; waste, 15 cents per pound. Re-building, superintending, teaming, and all other expenditure relating to repairs, are included in the above cost of the performance of locomotives. Two empty cars are rated as one loaded. Whole number of engines owned by the company, 167. Average cost per mile, in cents, for—

Passenger engines	23.20
Freight „	32.28
Construction „	27.05
Switching „	21.18

AT the last fortnightly meeting of the Royal Horticultural Society, held at South Kensington, there were shown some new fancy pelargoniums from Mr. Turner, a collection of pyrethra from Mr. Salter, and a most interesting orchid Arachnanthe muscifera from Mr. Williams. A pelargonium was sent by the Rev. A. Rawson, on which Orobanche cærulea was parasitic. Another species of orobanche has been observed on pelargoniums by Mr. Halles. Mr. J. Russell Reeves, F.R.S., presided, and the following candidates were elected fellows of the society:—Mrs. F. Barrow, Mrs. J. L. Bell, Sidney Biddell, M.A., Mrs. Burne, Colonel Arthur Herbert, Dowager Countess of Lanesborough, Charles Meeking, jun., Miss E. A. Neal, M. le Chevalier de Rosaz (Advocate of the Court of Paris), Miss Williams, &c.

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AMERICAN COAL.

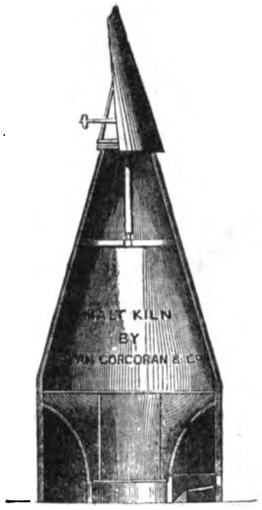
IT appears, from official American statistics, that the quantity of coal imported into the United States in the first four months of last year was 39,931 tons; in the second four months, 283,420 tons; and in the third four months, 145,371 tons, making a total import for 1867 of 468,722 tons. The value was returned at 1,334,261 dollars, or about £330,000. The quantity of English coal sent to the United States last year was 123,392 tons (as compared with 134,113 tons in 1866, and 197,401 tons in 1865). English coal thus figured in the foreign coal supplies of the United States to the extent of little more than one-fourth last year, the amount derived from other quarters besides England having been 345,330 tons. It is worthy of note that, although the population of the United States is now approaching that of France, the Americans import far less coal than the French. Thus, while 468,722 tons of coal were imported into the United States in 1867, the corresponding imports into France in the same year were 6,562,369 tons, although the French have made tolerably successful efforts during the last ten or fifteen years to utilize the coal wealth which they undoubtedly possess. After all, however, the coal resources of France are probably small as compared with those of the United States.

PRODUCING A VITRIFIED SURFACE ON CAST METAL.

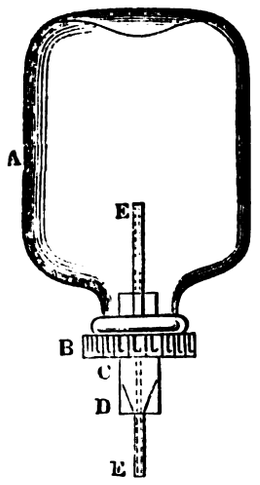
AN invention has recently been patented by Mr. E. T. Horsley, of Alfreston, and Mr. C. Horsley, of the Wharf-road, City-road, and which has for its object improvements in the production of a glazed or vitrified surface on cast metal. In producing castings of iron or other metal they coat the mould and core with powdered glass, furnace cinder, or enamel, or other material capable of being vitrified by the heat of the melted metal when it is poured into the mould, so as to form a glaze or enamel on the surface of the casting. The operation is as follows:—Prepare a mould in the usual manner either of common sand or red loam sand, and either with or without cores, as the case may require. When the mould is finished, paint it over with a paint-like composition prepared by grinding together gas tar and common blacklead in the proportion of about 2lb. of blacklead to a gallon of tar. Immediately dust over it finely ground window glass, or green bottle glass, or slag from a blast furnace may be used, as may also other vitreous materials or enamel compositions, such as are used for enamelling articles of wrought and cast iron, but when casting iron ground glass is preferred. Any excess of the powder is dusted or blown off, and the mould is allowed to dry, or is dried by artificial heat until the composition on its surface is set and hard, so that it will not rub off. The metal is then run into the mould in the usual way, the heat fuses the vitreous material with which the mould is lined, and causes it to form a glaze on the surface of the casting. The paint-like composition by which the powder was made to adhere to the mould also serves as a separation when the fusion takes place, and so a smooth face is ensured. This process is more especially applicable when casting iron, but it may also be applied advantageously in some cases when casting brass and copper, the vitreous material employed being such as fuses readily with the heat of the melted metal.

CIRCULAR MALT KILN.

OUR attention has recently been drawn to some improvements in the construction of malt kilns, which have been made by Messrs. Bryan, Corcoran, and Co., of 48, Mark-lane, and the New Sun Wharf, Ratcliff-cross, and about which we propose to say a few words. These kilns are circular in form, both in the lower portion and the dome, as will be seen by the accompanying engraving. This form conduces to the equal passage of the heated air through the floor, which is further promoted by the arrangement of the fire and the arches which enclose the kiln pit. Messrs. Corcoran have made malt kilns their speciality, and have arrived at great perfection in their construction, which is based on sound principles. Their kilns, capable of drying twenty-five quarters at a time, are 25ft. in diameter over the floor, and they have a 6ft. opening at the top of the dome. The kiln pit is 12ft. 6in. in diameter, and the floor is 12ft. 6in. above the grate level. The dome is 38ft., and the cowl 19ft. high. The floors in Messrs. Corcoran's kilns are of wove wire, and are strained through the walls by means of bolts and nuts screwed upon the outside. The wire plates are supported on round bars which are carried on wrought-iron beams, which are in their turn partly supported by wrought-iron girders, and are partly set into the walls. This arrangement makes an excellent floor, the round bars leaving nearly the whole surface of the floor exposed to the heated air, and available for work. We have referred to a kiln 25ft. in diameter, but this is not the longest made, Messrs. Corcoran having constructed one at Messrs. Day's brewery, at St. Neots, 30ft. in diameter.



Whilst looking round Messrs. Corcoran's premises in Mark-lane, where they have carried on business for nearly a century, we were struck with a very simple and efficient oiler for machinery. This is known as the needle lubricator, invented by M. Lieuvain, and is shown in the annexed sketch This apparatus is composed of a strong



globe of glass A, having a neck fitted with a stopper of wood B, through which is a conical metal tube C, forming the only exit for the oil. In order to regulate the supply of oil, a metal rod or needle E passes through the tube. The apparatus is filled with oil and turned neck downwards, and the lower end of the stopper is fitted over the bearing of the shaft. The needle E alone descends, and comes into contact with the parts requiring to be lubricated, the least movement of which produces an oscillation or vibration of the needle, which disengages a small portion of oil and causes it to descend from the globe, the quantity being in proportion to the speed. When the machinery stops, or is not in motion, no oscillation of the needle takes place, and the pressure of air at the base of the tube, also the partial vacuum formed in the globe, prevents the oil from descending until the machinery is again set in motion. Its economy in saving of oil is very great. We understand that an ordinary globe, containing but a small quantity, will lubricate a small shaft turning 150 to 200 revolutions per minute for upwards of a month. This lubricator has come extensively into use both at home and abroad, and it justly merits the success it has met with.

THE Royal Humane Society have awarded a medal to Mrs. Elizabeth Poingdestre, the wife of a Jersey clergyman, for rushing into the sea and saving a man from being drowned in February last.

THE MONCRIEFF ELEVATOR GUN-CARRIAGE.

IN our notice of the soiree of the Royal Society, we briefly alluded to Captain Moncrieff's system of working guns. Pending the preparation of some drawings which we were promised, we give the following description of this invention from the "Standard":—This gun-carriage, which is apparently one of the most important inventions in modern artillery, has been for some months in course of construction under the sanction of the Ordnance Select Committee, at the Arsenal at Woolwich, and in a few weeks will be experimented upon as adapted to a 7-ton gun at Shoeburyness. It has for a long time been a great desideratum for artillery of position to possess some means of firing over a solid parapet, while preserving free lateral range, without either exposing the gun or its detachment (*i.e.*, the artillerymen who serve it), or involving the labour of raising and lowering the piece at each discharge. This appears to have been now fully obtained by Captain Moncrieff's invention, with the immense advantage of almost completely neutralizing the destructive effect of the recoil upon the gun-carriage, platform, and pivot; and, moreover, utilizing the force of the recoil for the working of the gun itself. The gun carriage, which is of a peculiar form, is mounted upon a quadrant-shaped piece, called the "elevators," to the top of which it is pivoted; the curved part of the elevator rolls like a wheel upon the traversing platform upon which it is mounted, and a counter weight is attached in front a little in excess of the weight of the gun. This counter weight absorbs the force of the recoil; consequently, when the gun is discharged the elevators roll back upon the platform, causing the gun to descend in a cycloidal curve, the leverage in favour of the counter weight going on in an increasing proportion as the gun sinks, so as to be able to meet the utmost force of the recoil; the gun thus sinks some 4ft. below the crest of the parapet. The gunners are then enabled to reload in perfect security; and when the gun is to be again fired a self-acting pawl, by which it is kept in the loading position, is released, and it immediately rises to its firing position over the parapet. The advantages of these conditions for a heavy piece of ordnance in battering in an earthwork must be patent to any one at all acquainted with practical artillery. They chiefly consist in—

1. Protection from direct fire.
2. Unlimited lateral range.
3. Economy in construction of works.
4. No mark is offered to the enemy to fire at, as the gun is masked till the moment of firing, being entirely concealed behind the parapet.

With regard to the first-mentioned advantage, as the parapet may be of any thickness of earth and there are no embrasures, there is no necessity for any greater protection to the gun detachments than that given by the parapet itself, behind which they remain completely under cover.

Second.—Lateral range.—The lateral range is the same as that of guns in a cupola, and will entirely alter and modify the trace of future fortifications, whether field or permanent, in which this system is used, as guns in a face will have the same power as guns in a flank. Moreover, a most excellent mode of mounting these guns has become for the first time possible, viz., that of putting them in pits of, say, 18ft. diameter and 10ft. in depth; thus no fortification would be visible to an enemy.

Third.—Economy in the construction of works.—The improved accuracy and increase of penetration of modern ordnance have only been met hitherto by the employment of iron in fortifications, which, however, from its enormous expense and other disadvantages, was only thought of because no other alternative appeared to present itself. A two 12-ton gun cupola in itself costs about £15,000, and what Gibraltar shields and other plans for iron defences will come to, if adopted, Heaven only knows. The employment of Captain Moncrieff's protected barbette system ought, in almost every circumstance, to obviate any necessity for the use of these extravagently-costly methods of protecting modern fortifications, which even may themselves be found insufficient to cope with a further improved artillery; whereas with this system, if the parapet is simply thickened, which it can be *ad infinitum*, it will set increased penetration at defiance, and it is to be hoped that if this system be finally adopted the country will bear in mind the immense saving to its finances from the labours of the inventor, who, for a long period of years, and at a great expense, has at last succeeded in developing the practical utility of his system.

Fourth.—Economy of life.—None of the conditions produced by the greatly-increased range and accuracy of small arms, or the enormous concussion of the monster cannon shot of the present day, can affect the gunners in the present case, occupying as they do the defiladed space in rear of a high parapet, and completely under cover, for the elevation of the parapet would be about 10ft. from the ground to the interior crest.

Sixthly.—Making the gun.—As the gun is only visible at the moment it is raised above the parapet to be discharged, and as even for that moment it may be masked by a brushwood screen, it is evid e

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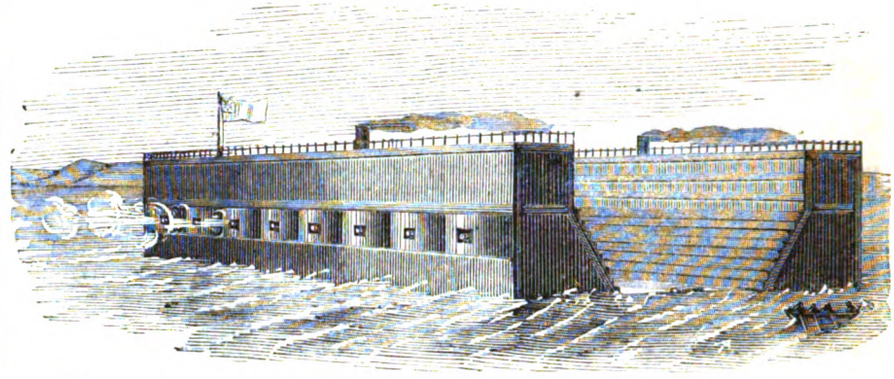
hat it is masked till fired, and immediately it is fired it drops again behind the parapet, so the eye of the enemy has nothing to guide it but a whiff of white smoke rapidly changing its position and drifting to leeward. One can imagine nothing more distressing to a hostile ship than to receive a galling fire from every green hill in the vicinity of a fort which she was about to attack without possessing any means of exactly determining the position of her tormentors.

To conclude this notice, it were well if attention were drawn to the enormous expense attending the proposed great employment of iron in our fortifications, and to pause before spending the millions necessary for the proposed works; for may they not be advantageously economized by the adoption of the foregoing invention for the armaments of permanent fortifications? and in cases where new fortifications are to be constructed, they may be adequately replaced by long lines of earthen parapets only elevated about a foot above the glacis, behind which the armament would remain, the more formidable because unseen. A further improvement may be made with this class of work, hitherto uncontemplated on account of the mechanical difficulties in the way, for a line of rails may be laid down parallel to the crest line of the parapet, upon which the platforms on which the guns are mounted can travel on trucks; therefore, if the lines be long, you can concentrate your artillery immediately upon any point at which it may be most required, the guns admitting of being discharged upon the trucks on which they are mounted, as there being a moving fulcrum between the gun and the platform, the rails would not be torn up by the transverse strain, which would infallibly be the case with rails laid in the ordinary manner were the gun mounted on the usual service carriage, for they would then have to bear the force of the recoil; the whole weight of the gun and platform would be considerably under that of a heavy locomotive, which weighs about sixty tons. The guns could, therefore, even be pushed by their detachments from point to point without being exposed to view. As it is the action of the counter-weight which raises the gun from its position under cover to the firing position over the parapet, for naval purposes the action of hydraulic power, steam, or compressed air may be substituted for it in cases where it would take up too much space. In fact, the number of conditions to which this novel and extremely simple mechanical principle may be adapted would require much more space than we have at our command to describe or particularize.

DOCKING AN IRONCLAD.

OUR readers are doubtless aware of the existence of an extensive dockyard and a floating dock at Cartagena. On the 26th of last month, an event occurred in connection with it of considerable interest, namely, an armour-clad ship, larger and heavier than the English Government ship "Bellerophon," was raised by means of the floating dock for the purpose of repairs. As a floating dock is now building in England for that class of ship, it may be interesting to know that such a ship has actually been lifted. According to the "Times," the well-known "Numancia," ironclad ship, having returned from the Pacific, was required to be docked for the purpose of making good the damage done during her attack on the forts of Callao, the most notable injury being due to the effect produced apparently by a 9-inch or 10-inch projectile, which had struck the ship just between wind and water, and crushed the armour-plating into the wood backing without actually penetrating the inner skin, but had made such an indentation that it was absolutely necessary to dock the ship. As there is no graving dock in the Spanish peninsula of sufficient dimensions to take in a vessel of the "Numancia's" class, it was determined to employ the iron floating dock of Cartagena for that purpose. There were many grave doubts as to the dock being able to lift the ship. However, orders were received from the Ministeria de la Marina at Madrid to dock the "Numancia" without delay. This order found the dock in its shallow basin (in which it was originally built), undergoing a process of cleaning and painting, which had not been done since the dock was first used, some three years ago; but before this was completed the dock was hauled out and moored in the deep-water basin, ready to receive the "Numancia." At 11 a.m. on the 25th the "Numancia" was placed over the keel and bilge blocks, and the engines and pumps of the dock set to work very slowly. Soon the dock was observed gradually to rise, and the "Numancia" with it. However, twenty minutes had hardly elapsed when orders were given to stop, to adjust the shores for supporting the ship sideways, and so it went on stopping and moving until six in the evening, when the ship was nearly half lifted out of the water, and in that state she remained until half-past seven next morning. The pumps were again set to work and continued working with little interruption until noon. By that time the floor of the dock with the ship was above the level of the water. The weight of the ship, although lightened of its stores, was over 5,600 tons, and as no vessel had hitherto been lifted of that weight in Spain or elsewhere, it was considered desirable by the engineer in charge to use the utmost care and caution in raising it as slowly as possible, that the weight might be properly adjusted, for which purpose the pumps were only driven at one-third of their usual speed. During the process of lifting no canting or irregular motion was in any degree observable, but the whole operation was done with a regularity that produced confidence as to its safety. The dock had been sunk 40ft. in order to insure the vessel being easily hauled in; the time of actual lifting was 8hrs. 13min. It might be performed under 4hrs. on another occasion, but when the great weight of the vessel is taken into consideration, it is certainly a remarkable feat to have accomplished. The "Numancia" is built entirely of iron, with the exception of the teak backing for the armour plating; she is 316ft. long, 57ft. beam, draught of water 27ft. 4in., with a displacement of 7,420 tons (her displacement on leaving for the Pacific was 8,200 tons); she is completely encased by 5-inch armour of 1,500 tons weight, and pierced for forty 68-pounders. The port cills, with provisions for 600 men, and 1,000 tons of coal on board, are 7ft. 6in. out of water; her full speed thirteen knots; her engines are 1,000-horse power, developing nearly 4,000. The Cartagena dock was designed and constructed by the Rennies, civil engineers, and was the first introduction of iron floating docks; the length is 324ft.; breadth outside, 105ft.; and inside, 78ft. Two days after the "Numancia" was on the dock a thorough examination was made by the Spanish Engineer-in-Chief, Don Thomas Thalierie, when there were no perceptible alteration found in any of the internal bulkheads or bracing, and all seemed as true as when originally made. This speaks well for English workmanship, material, and the good principles on which the work was designed.

COMBINED FLOATING DOCK AND BATTERY.



Correspondence.

COMBINED FLOATING DOCK AND BATTERY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—As your readers are quite familiar with iron floating docks, constructed so as to lift for repairs vessels of the heaviest class, I will merely explain the idea embodied in the enclosed sketch. The middle compartment of such a structure is merely to unite the basement with the top chamber, the water simply flowing into the middle chamber, and flowing out again; no pumping, as erroneously supposed, is required to fill or empty this chamber—so I have utilized this space, by forming it into a powerful battery, the great base on platform of the dock enabling me to place therein guns of the heaviest calibre.

The dock has a semicircular front, and at the back a caisson is fitted, so as to insure great stability for docking ironclads, the form of the battery resembling an elongated horse-shoe, with indented embrasures, so as to be able to fire right ahead, when the dock is securely moored. The design being simply to protect our harbours and mouths of rivers, and as the guns would be heavier than what can possibly be carried on board ship, I would merely armour-plate the top and sides of mid-chamber, and the top of basement, to protect it from vertical fire, depending on the heavy guns to keep without reach of the enemy's shot. When the dock is used for docking purposes, the ports would be filled up with suitable water-tight doors.—I am, Sir, yours, &c.,

JOHN G. WINTON.

13, Gladstone-street, May 15.

A BRONZE Roman coin of the age of Phillipus the Younger, A.D. 249, has been dug up at Carisbrook, in the Isle of Wight.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—J. F.—J. G. W.—G. S. K.—C. H.—A. W.—L. O.—W. L. W.—A. C.—Messrs. E. and H. O.—J. H.—A. M'C.—E. M.—S. A.—J. H. T.—F. R.—R. G.—J. M.—G. E. P.—E. A.—B. W.—Messrs. W. and J. K.—R. B.—W. T. C.—J. R. M.—E. D.—J. E.—F. G. B.—S. C. D.—P. T.—R. W.—M. E.—R. T. G.—J. P.—B. C. R.—J. H. L.—G. S.

Meetings for the Week.

MON.—Royal United Service Institution.—Mr. John Elder on "Circular Ships of War with Immersed Motive Power," at 8.30 p.m.

TUES.—The Institution of Civil Engineers.—The President's Annual Conversazione, at 9 p.m.

Royal Institution.—Dr. M. Foster on "The Development of Animals," at 3 p.m.

THURS. — Royal Institution. — Professor Grant on "Astronomy," at 3 p.m.

FRI.—Royal Institution.—Mr. W. E. H. Lecky, on "The Influence of the Imagination upon History," at 8 p.m.

SAT.—Royal Institution.—Professor Grant on "Astronomy," at 3 p.m.

Naval, Military, and Gunnery Items.

DURING the past week thirty-nine wrecks have been reported, making for the present year a total of 894.

THE annual regimental dinner of the brigade of Grenadier Guards takes place on June 2, at Willis's Rooms.

STATISTICS have lately been compiled on the subject of deaths at sea by the Registrar-General of Seamen and Shipping, which form a continuation of a return moved for in the House of Commons by Mr. Graves last year. These statistics show that, during the year 1867, 5,283 deaths are recorded as having occurred among the crews of British ships at sea, 2,370 of which were due to disease, 1,808 were caused by wrecks, and 1,105 by accidental drowning. The deaths from diseases of all kinds are less than those of the previous year, but the total number caused by wrecks indicates a considerable increase.

IT is in contemplation to discontinue the issue to the troops of fuel in kind, and to substitute a money allowance to each corps. The "United Service Gazette" says that an officer is to be appointed in each regiment as treasurer, under the supervision of the commanding officer, of the funds thus allowed, whose duty it will be to make contracts for the supply of fuel, and also to superintend the canteen stores. Additional pay will be granted to the officers filling this office. Many advantages are expected from the new system, particularly, we opine, to the chief regimental authorities.

IN the Court of Admiralty, the other day, before the Right Hon. Sir R. Phillimore, the case of the claim made by 350 seamen against the "Great Eastern" was heard on appeal. Objections were taken by the Great Ship Company to the finding of the Registrar as to the claim of about 350 sailors who were dismissed last May, when the vessel arrived at Liverpool, after the failure of the speculation on account of the French Exhibition. Mr.

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C. P. Butt appeared for the ship, and the Solicitor-General, Mr. V. Lushington, Mr. R. G. Williams, and Mr. James Aspinall for the men. After a long legal argument, his lordship reserved judgment.

THE National Lifeboat Institution has presented to Mr. Quigley, of the Coastguard, Whitby, its silver medal and an inscribed record on vellum for having during winter descended by a rope the cliffs south of the harbour, 300ft. in height, and thus saving the lives of four persons, being the master and crew of a schooner wrecked on the rocks, out of reach of lifeboat and rocket apparatus. The master had a broken leg, but was safely landed. Nine other men who aided in the exploit are suitably rewarded. The vessel went to pieces, and but for the prompt action of the men referred to all must have perished.

THE "West Cork Eagle" records the following extraordinary passage in an open boat:—On the 7th instant, Mr. William Salter, with only one man, sailed from Cowes, Isle of Wight, for Baltimore harbour in a small open pleasure boat, purchased there by Sir H. W. Beecher, Bart. Great uneasiness and anxiety were felt by the friends of these daring men, who ventured such a distant and dangerous passage in so small a craft; but we are glad to learn that their friends were relieved of their anxiety by getting a letter on Friday from Mr. Salter, stating that he put into Youghal through stress of weather, and praising the seaworthiness of his little boat. It appears that they went through very heavy weather and high seas.

THE trial trip of the "Victoria," iron-cased frigate, built by the Thames Ironworks Company for the Spanish Government, engined by Messrs. John Penn and Son, has just been made at the Maplin measured mile. The dimensions of the ship are:—Length, 316ft.; breadth, 57ft.; depth, 38ft.; burden, 4,862 tons. She is completely armour-plated from stem to stern with 5½in. plates and 10in. teak; the engines, of 1,000-horse power, nominal, are of the same type as those of the "Warrior" and "Minotaur." The frigate left Gravesend at 11·30 a.m., arriving at the Maplin at 1 p.m., where the trial at once commenced. The mean of the four runs was 14·1 knots; revolutions of engines, 65; pressure of steam, 23lb. The engines worked in a most satisfactory manner, indicating 4,500-horse power. The weather was all that could be wished, but the tide being half ebb was unfavourable to the trial.

Miscellanea.

A TORNADO visited Shanghae, Illinois, on Sunday, the 3rd inst.; fourteen houses were blown down, several others unroofed, four persons were killed, and forty injured.

A BRONZE statue of Sir Peter Fairbairn, who, as Mayor of Leeds, was knighted by the Queen when her Majesty opened the Town Hall in 1858, was inaugurated in Leeds yesterday week.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending May 16, was 2,435; total number since the opening of the museum, free daily (May 12, 1858), 1,298,147.

MR JOHN CRAWFURD, the distinguished Oriental scholar and ethnologist, died on Monday week at his residence, in Elvaston-place, South Kensington. He was born on August 13, 1783, in the Island of Islay.

THE Council of King's College, London, have elected the Rev. Dr. Barry, head master of Cheltenham College, to the office of Principal. Dr. Barry was fourth Wrangler, and second Smith's Prizeman, seventh on the first-class of the Classical Tripos, and formerly Fellow of Trinity College, Cambridge.

THE number of visitors to the South Kensington Museum during the week ending May 16, 1868, was —On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., 8,322; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,720. National Portrait Exhibition, by payment, 2,661; Total—12,703. Average of corresponding week in former years, 10,952; total from the opening of the Museum, 7,386,183.

THE contract for the Calcutta Waterworks is being proceeded with. The concrete is laid over a considerable portion of the area of the tank in Wellington-square. We regret to learn that the contractor's engineer has been obliged to leave for England, owing to bad health. Another engineer, Mr. Aird, has, however, arrived, and is pushing on the works as rapidly as possible.

THE broccoli season for West Cornwall is over, and shows a great improvement on last year. The West Cornwall Railway has sent off 3,600 tons, against 1,500 in 1867, and 3,200 in 1866. These have come principally to London, but they have been sent to many other large cities of England also, and as far north as Hull and Edinburgh. In addition, the neighbourhood of Penzance has furnished West Cornwall with a constant supply of broccoli from December to April.

THE publication of the "National Records of England and of Scotland" will probably be completed in the course of the present year. It is proposed then to publish the facsimiles of "National Records of Ireland." There is a steady demand for the facsimile of "Domesday Book"; the sum of £3,556 has been expended in the publication, and at the end of February £1,938 had been received from the sale of copies, and the copies in store would produce £1,900, so that the sale will more than cover the cost of publication.

FRANCE has imported wheat very heavily this year. In the two months ending February 29 she received wheat to the value of £36,498 from the United Kingdom, £33,069 from Belgium, £375,819 from Russia, £252,610 from the Zollvercin, £115,577 from Italy, and £721,333 from Turkey and the Principalities, making a total of £1,534,906. In the corresponding two months of 1867 the value of the wheat imported into France was only £509,203; and in the corresponding two months of 1866 only £4,203.

DURING the first two months of the current year Belgium received from the United Kingdom 883,986 kilogrammes of soda, and chemical products of other kinds, amounting in value to 213,344f.; 21,442 tons of coal, 316,232 kilogrammes of coffee, 21,045 kilogrammes of flour, bran, &c., 3,310,672 of raw cotton, 52,150 of earthenware, 42,670 of herrings, and 48,157 of other kinds of fish. The other articles largely imported from England to Belgium are metal wares, rags, salt, textile manufactures, and raw wool.

BY a return issued on Wednesday week, it appears the sum required in the year ending March 31, 1869, to enable the Lords Commissioners of Her Majesty's Treasury to make the necessary advances for the purchase of a site, and for other expenses for the new courts of justice and offices belonging thereto (the amount of such advances to be repaid to the Consolidated Fund out of the surplus interest fund of the Court of Chancery), is £106,000. Of this sum £86,190 13s. 1d. is a re-vote.

THE American correspondent of the "Times" states that the present Congress is known as preeminently a Congress of jobs. There are now pending, in various stages of unfinished legislation, bills appropriating no less than 268,250,000 dollars, to various railways and navigation companies, the profit of which is intended to go into private pockets; and besides these there are also pending bills making all manner of land and money grants for every conceivable object. Every man who visits Washington seems to consider that he has a *carte blanche* to rob the Treasury.

A CHANGE of some importance has been made in the time at which the lectures at Gresham College are, for the future, to be delivered. Hitherto the lecturer has taken his place at one o'clock in the afternoon, but, from a prospectus which has just been issued, it appears that the lectures for Trinity and Easter terms will be delivered in the evening. Dr. E. Symes Thompson is the lecturer, and, on Monday evening next, at seven o'clock, he will deliver the first of the Trinity term series. His subject will be "On the Causes of Disease."

A NEW line of railway, unimportant in a commercial aspect, but which will be welcome to the tourist and the sportsman, has just been opened. The line is that of the Tees Valley, about nine or ten miles in length, which joins the Stockton and Darlington Railway, near Barnard Castle, and goes to within a short distance of the celebrated High Force, a magnificent waterfall. The scenery in the neighbourhood is some of the most picturesque in England; while the long stretches of moorland, on which grouse abound, which extend into Westmoreland, will afford ample pastime for the sportsman.

THE East Indian Irrigation Company publishes the following:—The accounts from Orissa are very satisfactory, both as to the spread of irrigation and the construction of the works. Upon the Midnapore Canal one zemindar was about, at his own expense, to construct a channel to carry water to his lands, upon which he had engaged to employ 500 labourers. This same zemindar had also signed a lease for 1,000 acres on another portion of his property, and had promised to execute another for 3,000 acres. Navigation had also commenced upon the opened portion of the Kendrapara Canal, although none was expected until its completion to tidal water,

A MINERAL discovery, which promises to be important, has recently been made on the banks of the River Don, Tasmania. A lode has been found, yielding cobalt, silver, copper, and antimony. A few stones broken from the lode were, a short time since, forwarded to an assayer at the Wallaroo Smelting Works, for analysis. The result was as follows:—Cobalt, 4oz. in the ton; silver, 100oz.; copper, 14 per cent., and a quantity of antimony. The ore is estimated at worth £85 per ton. A specimen of lead, as taken from the same locality, has also been analyzed, and found to contain 82 per cent. of pure galena, besides several ounces of silver to the ton.

A REMARKABLE plant is now in flower at the Royal Botanic Gardens of the same genus as the American aloe. The popular belief in England is that it is the nature of these plants to bloom but once in a century, but the fact seems to be that this peculiarity is attributable to them only in a cold climate like our own, and that in their native Mexico they reach the period of bloom in about fifteen years. Having flowered, they rapidly pine away. The flower now on view is called the Fourcroya longæba, and was raised from seed received from Mexico about twenty-eight years ago. In its native country it produces flower spikes more than 40ft. long. The flower is expected to remain some time in bloom.

DURING last week the mail and express trains between York and Scarborough were fitted with the new cord arrangement invented by Mr. George Brown, of the North-Eastern Railway. A trial train was sent down the line, and the experiments with that, and with the passenger trains since, have been very satisfactory. The arrangement is very simple. A cord passes above the door within reach. A pull forward sounds the whistle, and a pull backward rings the guard's bell; but the cord cannot be used without first springing a semaphore signal indicator from the side of the train at the part where it is in request. This signal locks itself, and cannot be put back except by the guard. The company intend to fit the arrangement to their summer expresses to Scarborough.

THE condition of the milk supplied to the inhabitants of London has been investigated by the "British Medical Journal," and a second report upon it appears this week. According to the date furnished by a series of chemical analyses by Dr. Divers, F.C.S., it seems that out of sixteen samples of milk, purchased in the Bayswater, Kensington, and Holborn districts, only one proved to be in its original state, all the others being more or less watered and deprived of cream. One specimen, for example, proved to be nearly half water; another to have lost more than half its cream, besides being diluted with water. A charge of fivepence per quart for two of the samples was found to be no guarantee to customers willing to pay the extra penny that they can assure to themselves, by so doing, a supply of pure milk.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3094, 3122, 3123, 3131, 3133, 3138, 3139, 3142, 3168, 3169

BUILDINGS AND BUILDING MATERIALS—3121, 3141

CHEMISTRY AND PHOTOGRAPHY—3132

CULTIVATION OF THE SOIL, including agricultural implements and machines—None.

ELECTRICAL APPARATUS—None

FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3091, 3092, 3093, 3098, 3099, 3100, 3101, 3103, 3113, 3114, 3134, 3135, 3136, 3152, 3153

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—3120, 3140

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—3104, 3137, 3149, 3162, 3165

GENERAL MACHINERY—3106, 3109, 3110, 3116, 3124, 3126, 3147, 3148, 3156, 3159, 3163, 3164

LIGHTING, HEATING, AND VENTILATING—3105

METALS, including apparatus for their manufacture—3107, 3157

MISCELLANEOUS—3096, 3097, 3102, 3108, 3111, 3115, 3117, 3118, 3119, 3125, 3129, 3130, 3146, 3150, 3154, 3158, 3166, 3167, 3170

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3128, 3143, 3144, 3151, 3161

SHIPS AND BOATS, including their fittings—3095, 3112, 3145

STEAM ENGINES—None.

WARFARE—3127

3091 T. B. CUTTS and F. W. BROOKSBANK. *Improvements in the manufacture of laces in twist lace machines.* Dated November 2, 1867.

According to this invention the patentees produce the desired twisting of the bobbin wefting threads at the edges of the weavings by lapping the warp threads which form the longitudinal threads of the weaving around the bobbin wefting threads, not only so as to lay the said bobbin threads over and under them alternately, in the usual manner, but also so that the said longitudinal warp threads of the weaving, as they straighten in the work, drag one of the wefting bobbin threads around another, and so produce the twist required.—Patent completed.

3092 W. COOKE and W. FRANCIS. *Improvements in mats and matting.* Dated November 2, 1867.

This invention relates to the manufacture of mats and matting for cleansing the feet, covering floors, packing or wrapping, and other purposes, and consists chiefly in the adaptation to such manufactures of the interior portions of common cane, such portions being usually wasted or destroyed after their separations from the exterior portions of the cane which are employed in the manufacture of chairs, and for other like purposes. In carrying the invention into practice, this refuse portion is divided or separated into fibres of suitable thickness and flexibility,

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and is then ready for use. In the manufacture of mats for cleansing the feet and similar articles, the cane fibre may be interwoven with strands or cords of hemp, cocoa-nut, or other fibre, and afterwards cut or divided to form the desired brush-like surface.—Patent completed.

3093 J. ORR. *Improvements in doubling, folding, or plaiting woven or other web fabrics, and in the machinery or apparatus employed therein or connected therewith.* Dated November 4, 1867.

This invention consists in giving an intermittent forward traverse to the cloth or other textile fabric in the direction the plaits or folds are doubled over each other, or from the part where they are folded upon or over the surface of a roller, straight plate, or table surface below or between it, and a thin or fine-edged folding knife, blade, or bar, or made to reciprocate in sequential order or equal time with the said intermittent forward traverse, and in the same direction right across the length of the plaits or width of the fabric to be folded; that is, at the time each forward feeding motion of the fabric stops, the edge of the folding knife is brought forward in the same direction to the extent of its backward traverse, so as to bring forward a corresponding length of the fabric over the surface of the roller or plate below the knife, and double up and fold the part in front of the knife over itself in the form of a loop or bow of two thicknesses, and crease and wedge the part of the lower thickness of the doubled cloth above the knife and the thickness carried forward below the knife, and held by its edge between the lower feeding roller or table surface and an upper feeding and pressing roller, or other equivalent surface, which then catches hold of it and carries the three thicknesses or double folded part forward, at the time the folding knife is making its backward traverse for a fresh length of fabric to be clipped or caught, taken up and folded in like manner.—Patent completed.

3094 C. RILEY. *Improvements in tubular boilers.* Dated November 4, 1867.

The patentee claims the placing or fixing of a perforated plate, grate bars, or other form of fire protector, between the burning fuel and the heating surfaces of the boilers. —Patent completed.

3095 W. DAY. *Improvements in the mode of applying metal sheathing to composite ships with iron fastenings.* Dated November 4, 1867.

The patentee claims the application to composite ships with iron fastenings of a sheathing of zinc, or other electro-positive metal, in such a manner as to bring the said metal sheathing in contact with the heads of the iron bolts or other iron fastenings; and also the application of zinc washers to the inner ends of the iron bolts or fastenings, for the purpose of establishing a galvanic connection of the ironwork inside the vessel with the zinc sheathing, so that, when immersed in water, or partly so, the galvanic action of the two metals may prevent the corrosion of the iron bolts or fastenings, and the fouling of the sheathing. —Patent completed.

3096 J. FRASER and G. DUNCAN. *Improvements in counter-check books.* Dated November 4, 1867.

The object of this invention is to provide the said check books in such a form that the labour of checking the receipts will be greatly reduced and much time saved. For this purpose the inventors print the invoice heading on the faces of the seller's checks in the usual manner, but instead of printing the distinguishing numbers or characters on the faces of the slips, they print them on the back thereof, on all the three portions, on a part not likely to be written over. By so doing the distinguishing numbers or characters appear one on the back of the buyer's check, which is of no importance, and the other two, from the mode of use above explained, on the same sides of the counterfoil and seller's check, on which the writing and figures appear. The corresponding distinguishing numbers or characters are printed at one operation, slip after slip, by consecutive numbering, or any ordinary printing machine or press. In practice they usually print on large sheets, both before and after they have been perforated, and cut out the slips, which are afterwards bound up into books of the required size.—Patent abandoned.

3097 W. DICKINSON. *Improved means of joining leather or other material in the constructing or repairing of straps or driving belts for machinery.* Dated November 4, 1867.

The patentee claims the application and use of nails or headed and pointed pins of wrought iron, or other suitable metal, and washers or "burrs" to form or constitute revils in the construction or repair of mill straps or driving belts for machinery.—Patent completed.

3098 R. ACKROYD and G. HODGSON. *Improvements in looms for weaving.* Dated November 4, 1867.

This invention relates to means of operating the healds or heddles in looms for weaving, and the improvements consist in the employment of a set of jack rods and levers under the healds or heddles in addition to the ordinary set above them.—Patent completed.

3099 J. CLARKE and T. HOLT. *Improvements in warping.* Dated November 4, 1867.

Warping mills have formerly been constructed to lay the yarn upon the swift in layers of spiral form, and for convenience in taking it off space has been left between the spirals, as it has been found that, when not kept apart, there has been a tendency in the spirals to become entangled. The invention consists in placing upon a carriage, movable on a pillar or post, a roller, so as while the yarn is freely drawn over it, the carriage in which it moves shall have a movement perpendicular to the surface movement of the swift, and corresponding to the rate of delivery of the spirals thereon. To prevent the yarn from spreading over the ends of the before-mentioned roller they place other two rollers on studs, one at or near each end of the same, between which guiding rollers the yarn passes. They obtain the motion suitable to traverse the roller carriage from the well-known motion by which the jack is caused to travel on its post, but as this motion may be independently obtained from the motion of the swift, they do not confine themselves thereto. Motion is proximately conveyed to the roller carriage by means of an endless chain or band; but this also may be varied, and they do not confine themselves thereto, the invention being—the traversing upon its post or pillar a suitable carriage, having a roller furnished with upright guiding rollers by means of a motion corresponding more or less exactly to the motion which is imparted to the jack in laying the yarn spirally upon the swift, by which the yarn may be kept disentangled when being taken off.—Patent abandoned.

3100 R. BAGULEY. *Improvements in the manufacture of shuttles employed in weaving.* Dated November 4, 1867.

This invention has for it object the construction of "shuttle pegs" or skewers with the desired expansion and elasticity for securely holding the cop thereon without the aid of springs or other contrivances, as heretofore used for that purpose. This the inventor effects by securing the bent or arched portion of the said peg or skewer at the nose end thereof, and tempering or hardening the same whilst in an arched position, thus securing the elasticity required; the loose end of the arched portion of the said peg or skewer is pointed and received in a hole or groove formed for that purpose at the block end of the peg or skewer.—Patent abandoned.

3101 H. HEBDEN. *Certain improvements in mules for spinning, doubling, or twining cotton or other fibrous substances.* Dated November 4, 1867.

The patentee claims, first, the use of two shafts, one parallel to the other, so as to drive one from the other during the "single speed," and by altering the position of the intermediate gearing, and which alteration shall effect simultaneously an immediate change of the "speed" of the spindles, as required, in the manner and for the purpose described. Second, the arrangement and combination of mechanism whereby the change of pinion and intermediate gearing shall simultaneously alter the speed of the entire mule during the formation of yarn or first part of draw, called the single speed; and, third, the use, when required, of a change pinion and intermediate gearing for the "hardening" portion of the draw, called the "double speed," as described.—Patent completed.

3102 A. A. L. HARRISON. *The making of the improved label band.* Dated November 4, 1867.

This improved label band for holding papers together is formed by combining two parallel plates or strips of tin or other metal with one or two (according to the purposes and strength for which the bands may be required) india-rubber bands passing through removable wire links fixed at both ends of each of the two tin plates into tubes made by turning inwards the long edges of the tin plates. These wire links are somewhat in the shape of a horse-shoe; they would be slightly bent towards the curved end, and these curved ends would be enveloped with brass, metal, or tin movable tubing, and if one india-rubber band only be required, it would be inserted through the links, and would run through the grooves formed by the tubes. But if two india-rubber bands are required, they would not pass through the grooves, but each would pass through the two opposite wires of the tin plates. The tin plates would be japanned, and the outside surface of the upper plate would hold an adhesive paper gum label. Where one india-rubber band only is used, the construction of the plates would be as follows:—The tubes would not be carried throughout the whole length, but the space of an inch, or thereabouts, would be interposed in the middle of each of the two tin plates, and that space of tin would be folded on either side the depth of the tube, and parallel with the parent plate, but leaving a small interstice for the insertion of the india-rubber, which this part of the plate would shield from the rubbing of any papers held by the improved label band.—Patent abandoned.

3103 T. WRIGHT and I. FOX. *Improvements in machinery or apparatus for producing plain and fancy wearings in bobbin net or twist lace machines.* Dated November 4, 1867.

Heretofore, in producing plain or fancy weavings in bobbin net or twist lace machines, the weft threads have been traversed to the right or left across two or more breadths of work in the machine, other threads at each side being at the same time traversed in like manner. Now, by this invention, the patentees throw or traverse one thread quite across the machine from side to side, either way, such thread forming the weft in the whole width of work in the machine. This thread they cause to traverse by the employment of special machinery or apparatus, the details of which we cannot give space to here.—Patent completed.

3104 N. BIRKENRUTH. *Improvements in mattresses, cushions, sofas, seats, and other similar articles.* (A communication.) Dated November 4, 1867.

Heretofore, in the construction of mattresses, cushions, sofas, seats, and other articles for sitting, reclining, or resting upon, where an elastic or resilient or spring surface is required, it has been usual to form such surface by interposing between two plane or horizontal surfaces of textile fabric, or other like material, a number of springs, or a resilient substance or yielding agent generally, disposed vertically, so that a certain springiness has been obtained. Whereas, according to this invention, the horizontal surface is formed of a number of slender, pliant, or flexible wires interlaced, intertwined, or woven together, or traversing or passing under and over each other, and attached at the ends and sides to a rigid frame. The wires are so interlaced as to leave sufficiently large interstitial openings to ensure the requisite resilience. It is preferable to have two parallel layers or surfaces of wire formed as described, one over the other, and very near to it.—Patent abandoned.

3105 J. KIDD. *Improvements in obtaining artificial light and in the apparatus employed therein.* Dated November 4, 1867.

This invention consists in producing a mixture of atmospheric air, or air and coal gas combined with the heated vapour of non-volatile heavy hydrocarbons, and in burning such mixture for the purpose of obtaining light therefrom.—Patent abandoned.

3106 A. V. NEWTON. *Improvements in sewing machines.* (A communication.) Dated November 4, 1867.

This invention is not described apart from the drawings. —Patent completed.

3107 W. E NEWTON. *An improved mode of covering steel or iron plates with copper, and manner of arranging or disposing such plates.* (A communication.) Dated November 4, 1867.

This invention relates to the covering of steel with copper, and consists, first, in serrating or otherwise roughening the surface of the steel to be covered; and, second, in then placing the serrated steel plate with the copper plate in contact with such surface, and with borax or tinner's flux between the two plates, after which the two plates are placed upon a thick bed-plate of cast-iron or steel previously heated to or above the melting point of copper. This bed-plate is placed on the lower disc of the press, the upper disc of which is made hollow, and with a non-conducting substance inside. Pressure is then brought to bear, and the steel plate, by expanding under heat, the hot or melted copper will be forced into the indentations and body of the steel, and, as the steel cools, it will be closed or shut up, thus fastening the copper thereto, and producing a permanent adhesion or union of the two metals.—Patent completed.

3108 W. R. LAKE. *An improved artificial compound chiefly designed for use as a substitute for india-rubber or caoutchouc.* (A communication.) Dated November 4, 1867.

This invention consists in compounding and combining together in certain proportions, and in any suitable manner, one or more vegetable fats or oils, one or more mineral oils or resins, one or more gum resins, one or more essential or volatile oils, either with or without resins, or one or more alkalies and sulphur, and in the uniting or combining this compound with a small proportion of caoutchouc or india-rubber, or gutta-percha, or their equivalents, and vulcanizing, the same by any mode adapted for that purpose, whereby the patentee obtains a product which is characterized by the possession of the leading qualities of vulcanized caoutchouc, and also other very important qualities, and which can be manufactured in any desirable quantity, and at much less cost than the ordinary vulcanized caoutchouc.—Patent completed.

3109 W. MARSHALL. *Improvements in machinery or apparatus employed in the clipping of lace and other fabrics.* Dated November 5, 1867.

Heretofore, machinery used in clipping lace and other fabrics consisted of two, or at most three, cutting blades lying flatwise on each side of a two-edged central blade, such blades being adjustable towards or from each other. Now, in this invention, the inventor employs two, three, or more blades, each blade being capable of adjustment separately, and, moreover, he employs several sets of these blades; each set of blades will perform cutting operations at one and the same time.—Patent abandoned

3110 H. ALLMAN and F. N. GISBORNE. *Increasing the production of light from, and improving the combustion of, carburetted gases.* Dated November 5, 1867.

This invention is not fully described without reference to the drawings.—Patent completed.

3111 A. VERDALLE. *Improved means for closing doors or windows.* Dated November 5, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

3112 T. WINGATE. *Improvements in anchors.* Dated November 5, 1867.

This invention relates to the making of an anchor without a stock, and the patentee is enabled to dispense with that part by making the anchor with three or more movable or jointed arms. In carrying out the invention, he prefers to use four arms, which are made in pairs, each pair being formed in one piece, which is jointed upon the shank. The invention cannot be fully described without reference to the drawings.—Patent completed.

3113 T. BRIGGS and W. E. YATES. *Certain improvements in looms for weaving.* Dated November 5, 1867.

The patentees claim, first, the arrangement and combination described of apparatus between the breast beam and the cloth roller for taking up and stretching the cloth. Second, the employment and use of a picker having a yielding or elastic surface, by which the shuttle is struck and propelled. Third, the employment and use of a movable tube of wood, metal, or suitable material, applied to support the picker, and to slide upon the shuttle box spindle; and, fourth, the general arrangement, construction, and combination of the apparatus constituting the improved picker, as described.—Patent completed.

3114 S. H. FOSTER and T. BUNNEY. *Improvements in the manufacture of looped fabric for braces.* Dated November 5, 1867.

This invention relates to the production of an improved looped fabric to be used in the manufacture of braces. For this purpose one of the guide bars which, for the sake of distinction only, the inventors call the bottom guide bar of the frame or loom, is caused to rise two needles at the same time that the other guide bar (say the top guide bar) rises one needle. Both guide bars then fall one needle. The needles are pressed, a course of loops formed, and the last-formed row of loops on the fabric is knocked over the needle heads. For the reverse course the bottom guide bar falls two needles at the same time that the top guide bar falls one needle. Both guide bars then rise one needle, the needles are pressed, and the last row of loops on the fabric is knocked over the heads of the needles as before, completing the course.—Patent abandoned.

3115 H. SMYTH. *Improvements in umbrellas, parasols, and sunshades.* Dated November 5, 1867.

This invention relates to means for effecting the connection of the ribs and the stretchers to their "wheels," as well as of the ribs and stretchers to each other, so as to obtain simplicity in the action of the parts, with other advantages. Also the improvements relate to means for effecting the locking of the runner of the stretchers either when the umbrella, parasol, or sunshade is open or closed. For these purposes the end of each rib or stretcher attached to the "wheel" is formed spherical, or with a ball at its end, and these balls or spherical ends are received into correspondingly shaped recesses or sockets formed for them in the "wheels," where they are covered and held securely by a covering ring or cap, openings being left from the recesses or sockets in the "wheels," and their caps to admit of sufficient play for the ribs and stretchers. The end of each stretcher attached to the ribs is also formed spherically, and is received between two hollow surfaces in a plate on each rib. The holding rings are retained by rivets, screws, "burnishing," or by slight soft solder, so as to be removed and replaced when required. The runner with its "wheel" connected to the stretchers is grooved to run upon a pin or feather on the umbrella, parasol, or sunshade stick, or it is provided with a pin or feather to run in a groove in such stick. A spring stop acts in corresponding recesses to hold the runner in position, either when the umbrella, parasol, or sunshade is open or closed. Stops may be used to control the extent of motions. The spring stop may be provided with a knob or milled ring.—Patent abandoned.

3116 H. ADEANE. *The protection of the eye from wind, dust, and the inclemency of the weather.* Dated November 5, 1867.

This invention has reference to an improved apparatus for protecting the eyes from wind, dust, snow, and the inclemency of the weather, and consists of a metallic frame, the upper part of which is fitted to the forehead, the middle portion projecting over the eyes, and a third or lower part declining to and resting on the nose and face, also a piece joined by means of pivots or hinges at each end of the forehead clip for the purpose of fixing the frame

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to the head, and also for the adapting of the whole to various sized faces. At each side of the frame a movable stay or bracket is provided for the purpose of firmly keeping the frame extended. The frame is to be made with either pivots or hinges capable of being folded when not in use, the whole or part to be covered with gauze, net, or other suitable material, whether transparent or otherwise, for the protection of the eyes.—Patent abandoned.

3117 C. E. BROOMAN. *Improvements in reckoning, counting, or calculating apparatus.* (A communication.) Dated November 5, 1867.

We cannot here give space to the details of this invention.—Patent completed.

3118 E. C. VINE. *Improvements in stays, corsets, bodices, and riding belts.* Dated November 5, 1867.

This invention consists in the employment of one, two, or more bands, strips, or pieces of elastic substance in the stay, corset, bodice, or riding belt at or about the region of the waist, such elastic substance being attached to or combined with the stay in such manner as to form a portion or portions thereof, especially or mainly in the direction or at the circumference, of the waist, or obliquely thereto. —Patent completed.

3119 A. M. CLARK. *Improvements in railway and other brakes.* (A communication.) Dated November 5, 1867.

This invention is not described apart from the drawings. —Patent completed.

3120 R. PALMER and H. S. BIRD. *Improvements in the manufacture of wheaten flour and bread.* Dated November 5, 1867.

According to this invention, after separating the bran in the usual manner, the patentees grind it to an impalpable powder, and remix it with the white flour, and from this mixture, the whole of which is an impalpable powder, they make brown bread.—Patent completed.

3121 W. GEEVES. *Improvements in the construction of panel doors and frames.* Dated November 5, 1867.

According to this invention the patentee makes the mortices with parallel ends, and between each end of a mortice and its tenon (which is parallel, as heretofore), he inserts two keys or wedges; one he places in the key way with its broader end inwards, and he then drives the other key or wedge home upon it. On the inner sides of the tenons he forms the driven wedges considerably longer than the tenons, so that they drive into holes formed for them in the substance of the rails, and serve also as dowels.—Patent completed.

3122 W. E. NEWTON. *Improvements in steam boilers.* (A communication.) Dated November 5, 1867.

This invention consists, first, in a novel means of connecting by return pipes or bends tubes arranged in a tier one above the other over the fireplace, and containing the water to be heated, while the fire plays outside the tubes. These return pipes communicate with apertures one over the other at the ends of the tubes, and connect each tube with one above and below it, whereby a perfect circulation is kept up, and foaming is prevented and the steam kept drier. The invention also consists in attaching these return pipes to the tubes by free socket joints provided with packing and outside clamps covered and secured by stud bolts, whereby every provision is made for unequal expansion of the parts, and the return pipes are allowed to tip or twist without straining the main tubes. The invention further consists in constructing the ends of the boiler of a series of plates of square or parallelogram form fitted to or cast with each main tube, and serving, by means of apertures, to connect the main or water tubes with each other by pipes or bends. The invention also consists in a connection of cross water pipes with the main tubes by means of return pipes or bends, as aforesaid, and arranged to communicate with the tubes, or one of them, at their ends without breaking the continuity of the tubes.—Patent completed.

3123 A. V. NEWTON. *An improvement in roller or anti-friction journal boxes or bearing, applicable also to the hubs of wheels.* (A communication.) Dated November 5, 1867.

This invention has for its object the diminution of friction in bearings to axles, shafts, and wheels, or other like bodies having a rotary or turning motion about an axis, and consists in a combination of a journal box provided with a series of anti-friction rollers arranged around and within the box that, together with its rollers, is hung free to turn or rotate on or around a central axle shaft, trunnion, or gudgeon, and is surrounded externally by a box or brush having an interior bearing surface between which and the axle or shaft the rollers lie, and with both of which they form bearing contact.—Patent completed.

3124 A. M'DOUGALL. *Improvements in apparatus for stirring or agitating solid substances, and for exposing them to the action of the air, gases, and vapours.* Dated November 5, 1867.

This invention is not described apart from the drawings. —Patent completed.

3125 J. W. R. HILL. *An improved mode of, and means for, propelling rocking-horses, carriages, and other vehicles.* Dated November 5, 1867.

This invention relates to means for causing a rocking-horse, carriage, or other vehicle, to advance by its oscillating or rocking motion, the weight of the horse or carriage, together with the weight and action of the rider or operator, being the motive power.—Patent abandoned.

3126 R. LEAKE and J. BECKETT. *Improvements in machinery for polishing cylinders.* Dated November 6, 1867.

The cylinder to be polished is supported in suitable bearings, and is turned round by steam or other power. The stone or other polishing agent is held in contact with the cylinder by a weighted lever or weight, and is traversed to and fro lengthwise, and at right angles to the cylinder, by a rack and pinion and a crank, or other equivalents. By the combination of these three motions, that is to say, the rotation of the cylinder, and the to and fro motions of the stone, the surface of the cylinder is accurately polished without the aid of manual labour, as is now customary. A self-acting apparatus is or may be applied to the machine to arrest its action as soon as the cylinder has obtained the diameter required.—Patent completed.

3127 E. C. PRENTICE. *Improvements in the treatment of gun cotton and charges or cartridges made therefrom, as also in the processes employed in their manufacture.* Dated November 6, 1867.

We cannot here give space to the details of this invention.—Patent completed.

3128 T. F. CASHIN. *Improvements in apparatus for working and governing the action of railway points and signals, a part of which is applicable for other purposes.* Dated November 6, 1867.

We cannot here give space to the details of this invention.—Patent abandoned.

3129 H. A. BONNEVILLE. *A new and improved box for preserving pasty matters and substances.* (A communication.) Dated November 6, 1867.

The patentee claims the combination, with a movable diaphragm at top and bottom, actuated by an endless screw, or other suitable means, of a box or recipient, intended to preserve pasty substances, substantially as described.—Patent completed.

3130 W. E. GEDGE. *Improvements in venetian blinds.* (A communication.) Dated November 6, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

3131 R. NEWTON. *Improvements in fuel feeding apparatus for steam boilers.* Dated November 6, 1867.

This invention has reference to a previous patent, dated March 24, 1866 (No. 878), and relates to the well-known feeder in which the fuel passes between toothed rollers, and is thereby triturated, when it falls upon distributors, by which means it is thrown upon the fire. To remedy the defects of the usual arrangement is the object of the present invention, and for this purpose the patentee so arranges the teeth of the crushing or triturating rollers relatively to each other, that, instead of meeting each other point to point, as is now the case, they follow each other in a manner similar to that which they would do supposing them to be in gear at the side (so to speak) of each tooth. The purport of this arrangement is to enable him to use any class of coal or coke fuel, so that in the event of "slack," say, being used, it is gradually and evenly admitted to the distributors. A further improvement consists in making the centres of the distributors (which are the well-known circular webbed discs) of a bell formation, in order that the fuel falling from the rollers above them may be pitched towards their outer edges, and thus more readily (through their rotary movement) thrown upon the furnace beneath them. The webs of the distributors he also hollows out near the shaft, to prevent any one compartment being choked.—Patent completed.

3132 I. BAGGS. *Improvements in preparing and oxidizing certain substances capable of producing chlorine.* Dated November 6, 1867.

One part of this invention consists in converting the suboxides of manganese, whether natural or artificial, and from whatever source they may be obtained, into peroxide, or in imparting a higher state of oxidation thereto than they have previously possessed.—Patent abandoned.

3133 E. and R. THORNTON. *Improvements in steam boiler and other furnaces.* Dated November 6, 1867.

This invention consists in the construction and application to furnaces of cylindrical grate bars capable of rotating on suitable framework. These grate bars are made hollow, and perforated through their crust for the passage of air. They are also provided with teeth or projections on their external surfaces, for the purpose of carrying the fuel forward in the furnace. Motion may be given to these grate bars by screws or worms and worm wheel, or any other means of producing rotary motion in the same direction, so as to gradually carry the fuel from the front to the back part of the furnace where the clinkers pass out to the ash pit.—Patent abandoned.

3134 W. PEARSON and W. SPURR. *Improvements in looms for weaving.* Dated November 6, 1867.

This invention relates to looms for weaving fancy woollen fabrics, or such as require two or more different colours or kinds of yarn to be used in their production, and for which purpose change shuttle boxes and jacquard apparatus, or other indicating apparatus, are required to be employed therewith. In the working of this class of looms various means are adopted for giving motion to the said change boxes, the indicating apparatus, and other parts of the loom, but which means are usually required to operate simultaneously, or in concert with each other, and in the process of weaving, when the weft breaks or becomes used up, the loom being heavy will continue to run for some time after without the introduction of weft, so that it becomes necessary to turn those parts back to the broken pick, or to place the several parts of the loom in the same relative position as they were when the weft broke.—Patent abandoned.

3135 J. BOTTERILL. *Improvements in the dyeing of textile fabrics.* Dated November 6, 1867.

This invention relates to the dyeing of woven fabrics composed wholly or partly of the fibre known as China grass. This fibre has naturally a lustrous appearance, but it has been found that when dyed by the ordinary methods employed in dyeing cotton goods, the lustre is lost, and the fabric is permanently creased. By the improved process the patentee avoids these defects, and adds to the lustre of the goods. In treating goods composed wholly of China grass, or of China grass and cotton, the warp being of one material and the weft of the other, he first cleanses the goods thoroughly in a warm solution of soap, taking care, by the use of rollers, to avoid the creasing of the fabric. After cleansing he suspends the goods in a stove charged with brimstone fumes, in order that they may become thoroughly saturated therewith. The sulphur thus imbibed will serve as a mordaunt suitable for fixing (say) aniline colours. The goods thus heated are then ready for the dyeing operation.—Patent completed.

3136 W. R. LAKE. *Improvements in the manufacture of waterproof fabrics, and in articles formed of the same.* (A communication.) Dated November 6, 1867.

Belting, hose, packing, and other like articles, have heretofore been manufactured by applying to woven fabrics compounds prepared for vulcanization, in which compounds either india-rubber or gutta-percha has been the principal ingredient. When the compound used consists, principally, of india-rubber, the belts or other articles are not only injuriously affected by the atmosphere in hot weather, and exposure to all artificial heats in their various uses, but are also liable to be injured and destroyed by oils, alkalies, acids, and other chemical substances. When manufactured of a compound whose principal ingredient is gutta-percha, they lack the requisite elasticity, and are liable to crack. The nature of this invention consists in applying to a woven fabric both of these compounds separately, and thereby preserving the elastic quality required in belting, hose, packing, and like articles, and protecting them against the injurious operations of heat, oils, alkalies, and acids, and against injury from other causes.—Patent completed.

3137 A. M. CLARK. *Improvements in pianofortes.* (A communication.) Dated November 6, 1867.

This invention relates to the application to grand, square, and other pianos, of an apparatus for prolonging the sound, by producing the continuous vibration of the wires. We cannot quote the details of the invention.—Patent completed.

3138 C. L. HETT. *Improvements in the governors of steam and other motive power engines.* Dated November 7, 1867.

This invention relates to centrifugal or ball governors, and it consists in so connecting the suspension rods and links to the vertical shaft that the path of the balls as they expand from an approximate parabolic curve, instead of the arc of a circle, as usual, and, consequently, the sliding bush and rod connected to the throttle valve or cut-off gear is moved to the required extent with the slightest variation in the speed of the engine to be governed.—Patent completed.

3139 T. R. BARDSLEY and W. BLACKSHAW. *Improvements in apparatus for smoke consuming in steam boiler and other furnaces.* Dated November 7, 1867.

This invention has for its object the consumption of smoke in steam boiler furnaces by the introduction of heated air at the back of the bridge, which, mixing with the smoke, is immediately converted into ignited gas, the extra heat thereby produced being at once communicated to the boiler, and this invention consists in the use and application of a tube formed of metal, fireclay, or other suitable material carried from the rear of the boiler (where a damper may be applied to its end) into the metallic tubular flue, or through the brick flues round the boiler, and thence through the metallic tubular flue, where it may open into a cavity formed at the back of the bridge, which cavity has a narrow opening into the flue at the back of the bridge, which may or may not be covered with an overhanging top to prevent soot falling into the cavity, and thus choking it up. The action of this apparatus may be thus described:—By means of the draught in the flues, atmospheric air is caused to pass through the metallic or other tube into the cavity at the back of the bridge, which, becoming heated and rarefied in its passage, is in the proper state to be mixed with the smoke in the flues, and the quantity of air admitted may be regulated by a self-acting damper, so that when the furnaces are freshly fed, a greater quantity of air may be supplied, which may again be reduced gradually until entirely cut off by self-closing mechanism applied to the damper.—Patent completed.

3140 T. J. BAKER. *Improvements in the manufacture of wheat and other grain into flour, and in the machinery connected therewith.* Dated November 7, 1867.

These improvements consist under one head in forming an air and moisture trap in the meal spout, by inserting therein, in a suitable case, a wheel having vanes at short distances around it, and moving at a slow velocity, the case at one side being open into the meal spout both above and below, the connection between the top and bottom of the spout being cut off by the vane wheel, so that, as the meal or products of the grinding descend in the spout, they are caught by it and permitted to advance only at the rate, and in the direction of, the said vane wheel. The patentee gives the before-mentioned vane wheel motion in direction contrary to the descending meal, so that the meal is, by its action, first heaped upon one side of the meal spout, and the passage sealed against the descent of air and moisture, and is then carried round the top of the wheel, at a velocity so slow as to seal the passage at the other side of the case, and around the top, against the escape of air and moisture.—Patent completed.

3141 E. SEPHTON. *Improvements in the construction or arrangement of blocks of so-called workmen's dwellings.* Dated November 7, 1867.

Here the outer walls of each block of dwellings are of any desired outline in plan, and the rooms are arranged and set apart to suit the proposed class of tenants. The entrances from the street are by passages or covered ways to the back of the block, where corridors and staircases common to the tenants branch off. The staircases lead to terraces running along each floor at the back of the building, and from the terraces the doors of the respective tenements open, each tenement being preferably so arranged that one half of the apartments have light from the front of the block, and the other half from the back thereof. At certain distances, say each tenth or twelfth dwelling, a vertical shaft to receive ashes and other waste rises upwards through the terraces. Folding doors or traps are fitted to the said shaft on each terrace, and when water-closets are not provided in each dwelling, they are placed around or near the shaft.—Patent completed.

3142 W. J. M. RANKINE. *Improvements in apparatus for obtaining uniform rotation.* Dated November 7, 1867.

This invention consists of improvements on the instruments commonly called governors, in which a load and the centrifugal force of a revolving mass or masses act in opposition to each other, so that as one or other of their forces preponderates, the arm or arms carrying the revolving mass or masses shift their position in one direction or the other, so as to act on the motive power by means of a regulating valve, or other suitable apparatus. The defect of the ordinary governor is that the speed of rotation at which the balance between load and centrifugal force takes place varies with the position of the arms. In order that such balance may take place at one uniform speed only for a given load, the load is made to act upon a lever or levers so connected with the arms carrying the revolving masses that during any change of position the levers acted upon by the load move through double the angle that is moved through by the arms carrying the revolving masses. The speed at which the balance of load and centrifugal force takes place can be varied at will by altering the load, but not otherwise. The load may constitute either of a weight or weights, which must be distinct from the revolving masses, which exert centrifugal force, or of the elasticity of a spring. In one arrangement for carrying the invention into effect two rods with balls at their four ends are jointed at their middles to a vertical spindle, so as to be capable of moving about the joint in vertical planes passing through the spindle. Two short levers are jointed to the spindle at a point the distance of which below the joint of the ball rods is equal to the length of those short levers, and their ends are fitted to slide upon the lower parts of the ball rods, with which disposition of the parts it follows that the short levers must always move through double the angle moved through by the ball rods. The rods with the balls are balanced as

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regards gravity, but are free to assume different positions under the influence of centrifugal force. If the load to oppose centrifugal force is to be obtained by means of a weight, such weight may be in the form of a ring concentric with the spindle, and freely suspended by links or otherwise to any convenient parts of the short levers; or the load may be produced wholly or partly by a weight adjustable on a lever acting on a collar on the spindle, such collar being connected to the short levers.—Patent abandoned.

3143 C. H. BRIGHT. *Improvements in tramways or railways for streets or roads, and wheels adapted to run thereon.* Dated November 7, 1867.

At the level of the surface of the street or road to which a tramway or railway is to be applied, the patentee places a bar or flat rail (one rail being used for each side of the railway or tramway, as usual), and he secures the same upon and to suitable sleepers by screws or spikes, the bars or rail being so laid or placed that, in its transverse direction, it shall slant off from the central line of the way between the rails, which arrangement or construction is specially adapted for the transit of wheels with peripheries corresponding to the slant or angle of the rails, namely, constructed with tires or peripheries, one portion of which (that is, the portion which is on the inner side of the wheel) is bevelled off to suit the angle at which the aforesaid bar or rail is placed; and, further, these tires may be constructed as compound tires, that is, in two parts, the flat circle or periphery, which is intended for running on the ordinary roadway, being in one part, and the bevelled portion of the said circle or periphery, which is to run on the rail, being the other, this latter portion being bolted to the aforesaid flat part, or otherwise securely attached thereto.—Patent completed.

3144 C. H. BRIGHT. *Improvements applicable to carriages for tramways or railways for streets or roads.* Dated November 7, 1867.

Here the inventor constructs the carriages abovementioned with the fore wheels arranged and acting on the bogie system with provision for "locking" the same by means of a cam or bolt put into and out of action by the agency of a handle or foot lever worked by the driver of the carriage or other attendant, in order that when the wheels are working on the rails the "locking" thereof may aid in the retention of the carriage on the line. These carriages provide with friction breaks arranged two for each wheel, so that the periphery of the same may be gripped by two breaks acting perpendicularly opposite each other, such breaks being put into and out of action by means of screwed shafts or rods, or other similar gearing worked by a handle or handles (two being preferred, one for the driver and the other for the conductor), in order that the one may assist the other for greater efficiency of working.—Patent abandoned.

3145 E. SACRE. *Improvements in the construction of armour for the defence of ships, forts, batteries, and other constructions.* Dated November 7, 1867.

These armour-plates are formed of two plates of wrought iron produced by either rolling, hammering, or in any other convenient manner. These plates are to be secured together by means of bolts, but before so doing the inner sides have semicircular grooves formed on them. Or these grooves may be of any other form that might be found necessary. The intervening spaces formed by these grooves are to be filled with cast iron chilled or otherwise, or of any other hard material. These grooves are placed so close together that there will not be space enough for a shot to pass between them, and as the hard metal contained in the grooves which run vertically (and if desired horizontally also) will be as hard as the projectile there will be sufficient resistance to stop the shot.—Patent abandoned.

3146 B. T. NEWNHAM. *Improvements in means or apparatus to be used in playing games.* Dated November 7, 1867.

This invention is not described apart from the drawings. —Patent completed.

3147 I. HEWITT. *An improved machine for forming, printing, and counting labels.* Dated November 7, 1867.

This invention relates to the construction of a machine for manufacturing in a more perfect and expeditious manner than has hitherto been found practicable plain or printed labels for addressing parcels and luggage, and for medical and other purposes. The invention consists chiefly in the devices and apparatus for printing, folding, punching, cyclelting, dividing, and counting the said labels; in the means for supplying the strips of paper or other material to the machine; and in the combination therein of the said devices and apparatus, whereby the strip is fed into the machine, and the labels delivered from the same in a perfect or finished condition. We cannot here quote the details of this invention.—Patent abandoned.

3148 J. F. BRINJES. *Improvements in apparatus for distilling, heating, evaporating, and cooling liquids.* Dated November 7, 1867.

The patentee claims, first, the combination of two or more rotary distilling vessels or chambers, situate one above another, and connected by pipes with each other, and with separate condensers, the whole being arranged and operating substantially as described. Second, the combination of two or more rotatory vessels or chambers for evaporating and heating liquids, substantially as described. Third, the application and use to, and in the cooling of liquids, of one or more rotatory vessels or chambers, arranged and operating substantially as described.—Patent completed.

3149 J. WHEELER. *Improvements in gloves.* Dated November 7, 1867.

This invention has reference to what are called the welts of kid and other like gloves, and consists in extending the welts without any join entirely round the upper part of the glove, and along the sides of the opening in front, the said welt commencing and terminating at the bottom of such opening or otherwise, in which case the said opening is strengthened at the bottom whilst all seams and multiple thicknesses or folds of material at the corners are avoided. Or the welt may be joined only at the two sides of the front opening just below the button and the button hole or other fastening. The corners are curved or rounded in lieu of being left square or pointed, as at present, whereby a neater appearance will be imparted to the glove. If desired, the patch or covering which is usually stitched over the back of the button or fastening may be made in one piece with the inner portion of the welt.—Patent completed.

3150 R. ROBINSON. *Improvements in the manufacture of filtering paper.* Dated November 7, 1867.

According to this invention the patentee strengthens filtering paper by embedding in its substance in the process of manufacture threads or cords, which may either be separate the one from the other, or woven or netted into a loose and open fabric. It is not essential that the threads or cords or fabries should be entirely enclosed in the paper so long as a secure adhesion is obtained.—Patent completed.

3151 T. CLARK. *Improvements in the permanent way of railways.* Dated November 7, 1867.

In constructing the permanent way of railways where double-headed rails are used, the ends of the rails are usually cut off square, or at right angles to the length of the line of railway, so that the wheels pass suddenly from one rail to another, and an uneasy motion is the result. Now, according to this invention, the patentee cuts off the ends of the double-headed rails in a direction inclined to the length of the line of railway, and he connects the ends so cut off with fish-plates secured by bolts and nuts, and the fished joints so formed are placed intermediate of the chairs by which the line of railway is supported.—Patent completed.

3152 T. BLACKBURN. *Improvements in looms for weaving.* Dated November 8, 1867.

The nature of the invention consists, first, in certain improved combined letting-off and taking-up motions. Second, in certain improved modes of working the vibrator to slacken and tighten the warp. Third, in the application of an indicator to register the length of warp let off the warp beam. Fourth, in certain improvements in the taking-up motion; and, lastly, in covering the letting-off and taking-up rollers of the letting-off and taking-up motions above referred to with cloth prepared with a solution of india-rubber, or any preparation of india-rubber.—Patent completed.

3153 C. ANDERSON. *Improvements in apparatus for regulating or adjusting the position of endless travelling webs or bands employed in various kinds of machinery.* Dated November 8, 1867.

For the purposes of this invention a guiding roller, which is supported at each end on a framing having suitable bearings, is used; the web or band rests on and passes over this roller, and, when at work, gives it a revolving motion immediately underneath; and stretching across the web or band, but clear of it, is a rod which is supported at each end on small levers fitted to a stud on the framing or other suitable place; near the end of this rod is fixed a metal blade close to but clear of both edges of the web or band. The bearings of the conducting rollers consist of a box-shaped bracket with a brass brush fitted and working into it, so that it may slide either way by the action of a screw shaft fitted into the box bracket and passing through the under side of the brass brush. The screw shaft has bearings at each end of the box bracket, and has small bevel pinions keyed on each end on one side of the bracket, and towards each end are fixed round studs on which is fitted to run loosely bevel pinions gearing in to the wheels. The pinions on the side are cast with long square necks, and are kept in their places by cotters fixed on the end of the studs. On these square necks ratchet wheels are fitted with square eyes, and the ratchet wheels are connected by a suitable clutch to a double lever having a centre bearing on a stud, which is fixed vertically on a suitable projection cast or fitted on the centre of the box bracket. To one end of the double lever the wooden rod is fixed, and on the spindle of the conducting roller is fixed a bevelled plate. When the web or band is in its true position, the ratchet wheels are set so that they clear without touching the bevelled plate.—Patent completed.

3154 I. M'KIMM. *An improved apparatus for indicating horizontal, vertical, or any angular or inclined line, position, or surface.* Dated November 8, 1867.

This apparatus consists of a metallic base-plate which is truly bevelled, so as to be applied to any line or surface. At the central part of the metallic plate an upright projecting piece is situated, and through which a hole is formed to receive a circular stud, which can be rotated therein, the outer end of this stud carrying a box containing a spirit level, whilst to the opposite end an index plate is fixed. The extreme end of the stud on which the index plate is fixed has a screw formed on it over which a thumb nut is placed, and the body of the nut is made slightly conical so that the index plate may at any time be firmly fixed, and accurately adjusted thereon. The periphery of the index plate is cut with teeth, and a retaining catch or spring is fixed to the base-plate with a tooth on it, which fits into the spaces between the teeth on the plate, so that, by depressing the catch, the level may be shifted to occupy any angle in either a right or left-hand direction; a stop is also placed on the under side of the one end of the box containing the level tube, and its end rests upon an adjustable screw, so that the accuracy of the instrument can at any time be fixed by placing it on a level surface, and adjusting the screw until the level stands in a central position, whether the instrument be applied to a truly horizontal or truly vertical surface.—Patent abandoned.

3155 J. W. SMITH and T. PETITJEAN. *Improvements in warming, ventilating, and heating apparatus.* Dated November 8, 1867.

Provisional protection has not been granted for this invention.

3156 H. JEWITT. *A revolving apparatus for exhibiting figures and other objects in apparent motion.* (A communication.) Dated November 8, 1867.

This apparatus consists of a stand with a hollow central column in which revolves a spindle of iron or other metal. This spindle is screwed or otherwise fastened into a hollow cylinder of cardboard, tin, or other suitable material. Inside the said cylinder are placed sheets of paper having figures or other designs printed, drawn, or painted thereon; the said cylinder has slits or perforations around its circumference, and, on rotary motion being imparted thereto, the figures or other objects on the inside appear in apparent motion.—Patent abandoned.

3157 G. W. R. PIGOTT. *Improvements in covering wire with metal or other material.* Dated November 8, 1867.

This invention relates to means and apparatus for covering or coating wire with tin, zinc, or other suitable metal or material, when in a state of fusion or liquefaction. We cannot here quote the details of the invention. —Patent completed.

3158 S. LANDELLS. *Improvements in the manufacture of glass globes and other hollow forms for gaseliers, chandeliers, candles, lamps, and other similar purposes.* Dated November 8, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

3159 W. INGLIS. *Improvements in shaft couplings.* (A communication.) Dated November 8, 1867.

This invention has for its object the coupling together of lengths of shafting in an improved manner without rigidly bolting them to each other, but so as to form a strong and simple coupling possessing the peculiarities and advantages of what is generally known as a universal joint, and it consists in forming the end of each shaft, or a piece fixed thereon, with lugs or teeth projecting parallel to the shaft, and in placing angular or wedge-shaped blocks in the spaces which occur between the teeth when the two shafts are put together. The annular blocks may be held in position by means of an external encircling band or hoop and annular plates connected by bolts passing through the blocks, or in an equivalent manner.—Patent completed.

3160 P. H. NATHAN. *Certain improvements in printing or producing patterns or designs on woven fabrics.* (A communication.) Dated November 8, 1867.

Provisional protection has not been granted for this invention.

3161 T. WRIGLEY. *Certain improvements in the permanent way of railways.* Dated November 8, 1867.

This invention consists in the application and use of two plates, which are bolted to each side of the main rail, and which are each provided at the extremities near the junction of the rail with swellings or projections of semicircular form; two other plates are bolted to the switch rail, and the projecting ends are curved, so as to embrace, and partly encircle, the semicircular ends of the other plates, which constitutes a union similar to a "ball and socket joint," within which the rail and switch are grasped, and on which the switch moves; thus the switch is firmly held by the novel adaptation of fish-plates, and yet is capable of being moved from side to side on its joint or unions, and the plates being screwed closely to the rail and switch, no aperture is left for the accumulation of dirt and cinders, which often prevents the close contact of the switch with the rail.—Patent abandoned.

3162 S. A. KIRBY. *Improvements in paraffin and other lamps.* Dated November 8, 1867.

The object of this invention is to prevent overflow or leakage, and the inventor accomplishes this purpose by attaching the wick-holder and other part of the lamp to the reservoir in such a way that any drops of oil which escape during the burning of the lamp are carried back into the reservoir. This is done either by constructing the wick-holder and cap so that they shall not extend beyond and overhang the neck of the reservoir, or by forming the reservoir with a lip so constructed as to catch the said drops of oil.—Patent abandoned.

3163 W. CHIPPINDALE. *Improvements in apparatus employed in coupling railway carriages.* Dated November 8, 1867.

In the specification of a former patent granted to the present patentee, January 3, 1867 (No. 18), was described apparatus for acting on the coupling links of railway carriages by levers or handles placed at the sides of the carriages to render it unnecessary for men to stand between the carriages or between the rails when coupling-up or uncoupling railway carriages. The present invention has for its object the so constructing apparatus of this description that it may be made at a less cost, and also that it may allow of using the old coupling chains. In order to hook the coupling chain or link carried at the centre of the end of one carriage over the draw hook at the centre of the end of the carriage next to it, he now proposes to construct the apparatus in the following manner:—The coupling chain or link is carried by the draw-bat at the centre of the end of the carriage, as is usual; below the drawbar is carried a slide, capable of sliding lengthwise of the carriage, the end of this slide projecting beyond the carriage, and carries a short horizontal axis on which are formed two arms, which ordinarily hang down below the carriage; the lower ends of the arms are suitably formed for taking hold of the end link of the coupling chain. At a short distance below the horizontal axis above mentioned each of the arms has pin-jointed to it one end of a horizontal lever, and the se levers pass respectively, the one to one side and the other to the side of the end of the carriage. Near the side of the carriage each lever is carried by a bear, which forms the vertical pivot upon which the lever turns. These bearings are so formed as to allow of the levers being turned on their own longitudinal axis, and the levers at their outer ends are each formed with a cranked arm, by which they can be thus turned. When either one or the other of the levers is thus turned on its longitudinal axis, the arms hanging down from the central slide, and to which the levers are jointed, are raised to a horizontal position, and their ends carry with them the end link of the coupling chain. If the levers are then caused to turn on their pivots, the slide to which the inner end of the lever is jointed is slid forward and caused to project further from the end of the carriage. The arms carrying the end of the coupling chain are thus also moved away from the end of the carriage, and carry the end of the coupling chain over and beyond the draw-hook at the end of the next carriage. By then allowing the arms to turn downwards, the coupling chain will be hooked on to the draw-hook, and the coupling may afterwards be tightened by shortening the length of the drawbars of the carriages, as described in the specification before mentioned. The bearings which form the pivots of the levers are connected by links to the ends of the carriage, or are otherwise formed to permit of the levers being caused to move forward the slide to which their ends are jointed.—Patent completed.

3164 G. T. BOUSFIELD. *Improvements in machinery for setting types.* (A communication.) Dated November 8, 1867.

This invention is not described apart from the drawings. —Patent completed.

3165 J. E. CASTEX. *Improvements in harmonium-piano.* (A communication.) Dated November 9, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

3166 S. HALL and M. WHITTINGHAM. *Improvements in locks.* Dated November 9, 1867.

This invention is not described apart from the drawings. —Patent completed.

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3167 H. ELLIS. *Improvements in the manufacture of parasols.* Dated November 9, 1867.

This invention consists, principally, in manufacturing parasols with straight ribs, and in cutting the gores of the silk or material with which such parasols are covered with straight (instead of curved) sides, so that, when the parasol is opened, it presents the form of a flat disc, or a very slightly conical shape, instead of the ordinary mushroom or pagoda form.—Patent completed.

3168 E. B. WILSON. *Improvements in furnaces.* Dated November 9, 1867.

This invention is applicable to flued boilers, and to marine boiler furnaces. When altering a flued or Cornish boiler furnace, the inventor constructs a perforated brick arch at the higher part of the flue, with a space between the arch and the top of the flue for supplying the perforations with air; the air so supplied passes down on to and into the incandescent fuel. Or he constructs the arch with segments of fireclay perforated.—Patent abandoned.

3169 J. GRESHAM. *Improvements in, or applicable to, that apparatus known as Giffard's injector, and in the method of, and machinery or tools for, making the same.* Dated November 9, 1867.

These improvements relate, first, to a new combination and arrangement of the parts of injectors, by forming two screw threads upon the central spindle, one of which threads screw through a fixed part or collar, and the other into a screw thread formed in the interior of the ram or part to which the steam nozzle is attached, so that, by turning the central spindle a double adjustment is obtained, that is, by turning one way, the steam nozzle will be made in one direction to shut or reduce the water space, and the cone spindle will be made to move in the opposite direction, to open or increase the steam space, and *vice versa*, by turning the other way. Or, according to another arrangement, the screw threads upon the central spindle will act to cause both the steam nozzle and cone spindle to move in the same direction, to open and increase the spaces for water and steam, or diminish and shut these spaces. The screw threads in this case are arranged so that the spindle will have greater end movement than the steam nozzle. The two screws upon one spindle for the double adjustment of the spindle and steam nozzle are applicable to those injectors where the steam is admitted directly into the ram to which the steam nozzle is attached, also to those injectors in which the steam is first admitted into a pipe in which the ram for the steam nozzle slides, packing being used round the ram to prevent the passage of steam to the water space. The two screws upon one spindle for the double adjustment of the steam and water are also applicable, according to the invention, where the steam nozzle is fixed and the combining and receiving cones or nozzles are adjustable; motion is conveyed from the external screw upon the spindle by outside rods to the combining and receiving cones. By the improvements above described, both the spaces for water and for steam will be adjusted by turning one handle. The improvements under this head also relate to a mode of conveying steam to the moving external steam ram (carrying the steam nozzle) of an injector, and it consists in making a short branch from the moving ram, terminating in a line with the axis of the ram, and this termination of the branch passes into a steam pipe, through a stuffing box, which permits the movement of the ram. This part of the invention also relates to the arrangement and construction of injectors. It consists in dispensing with the central cone spindle adjustment, and in making the sectional areas for steam and water where they combine of an oval or oblong form (thus exposing more surface to the condensing action of the water), and in making the water space adjustable. This part of the invention also relates to the arrangement and construction of injectors without adjustment, for either the water or steam spaces, or with a simple adjustment for the water space, where the combining and receiving cones are formed solid with the body part of the injector, and the steam nozzle is formed by a pipe screwed in a flange and without a central cone spindle. This pipe is placed either in a line with the axis of the injector, or passing in from one side, being curved to cone into the axis of the injector. The invention cannot be fully described without reference to the drawings.—Patent completed.

3170 S. SIMON. *Improvements in the manufacture of aprons, bibs, and pouches, for the use of children and infants.* (A communication) Dated November 9, 1867.

This invention consists in making aprons, bibs, and pouches, for the use of children and infants, of leather or American leather cloth, or other like impervious and damp-resisting materials or fabrics.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated March 2, 1868.

704 H. Wilson, Stockton-upon-Tees, Durham. Improvements in meters, valves, and cocks, for measuring, regulating, and discharging liquids, gases, and fluids.

Dated March 16, 1868.

889 F. H. and C. A. Elliott, Strand, opticians. Improvements in telescopes. (A communication.)

Dated March 21, 1868.

960 I. S. Lister, Laurence Pountney-hill, City. Improvements in hats and other coverings to the head, to obtain ventilation and comfort in wear. (A communication.)

Dated March 24, 1868.

1004 R. Smith, jun., Belper, Derbyshire, miller. Improved apparatus or machinery for scouring and hulling grain and seeds.

1005 M. P. W. Boulton, Tew Park, Oxfordshire, and J. Imray, Westminster Bridge-road, Surrey, engineer. Improvements in means and apparatus for effecting aerial locomotion.

Dated March 25, 1868.

1010 A. B. Wollaston, Chislehurst, Kent, merchant, and F. Stanbridge, Llangarron, Herefordshire, farmer. Improvements in the treatment of mixed fabrics, and in the separation of wool from cotton and other substances contained therein.

Dated March 27, 1868.

1046 S. Holman, Laurence Pountney-lane, City, engineer. Improvements in the construction and application of steam pumps, parts of which improvements are also applicable to other pumps, blast engines, exhausters, and other machines, also improvements in hydraulic lifts, and the mode of working the same.

Dated March 31, 1868.

1092 J. Lent, Berlin, Prussia, engineer. Improvements in electric telegraphs, and in apparatus connected therewith.

Dated April 4, 1868.

1145 C. E. Turnbull, St. Paul's-crescent, Camden-square, Middlesex. Improvements in paper binders or eyelets, and in means or apparatus for fixing together papers and other articles by means of such and other paper binders or eyelets.

Dated April 11, 1868.

1216 A. Barclay, Kilmarnock, Ayrshire, engineer. Improvements in apparatus to be used in condensing steam in steam engines, applicable also to other purposes.

Dated April 13, 1868.

1220 R. Ridley, Birmingham, engineer, and J. Rothery, Waterloo Main Colliery, near Leeds, colliery viewer. Improvements in machinery or apparatus for getting and hewing coal, stone, and other minerals.

Dated April 16, 1868.

1244 C. Burns, Middle Scotland-yard, Westminster. An improved mode of, and means for, propelling or shunting carriages and goods trucks on locomotive railways, and especially at railway stations.

1246 E. A. Morgan, Paisley, Renfrewshire, thread manufacturer. Improvements in the manufacture of the glass rings employed in spinning, twisting, and thread making machines of the class commonly known as ring and traveller throstles.

Dated April 22, 1868.

1313 T. L. Scowen, Allen-road, South Hornsey, Middlesex. An improved method of fastening the button boot without the use of button-holes.

Dated April 24, 1868.

1342 T. T. Macneil, Cockspur-street, Charing-cross. Improvements in apparatus for indicating the distances travelled by cabs and other vehicles, also applicable to the indicating of the fares payable for the distance travelled.

1344 J. R. Johnson, Red Lion-square, Middlesex. Improvements in repeating firearms.

1346 D. C. Lowber, Southampton-buildings, Chancery-lane. An improved wire tie for securing bales of cotton or woollen goods and other merchandise.

1349 J. Wetherilt, Chapel-street West, Mayfair, Middlesex, ironmonger. Improved apparatus for scoring or marking at billiards or other similar games.

1350 W. H. Ryland, Birmingham, manufacturer and factor. Improvements in fastenings for articles of dress and jewellery.

1351 J. Dewar, Kirkcaldy, North Britain, doctor of medicine. Improvements in making and preserving manure.

1352 W. Bartram, Sheffield. Improvements in the manufacture of cartridges.

1353 W. Bartram, Sheffield. Improvements in apparatus for filling, closing, and re-capping cartridges.

1354 G. A. Welch, Sydenham, Kent, Paymaster Royal Navy. Improvements in apparatus for the preservation of life and property at sea.

1355 J. Bernard, Salisbury-street, Strand. Improvements in preparing and dressing ores and minerals, and in the machinery or apparatus employed therein.

Dated April 25, 1868.

1356 T. F. Cashin, Sheffield. Improvements in apparatus for actuating and regulating the working of railway signals and the points and switches of rails (a part of which is applicable for other purposes), and also in the mode of fish-jointing rails.

1357 W. N. Hutchinson, Wellesbourne, Devonshire, Lieut.-General in her Majesty's Army. Improvements in apparatus for receiving and absorbing or checking the recoil of ordnance.

1358 G. Marson, Eagley, Lancashire. Certain improvements in the method of, and means for, retaining the outer ends of tapes, ribbons, and other similar narrow fabrics and paper.

1359 J. Craven, Thornton, Yorkshire, shawl manufacturer. Improved means or apparatus for producing the barrel fringe or tassel fringe on shawls.

1360 J. and R. Holding, Wheelton, Lancashire. Improvements in heald employed in looms for weaving.

1361 P. Spence, Newton Heath, Manchester, manufacturing chemist. Improvements applicable to the purification of gas used for illumination.

1362 A. W. Pocock, Pimlico. Improvements in working valves of steam and other engines.

1363 R. Cocker, Cockspur-street, Charing-cross, Westminster, publisher of the "Scientific Review and Journal of the Inventors' Institute." Improvements in purifying, seasoning, and preserving wood, and making it water and fireproof. (A communication.)

1364 C. Drake, Renfrew-road, Kennington. Improvements in constructing concrete buildings, and in apparatus used therein.

1365 A. M. Clark, Chancery-lane. Improvements in steam generators and furnaces. (A communication.)

1366 A. Parkes, Birmingham. Improvements in the manufacture of varnishes.

1367 J. Atkins, Birmingham, merchant. Improvements in ornamenting sheets or plates of metal.

1368 T. Pemberton, brass founder, and T. Hughes, brass finisher, Birmingham. Improvements in supports for fire-irons.

1369 F. C. Hills, Chemical Works, Deptford, Kent. Improvements in the manufacture of gas, and in the purification of gas liquor, and in utilizing gas, tar, and crude hydrocarbon oils, and in furnaces for effecting the combustion of the said gas, tar, or hydrocarbon oils.

Dated April 27, 1867.

1370 E. P. H. Vaughan, Chancery-lane. Improvements in telegraphy, and in the construction and arrangement of apparatus for communicating signals and intelligence. (A communication.)

1371 J. Hepworth, Wakefield, boiler maker, and G. W. Payldon, Calder Grove, near Wakefield, Yorkshire. Improvements in boilers and furnaces.

1372 S. Tidmarsh, Birmingham, manager of works. Improvements in locks.

1375 P. Nisser, Minories, City. An improved explosive compound or safety blasting powder.

1376 K. V. Barnekov, Newburgh, New York, U.S., civil engineer. Improvements in breech-loading firearms.

1377 H. Chaytor, Witton Castle, near Darlington, Durham. Improvements in the rolling stock of railways.

1379 L. Perkins, Seaford-street, Gray's Inn-road, engineer. Improvements in the manufacture of wrought metal wheels.

1380 J. Scofforn, New North-street, Finsbury, M.B. Improvements in sheathing ships' bottoms, and other surfaces exposed to the action of sea water.

1381 L. Perkins, Seaford-street, Gray's Inn-road, engineer. Improvements in tubular steam boilers.

Dated April 28, 1868.

1382 E. M'Donnell, Wallington Lodge, Fareham, Hampshire, civil engineer. An impervious concrete or cement.

1383 J. Pearson, jacquard harness maker, and M. Pearson, overlooker, Thornton, Yorkshire. Improvements in jacquard engines.

1384 G. T. Bousfield, Loughborough Park, Brixton, Surrey. An improved manufacture of hair seating, and for improvements in the mode of seaming or joining hair seating and other woven fabrics with a hair face, and strengthening the goods, and facilitating the upholstering of the same. (A communication.)

1385 G. A. Cox, Lochee, Dundee, Forfarshire, jute and flax spinner. Improvements in carpets, sackings, checks, bed-ticks or ticklings, and other similar textile fabrics.

1386 A. Jack, jun., Maybole, Ayrshire. Improvements in reaping machines.

1388 A. Dietz, New York, U.S., glue manufacturer. An improved method or process of treating or preparing and refining glue.

1389 H. Waugh, Whitefriars, City, civil engineer. Improvements in apparatus for screening or separating grain, seed, and other matters.

1390 W. Whitworth, Leeds, machine maker. Improvements in sewing machines.

1391 E. A. Rippingille, Holborn-hill. Improvements in obtaining motive power, and in means or apparatus employed therein.

1392 J. Bottomley, Laister Dyke, Yorkshire. Improvements in umbrellas and parasols, and in appliances to be used in connection therewith.

Dated April 29, 1868.

1393 G. B. Babacci, Florence, Italy. Improvements in gas engines.

1395 J. Gray, Glasgow. Improvements in coatings or coverings for preventing the fouling to which ships and other structures are liable in sea water.

1399 C. D. Fox, Spring-gardens, Middlesex. Improvements in machinery for nicking and dressing the heads of screw planks. (A communication.)

1401 J. J. Long, Glasgow. Improvements in machinery, processes, and apparatus to be used in the manufacture of matches and other similar articles.

1402 J. M'Kean, Walmer Bridge, Lancashire, manufacturer, and J. Stenhouse, Rodney-street, Pentonville, Middlesex, chemist. Improvements in the manufacture or preparation of materials for sizing or dressing yarns and textile fabrics.

1403 H. Deacon, Appleton House, Appleton, Lancashire, alkali manufacturer. Improvements in the manufacture of chlorine.

1404 R. Scott, Edinburgh. Improvements in apparatus for dressing millstones.

1405 J. H. Johnson, Lincoln's Inn-fields. Improvements in preserving meat and other animal matters. (A communication.)

1406 R. Heathfield, Birmingham, manufacturer. Improvements in machinery for the manufacture of cut nails. (A communication.)

1407 A. Homfray, Witley Lodge, Halesowen, Worcestershire. Improvements in the manufacture of iron or steel shackles, swivels, hooks, slips, and other kinds of iron or steel fastenings welded into an eye shape, and in machinery to be used in the said manufacture, which improvements are also applicable to the manufacture of the tyres of wheels.

Dated April 30, 1868.

1410 W. Ferrie, Monkland Iron Works, Lanarkshire. Improvements in blast furnaces.

1414 J. H. Cassell, Burdett-road, Limehouse, Middlesex. Improvements in sheathing iron ships.

1420 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for spinning fibrous materials. (A communication.)

1422 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of gelatine. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated May 6, 1868.

1485 A. C. Henderson, Charing-cross. Improvements in the mode of manufacturing albumen, and in the apparatus connected therewith. (A communication.)

Dated May 11 1868.

1538 J. B. Kingham, Dorchester, Norfolk county, Massachusetts, U.S. Improvements in nail machines.

1539 A. Holbrook, jun., Lynn, Essex, Massachusetts, U.S. A machine for sewing books.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," May 19, 1868.

38 G. Platts, W. Tate, and W. H. Bailey. Apparatus for laying fog signals on railways.

42 J. R. T. Mulholland. Bobbin holder.

43 J. Combe. Machinery for balling yarn.

52 J. Maury. Connecting the ends of metallic strap applied to bales of cotton.

53 W. T. Tongue. Lamps.

55 G. Smith. Apparatus for lubricating machinery.

56 J. B. Dunn. Buckle or tie for connecting the ends of metallic straps applied to bales of cotton.

61 J. L. Norton and W. H. Bailey. Apparatus for indicating the fluctuations of the pressures of liquids.

64 P. Spence. Roasting copper and other ores containing sulphur.

73 W. H. Bailey and J. W. Lowther. Lubricating tallow cups.

75 R. Girdwood. Bags for transmitting samples by post.

81 J. Petrie. Brats or travelling surfaces for conveying wool out of washing machines.

86 C. H. Newman. Manufacture of unfermented malt liquors.

87 S. G. Archibald. Preparing tablets for receiving writing.

90 O. H. M'Mullen. Mashing machine.

93 J. H. Glew. Manufacture of boots and gaiters.

101 C. S. Lennon. Shirt fronts.

105 W. W. Hooper. Apparatus for giving signals on board ship.

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121 W. E. Gedge. Breech-loading firearms. (A communication.)
125 J. C. Ramsden. Mechanism of looms for producing a certain class of fancy fabrics.
129 W. E. Gedge. The substitution of thin movable blades of sheet steel in lieu of rigid blades in planing machines. (A communication.)
133 D. Hodgson and J. Dodd. Machinery for cutting grass.
181 H. A. Bonneville. Ribbon looms. (A communication.)
225 C. E. Brooman. Mode of producing a colouring matter. (A communication.)
227 C. E. Brooman Extracting colouring matter from madder. (A communication.)
288 H. A. Bonneville. Ribbon looms. (A communication.)
291 C. E. Brooman. Manufacture of candles. (A communication.)
295 T. Corbett. Machinery for cleaning grain.
318 J. H. Johnson. Disintegrating raw wool. (A communication.)
323 H. Aland. Rotary blowing fans.
422 W. R. Lake. Locks. (A communication.)
473 A. F. Bayford. Apparatus for facilitating the watering of plants.
536 W. E. Newton. Material for the base of artificial teeth. (A communication.)
788 J. Campbell. Floating docks.
943 H. Chamberlain, J. Craven, and H. Wedekind. Burning bricks. (Partly a communication.)
1030 M. B. Orr. Apparatus for drying animal substances. (A communication.)
1229 A. and L. Braham. Hats.
1256 W. Gorman. Manufacture of iron and steel.
1337 J. Casson. Machinery for sawing wood.
1351 J. Dewar. Making manure.
1358 G. Marson. Means for retaining the outer ends of tapes.
1364 C. Drake. Constructing concrete buildings.
1369 F. C. Hills. Manufacture of gas.
1402 J. M'Kean and J. Stenhouse. Preparation of materials for sizing yarns.
1405 J. H. Johnson. Preserving meat. (A communication.)
1434 H. A. Bonneville. Measuring the flow of liquids. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the lis of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed May 15, 1868.

3255 R. W. Pearse
3257 J. M. Napier
3265 E. T. Hughes
3266 W., J., and J. Busfield
3270 G. Fitt
3272 T. Wood
3279 A. Barclay
3282 W. H. Richardson
3290 W. Brewster
3323 W. Mort
3378 J. M. Napier
3428 R. Porter
299 R. J. Moser
332 J. Thompson

Sealed May 19, 1868.

3281 C. Mole
3284 H. H. Lloyd
3286 J. Oppenheimer
3287 H. Greene
3288 Baroness C. de Lavenant
3291 L. B. Joseph
3293 W. R. Lake
3295 J. Townsend
3299 W. R. Green and J. G. Freeman
3300 W. Blundell
3311 A. Munro
3312 G. Welch
3314 G. D. Hughes
3318 P. Salmon
3320 W. Macnab
3332 R. Ward
3342 C. E. Penny
3343 J. A. and J. Hopkinson
3348 C. T. Higginbotham
3357 A. M. Clark
3379 E. Wood
3380 J. R. Pratt
3392 W. C. Houghton
3396 A. M. Clark
3402 W. Starkey
3489 W. Clissold

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1322 W. Chubb and S. Fry
1341 W. Deakin and J. B. Johnson
1357 R. Leddicoat
1371 W. Manwaring
1387 A. V. Newton
1392 W. E. Newton
1449 G. Elliot and R. P. Clark
1665 W. Clark

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1225 J. and J. Bullough
1226 G. S. Goodall
1253 D. K. Clark
1261 A. Allan
1275 J. Hughes
1295 T. Aveling and H. Rawlinson
1356 W. Bywater

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending May 16, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2584	0 4	2763	0 8	2799	0 8	2824	0 4	2837	0 8	2864	0 4
2698	1 4	2767	0 8	2800	1 4	2825	0 4	2841	0 10	2865	0 4
2714	0 8	2777	0 8	2806	0 4	2827	0 4	2842	0 10	2866	0 4
2726	0 4	2777	0 8	2807	0 6	2828	0 4	2843	0 4	2869	0 4
2747	0 10	2780	0 10	2808	1 0	2829	0 4	2844	0 4	2872	0 4
2752	0 10	2785	0 6	2812	0 4	2830	0 4	2845	0 10	2875	0 4
2754	0 8	2786	0 4	2814	0 4	2831	0 4	2846	0 10	2876	0 4
2756	0 8	2787	0 6	2815	0 4	2832	0 4	2852	0 10	2898	0 10
2758	0 10	2791	0 10	2816	0 4	2833	0 4	2856	0 4	2804	0 4
2759	0 4	2791	0 8	2819	0 4	2834	1 0	2858	0 4	2907	1 0
2760	0 10	2791	0 6	2823	0 4	2836	0 4	2862	0 4		

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

WOOD BROTHERS'
PATENT OBLIQUE TRANSVERSE TUBES
For the Flues of Cornish Steam Boilers.

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FOR PRICES, AND A LITHOGRAPH OF THE BOILERS, APPLY TO

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For Horizontal Cylinder Fixed Engine, THE FIRST PRIZE OF £20.
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Ports of Shipment, in the Firth of Forth.
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This invention saves 75 per cent. in oil.
It is generally adopted for shafting, &c.
It supersedes all others at any price.
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Kingston India-rubber Mills, Bradford, Wilts. A 34

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GALVANIZED OR LEAD SERVICE PIPE, BRASS BALL VALVES, ETC.
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With Planed Iron Beds, Standards, Turned Flywheel, Hand Rest, Chucks, Crank, Treadle, &c., complete, 3in., 4in., 5in., and 6in. centres. Illustrated Lists, two stamps.
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GOLD MEDAL
PARIS, 1867.
—o—
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STEEL
AND
STEELWARE,
FILES,
TOOLS,
SAWS. A 13

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, MAY 29, 1868.

THE NAVY ESTIMATES.

THE vast importance of this subject is a sufficient reason for our again calling the attention of our readers to what the Admiralty propose to do during the present year. In January last, we expressed a hope that double the sum would this year be appropriated to the construction of ironclad ships than was last year devoted to that purpose. Our hopes have not been fully realized, although a considerable stride has been taken in the direction we indicated. Mr. Corry stated in his speech that "it was the unanimous opinion of his colleagues and himself, that as large an amount as could possibly be spared from the other departments of the naval service, having due regard to their efficiency, ought to be appropriated to the construction of armour-plated ships." It is well known that this determination was not the view of the Admiralty when the Navy Estimates were first framed. On the contrary, it was the speech of Mr. Gregory, President of the Institution of Civil Engineers, that goaded the Admiralty to save on other votes and spend on ironclads. Mr. Gregory stated that less than one-twelfth of last year's money was so spent, and urged a great change in this respect this year, and he was unanimously supported by the press of the country. This is why more is to be expended this year in really strengthening our navy, and there is no other reason.

With reference to Mr. Corry's remarks about the "Inconstant" and "Volage," he seems still to take credit for building a second "Volage," in preference to a second "Inconstant," owing, no doubt, to the fact that the "Volage" is only half the tonnage of the "Inconstant." But the recent highly-successful trials of the American "Wamponoag"—a ship very much larger than the "Volage," and not very far short of the "Inconstant" in point of size—must have raised in the minds of many persons very grave doubts as to the wisdom of the change. We do not wish to say one word against the "Volage" and "Active"; they are, no doubt, exceedingly promising vessels, and will attain a very high speed for their tonnage. But the great object of these vessels unquestionably was to surpass, both in speed and in armament, the long American unarmoured ships, of which the "Wamponoag" is a specimen, and we have not the slightest hesitation in predicting that, while the "Inconstant" class will accomplish this object, the "Volage" will not. There is no comparison between the armament of the two ships, and no one who knows how much easier it is to get speed with a large ship than with a small one can doubt that the speed of the "Volage" will fall greatly short of the "Inconstant." It will probably be a year hence before either ship is tried, but when the trials have taken place we shall expect to find that this feature of Mr. Corry's management has given but little satisfaction. The difference between the "Druid" and "Briton" and the "Blanche" class is so small—consisting only of the addition of a few feet of length to enable a few more guns to be carried—that it is unnecessary to dwell upon it. It may be worthy of remark, however, that the estimates and policy of the Government point clearly to the fact that the "Druid" will be the last war ship built at Deptford. If the Government had intended to continue building there, the present year's programme must have been extended, for no provision is made in the Estimates for laying down any further vessels.

Much criticism has taken place respecting the design of the "Invincible" class, and whatever may be the merits or defects of that design, they will be mostly repeated in the "Iron Duke." It will not be too ungracious, perhaps, if we say that it is not at all impossible that the opposition to the "Invincible" class is largely due to the fact that the all-round fire of its upper deck battery has excited the jealousy of the turret advocates, for it cannot be denied that the "Invincible" will, and the "Captain" will not, have at least one heavy gun raised high above the sea, and protected by armour, capable of being directed to every point of the horizon. It would appear from the description given by Mr. Corry that the "Swiftsure" and "Triumph" are intended for a somewhat different service to that for which the "Inconstant" class is designed, since, while resembling them in their general dimensions, their armour, and their armament, they differ from them in having single lifting screws, and also in having their iron bottoms sheathed with wood and copper. These two facts taken together would seem to point to the use of the "Swiftsure" and "Triumph" for distant foreign service, while the "Invincible," "Audacious," "Vanguard," and "Iron Duke" (which are all exactly alike) are no doubt more particularly intended for European service. The question may nevertheless be raised whether it would not have been better to give the whole of these ships the advantages of a clean bottom and a lifting screw; and we are the more disposed to raise this question seeing that the whole of the six ships have been, as we have taken pains to ascertain, furnished with a spread of canvas unusually large for ironclad ships. A great misapprehension prevails respecting the upper deck battery of these six ships. It is commonly represented as overhanging the full breadth of the ship, like a paddle-steamer's sponson, and, consequently, the guns are said to be far removed from the centre of the ship, and subject to enormous motion when the ship is rolling. Now, neither of these representations is correct. The battery undoubtedly projects beyond the upper deck, but then the side of the ship is curved inwards to such an extent (as in the old French "Canopus" line-of-battle ship, and in Admiral Paris's designs), that in point of fact the very outside of armour of the battery is within the breadth of the ship at the waterline; and, as the ports are in the inclined 'thwartship bulkheads, the port pivots, and therefore the guns, are actually much nearer the middle line of the ship than they would have been had the side gone up straight, or with an easy curve, in the usual manner. These guns will therefore be practially steadier in a sea-way than the upper deck guns of an ordinary ironclad.

The "Sultan" is obviously another "Hercules," but with this difference, that her right aft fire is to be obtained from the upper deck by means of a projecting battery very much like that just described for the "Invincible" class. The only other important ships proposed to be built this year are the "Glatton" monitor and the ram "Hotspur," both of which are of novel construction, and will therefore be dealt with in a future article. Meantime, we have seen sufficient to show, first, that the naval policy of the Government has been materially modified by public opinion; and, secondly, that the development of that policy will still require to be carefully watched by ourselves, and other organs of similar views.

ALLOYS AND QUASI ALLOYS.

WE have noticed from time to time various mixtures or alloys of metals which have been brought forward as likely to be useful in manufacture. Some of them no doubt true alloys, but most of them simple mechanical mixtures. There seems to be a good deal of confusion in the notions of most people as to what is an alloy and what is not. To many a simple mixture of metals is an alloy, whether there be any chemical combination or not, or rather whether there be a perfect chemical combination or not. Any two metals that will enter into combination when melted together will certainly unite to a certain extent whether they be melted together in proper proportions or not. But then, if one of the constituents predominate over the other, the excess will remain in a free state. We noticed two of these so-called alloys of lead and tin lately, where the mixture had to be continually stirred till it was cool to prevent the precipitation of the free lead on account of its greater specific gravity. No doubt these were alloys to a certain extent, and in both of the mixtures the alloys may or may not be the same, according to circumstances, tin being capable of uniting with some other metals in four different proportions, but only in two with lead.

It is surprising how few really valuable alloys we possess; one may count nearly all of them on the fingers, so few alloys are malleable. For castings many others can be used, but they must be true alloys, otherwise the free metal will tend to separate itself from the other portion of the mixture and so spoil the casting; we have seen this result frequently, and especially with lead and zinc. Tin is a metal which will alloy with almost every other metal, and would indeed be a valuable constituent of various alloys if it were not for the property it has of making nearly all the compounds it enters into crystalline—consequently brittle. The only exception that we at the present can call to mind, are the alloys of tin and lead. We do not consider gun metal a true alloy of copper and tin, but simply an alloy of tin and copper in an excess of copper; but this is the most valuable quasi alloy we possess. The normal alloy of copper and tin is very brittle, the proportions of each are nearly equal, the copper being a little in excess of the tin, tin being tetratomic and copper biatomic. When electro-plating was discovered, brass and copper were the principal metals used as the bases of the articles which were manufactured to be plated, these being in use for the old close plating process.

But a new basis was desired more nearly the colour of silver with which the articles were to be covered. Naturally, attention was directed to the alloy called German silver, which already existed, but was not much known or used. This is a triple alloy of zinc, copper, and nickel, and the proportions for the best qualities are 50 copper, 30 zinc, and 20 nickel. For a true alloy, if nickel be biatomic, the proportions 50 copper, 26 zinc, and 24 nickel would be nearer the true equivalent ratios. But if nickel be tetratomic, as it is now believed by some, the proportions will be 34 copper, 35 zinc, and 31 nickel. Very little German silver in commerce is really a true alloy, and most of it contains but a small proportion of nickel; in fact, much of the metal going by that name is little better than highly speltered brass. The reason of this is that nickel is comparatively a dear metal, the pure being 6s. or 7s. a pound and the crude 3s. or 4s.; so that an alloy using even the crude metal cannot be produced under 2s. 6d. a pound, if nickel be biatomic: but what is called good German silver can be bought for 1s. 5d. a pound. For electro-deposit the true alloy is much superior to the metal found in commerce, a sound deposit is much more easily obtained upon it, and it is much more easily cleaned; but labour is cheaper than nickel.

Many fancy names have been given to this alloy, such as nickel silver, electra, &c. There can be no doubt that true alloys are real chemical combinations, for the alloy of two metals seldom exhibit the properties of the two metals composing it, but have dis-

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tinctly new properties. Alloys may be harder than either of the metals composing it, and may be denser than the mean of the densities of the two metals; moreover, its melting point may be higher or lower than either of them. Much has been done in finding out good alloys for various manufacturing purposes, but it has been done by mere blind groping; but let an alloy be considered to be a chemical compound, then it will be possible to see theoretically what combinations may or may not be attempted with any likehood of producing a true alloy. Not that its properties can be predetermined, but, whatever these properties may be, it will be known that they will be constant, which is not the case with our present alloys; scarcely two meltings have precisely the same colour or hardness, or, in fact, any of their properties.

CONVERSAZIONE OF THE INSTITUTE OF CIVIL ENGINEERS.

IF any doubt were entertained of the inadequacy of the Institution building in Great George-street to meet the demands upon it for space, it would have been put to flight on Tuesday evening, at the conversazione given by the President, Charles Hutton Gregory, Esq. The rooms and theatre of the Institute were thronged from first to last with a distinguished company, the attendance being more numerous than ever, and, so far, the gathering was a great success. But the wedge and crush was occasionally uncomfortably inconvenient, notwithstanding that Mr. Forrest had done his best to arrange the models, &c., so as to occupy the least possible room. And this led to another practical evil; the models and apparatus were crowded into each other, and, in some cases, were entirely hidden from view. For example, an interesting collection of iron and steel samples, which had undergone testing by Mr. Kirkaldy, who sent them for exhibition, were obliged to be placed under a table. Many other drawbacks there were of a similar character, which the executive are powerless to deal with; indeed, the wonder is, that, considering the want of space, they managed so well as they did. And not only to such exceptional evenings as last Tuesday do these remarks apply, for often on the ordinary meeting nights is the lecture theatre inconveniently filled. However, we congratulate the Institute on the circumstance of these crowdings; they show a healthy and expanding condition. We also congratulate the members upon the fact that arrangements have been made to enlarge the theatre to about double its present area, and, we believe, the opening meeting of the next session will take place in the enlarged hall.

We have said that Mr. Gregory had a brilliant reception. In proof of this we append a few names from the eight hundred and odd gentlemen who honoured the president's invitation. Of course, all the leading members of the profession were there, and amongst the visitors we noticed Professor Abel, Captain Arron, General Balfour, Admiral Sir E. Belcher, Dr. Billing, Mr. E. Bowring, C.B., Captain Burstal, Mr. P. H. Calderon, R.A., Colonel Campbell, R.A., Mr. E. Chadwick, C.B., Lord Alfred Spencer Churchill, Admiral Collinson, Mr. S. Cousins, R.A., Mr. E. W. Cooke, R.A., General Millans del Bose, Professor Donaldson, General Dunn, Mr. W. P. Frith, R.A., Mr. Glaisher. Dr. Granville, Earl Grey, Sir George Grey, Bart., M.P., General Hay, Lord Headley, Major Honchen, B.S.C., Field-Marshal Lieutenant Baron Jochmins, Mr. E. K. Karslake, M.P., Mr. Commissioner Kerr, Mr. Charles Landseer, R.A., Sir Charles Lanyon, M.P., Bishop of Limerick, Sir Arthur Mackworth, Bart., Alderman Sir F. G. Moon, Bart., Professor Partridge, Dr. Percy, Mr. H. W. Phillips, Dr. Quain, Lord Redesdale, Mr. Samuda, M.P., Mr. Warington Smyth, Mr. Lumb Stocks, A.R.A., Sir Henry Thompson, General Tremenheere, Mr. C. V. Walker, General Geddes Walker, Sir Thomas Watson, Bart., Mr. Westmacott, R.A., Lord Justice Page Wood, Mr. Basil T. Wood, M.P., Mr. Wyon, &c., &c.

Turning from the company to the objects of art and science exhibited, we will first notice the patent hydrostatic sluice gate, invented by Mr. W. Edwards, C.E., Mysore, P.W.D., and exhibited by Messrs. Turner, of the St. Peter's Ironworks, Ipswich. This apparatus consists of a gate made in wrought or cast iron, having a ram or plunger attached to each end of the upper cross piece, working in upright cylinders, the forcing of water into which, by means of a small force pump raising the gate, which shuts against a frame, composed of two uprights attached to the cylinders, and a sill upon which they stand. It is kept in position when up by a pair of vertical guides, mounted on the heads of the cylinders. Two graduated scales made in brass are fixed to the guides, divided into feet, and 100 parts of a foot; a vernier attached to the gate points to one scale, showing the lift of the gate in feet and decimals; the other scale is read by a vernier attached to a float, thus indicating the depth of the water-head with the same accuracy. The quantity of water, in cubic feet, discharged per minute by the sluice may—with the aid of hydraulic tables—thus be correctly ascertained. The working model showed the apparatus to be simple in construction, the gate itself being the only moving part except the pump, and thus not liable to be out of repair. The pump is placed in an iron box, which may also contain the regulating cocks, for adjusting the rise and fall of the gate, these being kept under lock and key. The supply can only be regulated by the officer in charge, who would have possession of the key.

Close by this sluice gate was Mr. Latimer Clark's pneumatic apparatus for signalling in trains, the tubes of which were laid completely round the hall. Mr. Clark's principle of pneumatic communication is very simple. A pair of circular bellows, or, for greater durability, a pump, is placed under the tender of the engine, the piston of which is kept working slowly as long as the train is in motion, being actuated by a crank and pulley, with a strap working round the axle of one of the wheels. This pump has ordinary india-rubber valves, and is connected to an exhaust tube, about the size of the finger, which runs beneath the carriages the whole length of the train, its extreme end in the hinder guard's van being closed by a plug; the pump exhausts the air from this tube (as long as there is any air in it), and at every stroke forces it out through a whistle which is fixed on some part of the engine or tender near the ear of the driver. A tap is provided in each of the guards' vans by which they can at will admit air into the pipe and cause the whistle to sound; and a modified form of the same arrangement is provided in every carriage; this constitutes the whole apparatus. When the train starts, the pump at first causes the whistle to sound, but after a few strokes the pump soon exhausts all the air from the closed tube, and although it continues to work, it cannot eject any more air, and can no longer blow the whistle, which necessarily, therefore, remains silent throughout the rest of the journey. But at any moment, while the train is in motion, if one of the guards wishes to call the driver's attention, he has only to open the tap which communicates with the exhaust tube beneath his van, and the air being thereby admitted, the whistle on the engine will begin to sound violently, and will continue to do so until the driver's attention has been obtained. The guards may also, if necessary, give special signals to the engine driver by opening their tap once, twice, or thrice.

Passengers may also make a communication to the driver; but the arrangement is such, that having once opened the communication they cannot close it again, and the whistle will continue to sound until the train stops, the driver acting as circumstances seem to require, and slackening speed, or stopping at once, or at some neighbouring station, at his discretion. In the event of a signal being made by the passengers without any obvious reason, he would probably signal to the guard by his steam-whistle, so that all parties might remain on the *qui vive* until their arrival at the next station, where a glance along the train at once discloses the carriage from which the signal proceeded. The accidental separation of a portion of a train, and especially of a heavy goods train, is a not unfrequent accident, and it sometimes happens that the driver proceeds a considerable distance before he discovers the separation. There is much loss of time, and some danger, in backing to seek the hinder portion of the train, especially if the accident occur in a tunnel or on a dark night, as the detached portion, although showing no visible light, may continue in motion for a long time before the guard becomes aware of the separation. All risk from this cause is obviated by the use of these signals; for if any portion of the train becomes separated, the whistle gives instant alarm, and the driver has time to warn the guard by his steam-whistle before any danger can ensue. Those of our readers who wish to go into the details of Mr. Clark's apparatus will find it fully described and illustrated in the MECHANICS' MAGAZINE for January 17 last. We may add that this system is now in operation on the London, Chatham, and Dover Railway.

Amongst the objects of telegraphic interest we noticed a well mounted selection of submarine cables, now being manufactured at the India-rubber Company's Works, at Silvertown. Amongst them were the three varieties of the present Cuba cable, shortly to be submerged between Havana and Key West. The main cable weighs three tons and the shore end about twenty tons per mile. All of them were well protected with Clark's bituminous compound. There were also specimens of cables now being manufactured for the Electric and International Telegraph Company, to be laid in the North Sea. The main cable weighs about ten tons and the shore end about twenty tons per mile; both are covered with hemp protected by bituminous compound, and are splendid specimens of heavy shallow water cables. This cable consists of four conductors, and the insulation of this, as well as of the Cuban, is higher than previous cables. These specimens were exhibited by Mr. G. E. Preece, who also showed some varieties of the new American insulator—Brooke's paraffin—now so much used. Electricity was well represented by Mr. Apps and Mr. Ladd, the former of whom exhibited his inductorium, which attracted much attention from the thickness and extreme rapidity of the discharges. Mr. Ladd showed his dynamo-magneto machine, which was also a centre of attraction for electricians. Dr. Guthrie sent his voltastat and voltameter, which is an instrument for regulating and measuring the force of a galvanic current. This ingenious apparatus will be fully described and illustrated in our next.

Mr. Laidlaw exhibited his patent pump or exhaust, which is small and compactly arranged. It has two rotary cylinders, and there is an entire absence of any leather, so that no damage arises from pumping water containing gritty substances. The small pump we saw was capable of pumping from 1,500 to 1,800 gallons per hour to any required height, and of draining from a depth of from 15ft. to 20ft. There were several steam pumps and donkey pumps by various

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makers, and amongst others that of Mr. Waygood, which we describe and illustrate in detail on another page. There were also Messrs. Kittoe and Brotherhood's patent paragon steam pump for feeding boilers, &c., and a pump for the same purposes, by Mr. Davey, who also exhibited his isochronal governor, particulars of which will be found at page 144 of our issue for February 21 last. Messrs. S. Owens and Co. sent one of Mr. Bernay's centrifugal pumps, which are deservedly coming largely into use, and with which most of our readers are well acquainted through our columns. We, therefore, need only add that the construction of this pump is such that the revolving fan is entirely relieved from the pressure of the column of water on its outer surface. Hence we get a reduction of friction, wear and tear, and the absorption of less power. Mr. A. Jackson sent a compact arrangement of his gas furnace as applied to a very nicely-constructed one-horse power engine. This engine was at work all the evening, and, with the exception of the electrical apparatus, was the only machine in motion. It gave the company a good opportunity of judging of the value of this system, which is invaluable where an intermittent use of steam power is required, and, moreover, is now being largely applied where hitherto the use of steam power has been prohibited by the insurance companies. Mr. Mabson was present with one of his Belgravia sewing-machines, which is half-a-dozen sewing-machines in one, forming, as it does, every other machine stitch, and one of its own —an embroidery stitch—besides. Mr. Mabson showed some beautiful specimens of embroidered work produced by this machine, which we purpose illustrating in our next.

Mr. John Hughes, of the Millwall Iron Works, the well-known inventor of the stringer backing for armour plates, had a select collection of objects especially interesting to artillerists and military engineers. In the first place, there was a model of a wrought-iron shield made with tongue and grooved bar, designed to be placed in stone buttresses, as shown by Messrs. Lancaster and Hughes to the British Government in 1860, with the exception of the additional 5in. front plate, which is added to meet the increased power of modern artillery. Next, we observed a model of a wrought-iron shield, fixed on granite foundation, as proposed by Messrs. Lancaster and Hughes to the British Government in 1860, and which was subsequently adopted by the Russian Government in the defences of Cronstadt. Then there was a section of a wrought-iron caponniere constructed with tongue and grooved bars, with front armour-plates designed by Messrs. Lancaster and Hughes in 1862. No. 4 was a section cut from end of one of the rolled bars used in the Russian defences, and which was rolled at the Millwall Iron Works in 1864, the weight being 1,600lb. per yard run. The model No. 5 was that of a War Office shield with hollow stringer backing, designed in 1865 for conducting three series of experiments on one shield. The lower half is covered with a 9-inch plate, and the upper with a 6-inch plate; a part of this is then covered with three 1-inch plates on the laminated principle. We next come to a model of a bombproof wrought-iron shield with hollow stringer backing for fixing in earthworks, which was designed by Mr. Hughes for a foreign Government in 1865. Adjoining this was a model of a wrought-iron bombproof fort, with hollow stringer backing and armour-plated roof, designed by Mr. John Hughes for another foreign Government in 1867. No. 8 was a model of a segment of a wrought-iron circular fort with brick and concrete roof and hollow stringer backing, designed in 1867. There was also a full-size section of dovetail tongue and groove bars (similar to those used in the Russian defences), showing the mode of fastening back supports without "through" bolts; this is designed for a third-class defence. Another section similar to the last showed a mode of fastening on front armour plates with double dovetail hollow bolts; this was full size for third-class defence. Finally, there was a section of a hollow stringer for the backing of armour plates rolled at the Millwall Iron Works in 1865, weight 210lb. per yard.

Mr. Hughes also exhibited some of Mr. P. M. Parson's patent bolts for armour plates, the peculiarity of which lies in their shanks, which are hollow, but are of the same sectional area as the thread. Hence there is a saving of metal, besides which the elasticity of the bolt allows of a considerably greater amount of screwing up, without breaking it, than can be given to an ordinary bolt. There is also far less liability of the bolt to break through the thread, the sectional area being equal throughout. In November last year we witnessed some highly successful experiments with some of these bolts, particulars of which we placed before our readers at the time. We are glad now to add the results of some severe trials to which several armour-plate bolts have lately been subjected, and which have proved equally successful. First, a hollow bolt about 24in. long, and 3¼in. in diameter, hollowed nearly down to the screw thread, made of Millwall iron, was held up by the swelled head with the nut screwed on, and submitted to eleven blows from a monkey weighing one ton, and falling upon the nut from a height of 26ft. The bolt stretched 4½in. in a marked length of 13½in. = 33 per cent. of elongation before rupture. The second bolt was made from a special iron, and was 2ft. 6in. in length, and 3 in. in diameter. This bolt withstood sixteen blows from the same monkey, with the same fall, the result being an elongation of 6½in. in 19in., again equalling 33 per cent. of stretching, and thus bearing high testimony to the value of Mr. Parson's principle.

Marine engineering was mainly represented by some highly-finished models of engines bearing well-known names. Messrs. Maudslay, Son, and Field sent a beautiful model of the engines of the "Agincourt," of 1,350-horse power. From the same firm also came a model of the engines of Captain Phillimore's yacht "Hebe," of 40-horse power nominal. Messrs. Maudslay also sent an alarm whistle for superheated steam, which gives notice to the engineer in the event of the steam being too highly superheated. Messrs. Ravenhill, Hodgson, and Co. sent a model of the engines of the "Lord Clyde," 1,000 horse-power, 116-inch cylinders, and 4-feet stroke. Naval architecture had also its representatives. Messrs. J. and G. Rennie sent a model of the iron floating dock of Cartagena, in which the "Numancia" ironclad is now docked, as stated by us last week. This firm also sent a model of the Brazilian armour-clads "Colombo" and "Cabral," as used in the Paraguayan war. Sir W. G. Armstrong and Co. contributed a beautiful model of the little gunboat "Staunch" (illustrated by us on the 8th inst.), which was designed by Mr. G. W. Rendel, constructed by Messrs. C. Mitchell and Co., and engined by Messrs. R. Stephenson and Co., the gun machinery being by Sir W. G. Armstrong and Co. The London Engineering and Iron Shipbuilding Company sent a model of a design for an ironclad frigate of 5,282 tons and 1,100-horse power. The system advocated by Captain T. E. Symonds, R.N., was represented by a model of an armour-clad twin screw frigate on the end-on and broadside system, mounting twelve 300-pounder guns. Lastly, Messrs. Samuda Brothers sent a model of an iron screw armour-clad turret ship of 1,752 tons burthen and 600-horse power.

Were we even to make only an inventory of all the things exhibited, we should be unable to enumerate everything we saw on the present occasion. We must, therefore, content ourselves with a passing notice of a few more matters of interest before quitting the subject, to which, however, we shall return next week. A rock boring apparatus, contributed by Mr. Appleby, appears (from a block of hard grey granite, through which a large number of holes had been bored), to be worth more than a cursory notice, and we hope shortly to give a drawing and description of the machine, together with details of working. The cutter used is the diamond crown, which was patented by M. Leschot, and has been purchased by Messrs. Appleby. The diamond crown rock borer, exhibited in work at the Paris Exhibition of 1867, differs, however, essentially from that under consideration, which, we believe, is the joint production of Captain Beaumont, R.E., and Mr. Appleby. We observed an ingenious hand signal lamp, by Messrs. Brown and Jones, which requires only one hand to change the colour of the light instead of both, as in the lamp now commonly used. Messrs. Moseley and Son had a collection of planes for various purposes, the chief novelty being a plane for preparing air-tight framing for show cases. Samples of this framing were shown, and certainly made a very good job. Mr. Rochussen exhibited some wire drawn from Berger's mild gun steel. To a piece of this wire, of very small diameter, was attached 280lb. of iron, which gave a load of 308,370lb. per square inch. This wire begins to elongate at 388,000lb. per square inch, and breaks at 427,000lb. Mr. H. K. York exhibited some beautiful specimens of raw and manufactured steel, made by his process. This consists in cutting up the pig iron in a red-hot state by means of revolving cutters, collecting the oxidized particles, and melting them in a crucible in the ordinary way. The samples of steel and the manufactured blades were of the highest character. Mr. W. Blundell sent a balanced-cone air and smoke escape of novel construction, based on sound principles, and of which we purpose giving details next week. The Manchester Boiler Association sent a model of a boiler which exploded at the Backworth Collieries, near Newcastle-on-Tyne, on January 13 last, and which was attended by several peculiarities shown in the model. Mr. W. Clark sent a working model of Batho's rivet-making machine, which swallowed up inch after inch of stout copper wire very rapidly, returning it in the shape of very neatly made rivets. Finally, there were some of Mr. L. Sterne's pneumatic rubber buffers, as now used upon the Great Western Railway, and of which, as also of the application of the principle to draw springs and buffers on the Metropolitan Railway, we shall have more to say hereafter. We cannot conclude without referring to the satisfactory character of all the arrangements, considering the want of room, and in congratulating Mr. Gregory upon the success of his conversazione.

TECHNICAL EDUCATION IN FRANCE.

THE report of the French Commission on Technical Instruction, appointed by Imperial decree, June 22, 1863, has been translated into English by M. Haussoullier, and presented by command of her Majesty to both Houses of Parliament. The report contains a large mass of valuable information, and many important recommendations, from which we infer that the French as well as ourselves are far behind the Germans in educational means, and appliances, and organization. The French Commissioners attach much importance to the ordinary apprenticeship system as a means of practical training, but report that it fails to satisfy the demands of technical instruction; and that the apprentices are often abused by over work, Sunday work, and exacting night work, and sometimes by bad food and ill-treatment. Much good is accomplished by

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the societies for the patronage of young apprentices—such as the Society of St. Vincent-de-Paul, and the Societies of Orleans and Nantes—but these are inadequate fully to supplement the need, and other means of instruction are recommended to accompany the practical training of the workshop, upon which dependence must be mainly placed. The Commission recommend that the apprentices' time in the workshop should not exceed ten hours per day, and that they should have at least two hours of school instruction daily. In illustration of the very deficient means of instruction placed within the reach of apprentices and workmen in France, it is stated that the Empire, with 38,000,000 of inhabitants, has only two establishments for superior technical education, which do not supply for industry and for the scientific arms of the artillery and engineers instructional means for more than from 350 to 400 young men, whereas there are in Germany and Switzerland polytechnic institutes for every five and a-half millions of the inhabitants, and means for training above 4,000 pupils, counting only those regularly matriculated and obliged to attend the classes. At Vienna the institute has 900 pupils; that of Prague, 718; of Carlsruhe, 589; of Berlin, 350; and so on. In Germany and Switzerland the total school fees range from 100f. to 150f.; and in many places for 1,000f. per annum, or even less, proper board and lodging can be obtained. The cost of similar instruction in Paris is about 3,000f. per annum. We fear that it may be added with truth that a course of instruction similar to that given in these continental polytechnic institutes is not to be had in England at any price whatever.

ENGINEERING FIELD WORK.*

THE simplest and most elementary form of surveying is that which is accomplished by the aid of the chain alone, together with a tape and offset rod, and might with strict propriety be termed measuring, since the object is to ascertain the relative distances apart of the various physical features of the locality. In the first four chapters of the book under notice, full and accurate instructions are given, not merely respecting the different operations necessary in what is called "field work," but also regarding the equally important item of "office work." It must always be borne in mind that no matter how accurately the field work may be performed, it is all vitiated by bad, careless, and incorrect plotting. It is of little use making notes with precision if their results be not transferred to the drawing paper with corresponding exactitude. We cordially endorse the opinion of the author on this point, and maintain with him that attention to what may at first appear very trifling details, in reality ensure the accuracy and fidelity of the work. The student and professional pupil will not fail to observe that it becomes necessary to employ several problems in plane geometry for the purpose of overcoming many minor difficulties in engineering surveying. These problems are explained in full, although at the same time we would advise all those who intend joining the ranks of the profession to obtain previously to their commencing their professional studies a good sound knowledge of the rudiments of plane geometry, and, if possible, of plane trigonometry also.

It has been frequently remarked that very good work may be done with very bad instruments, and to some extent the remark is true. There is, however, one point to be taken into account in this case, and that is that the person using the imperfect instrument is aware of its defects. If he knows it to be out of adjustment, although he may not be competent to put it in adjustment himself, yet he is well able to make allowances for its shortcomings, and, by many devices known to the experienced hand, counteract the errors he would otherwise be led into. Mr. Haskoll describes fully the usual instruments in vogue with the profession, and gives the preference to the theodolite, as it justly deserves. In fact, it may be stated that any engineer who possesses a first class 6in. theodolite, and knows how to use it, can never be mastered in any difficulty that may arise with respect to ranging or setting curves, bridges, or other work that may fall to his duty. Three chapters on hydraulics, and harbour surveying, and deep sea soundings bring to a close that portion of the volume devoted to surveying. In the latter portion of the book, several chapters are devoted to the subject of levelling, a branch of study and practice if possible more important than that already treated of. It is not very difficult to discover an error in surveying, particularly if one is acquainted with the locality, and the error be rather a large one, but the case is very different with levelling. An error in the levels can scarcely be discovered unless the ground is actually levelled over again, and frequently parliamentary plans have been rejected in committee from an error or inconsistency in their levels. In addition to the ordinary description of spirit levels, the author describes the mountain barometer and the manner of using it. This latter instrument is indispensable in determining trial lines in mountainous countries, when the usual means could not be applied until some kind of a path or standing place were made. Numerous plates and diagrams attached to the volume serve to render that indispensable aid to the text which the clearest written treatise invariably requires.

* "The Practice of Engineering Field Work Applied to Land, and Hydraulic, Hydrographic, and Submarine Surveying and Levelling for Railways, Canals, Irrigations, Roads, Towns' Water Supply, Rivers, Docks and Harbours, and Deep Sea Soundings; the Use of Surveying and Levelling Instruments, of Barometers and Thermometers for Exploring Levels: a Complete Treatise on Setting Out Curves." Second edition, revised, with considerable additions. By A. DAVIS HASKOLL, Civil Engineer, late Resident Engineer of the Great Western and Brentford Railway and Dock, and of the Ottoman, Smyrna, and Aidin Railway; author of "Railway Construction," &c. Vol 1: London: Atchley and Co., 106, Great Russell-street, Bedford-square.

ELECTRICITY AND TELEGRAPHY.

WE are glad to be able to announce the restoration of communication through the Persian Gulf cable. This took place on the 23rd inst.

The bill for acquiring the electric telegraphs has again been postponed, and it is now fixed for the second reading at a morning sitting on June 6.

The submarine cable between Malta and Sicily was lately interrupted. The fault was found near Modica, on the Sicilian side; the cable fortunately was speedily repaired, so that the delay to communication was but slight.

We regret to announce that the cable from France to Jersey is interrupted. We may shortly hope to hear of its being repaired, as the present season of the year allows the necessary operations to be performed with greater expedition.

A trial of telegraphic speed has lately taken place in America, on the wires of the Western Union Telegraph Company, from Washington to Cape Breton. Ninety-four messages of twenty words each were transmitted by one wire in an hour. On the same day, thirty-three messages were sent in the same number of minutes from Cape Breton to New Orleans.

The cable for Key West and Havana has just been completed at the Silvertown Works, and is being shipped on board the "Narva," now lying in the river off the works. In our next, we shall give a full description of this cable, which, for electrical perfection, surpasses any other similar cable hitherto manufactured.

The prospectus has been issued of the Anglo-Mediterranean Telegraph Company, who propose providing a direct and thoroughly efficient line of telegraph to Egypt. As the first step towards this object, they have contracted with the Telegraph Construction and Maintenance Company to purchase their overland line, now in course of construction, and nearly completed, between Susa, in Italy (the terminus of the French lines), and Modica, in Sicily, where the line will be joined to the Sicily and Malta cable. This land line is 1,300 miles in length, and has been constructed under a concession for forty years. It will be handed over in perfect working order, and worked throughout by the English staff of the company.

It is proposed to abandon the present communication by the coast line between Malta and Alexandria, now leased by the Telegraph Construction Company from the Government, who have "promised, in consideration of an annual payment of £2,000 for a term of fourteen years" to abandon it. In order to complete the communication with Alexandria, a new deep-sea cable 900 miles in length is to be manufactured, and laid direct from Malta. A contract for this cable has been entered into with the Telegraph Construction Company, which "provides for the making, laying, and delivery to the company, in perfect working order, within four months, of a deep-sea cable capable of transmitting messages at a speed equal to the existing Atlantic cables, and having an external covering suited to the known requirements of the Mediterranean bed." At Alexandria, the cable will be connected with the existing land lines to Cairo and Suez. "The sum to be paid for the making and laying of the deep-sea cable, for the purchase of the land lines through Italy, and the present interests in the existing Malta-Alexandria line, is £245,000." The projected cable will form one of the links in the chain of submarine telegraph communication to India and the East. We believe the money is all subscribed, and we may, therefore, expect to see the cable shortly commenced; and before the summer is over, we trust this line will be completed, so that we may not be entirely dependent on the present line, which of late has been so much out of order.

In our review of the past year, we alluded with great hopes to the coming year as being likely to see several schemes brought out, showing that confidence was restored and progress in telegraphy was once more the case. We are glad to find our prognostications fulfilled, for activity is being shown now, particularly in submarine telegraphy. In addition to what we have lately mentioned, there is this Malta and Alexandria cable, a length of 900 miles. The India Government are going to lay an alternative length of 500 miles in the Persian Gulf. This length is intended to be laid from the existing station at Gradur, along the Persian shore, past Mussendun, to Faiz on the Mekran coast, where it will join the land lines to Kurrachee. Interruptions have usually taken place between Kurrachee and Gwadur, so that when this cable is laid we may then expect to have always one line of communication open. It is not yet decided whether the conductor of the cable will be insulated with gutta-percha or Hooper's material.

The cable about to be laid from the north-east coast of England to Denmark, of about 300 miles, is being insulated by Hooper's material, at his works at Mitcham; the insulation is something marvellous. The cable itself is being manufactured by Messrs. Newall and Co. A further length of cable of about 250 miles will, ere long, be manufactured for the Black Sea, in connection with the Indo-European Telegraph Company. Mr. Henley is manufacturing a length of about forty miles for the Norwegian Government, and some shorter lengths for other parties. At the Silvertown Works the India-rubber Company are making over thirty miles of ponderous cable for the Electric and International Telegraph Company, and have just completed 105 miles for the Cuba cable. These lengths give a total of nearly 2,200 miles, a result highly satisfactory, as it will give plenty of employment to the various submarine factories, which, unfortunately have not been very busy of late.

A Parliamentary paper has just appeared, containing Mr. Scudamore's reply to the pamphlet that lately appeared stating the case of the Electric and International Telegraph Company against the Government bill. In replying, Mr. Scudamore premises "that he is by no means certain that the pamphlet can fairly be regarded as an official statement of the company's case, or as proceeding from the chairman of the company, to whom it has, by some, been ascribed." The various statements and arguments in the pamphlet are reprinted by Mr. Scudamore, with his answers arranged in parallel columns, and we must acknowledge that Mr. Scudamore has, in almost every case, decidedly the best of it; his arguments tend to support the complaints of the various

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chambers of commerce that "the existing charges for the transmission of messages are too high, that under the existing system there is often delay in the transmission of messages, that many important districts are unprovided with facilities for telegraphic communication." He again brings forward figures and statements in support of his original argument, that, as in Belgium and Switzerland, the development of telegraphic correspondence has been greatly stimulated by the annexation of the telegraphs to the post-offices of those countries, so in this country like results would follow the adoption of similar means, and "that from the annexation of the English telegraphs to the English Post-Office there would accrue great advantage to the public, and ultimately a large revenue to the State." There are too many points in this reply for us to take notice of, but all the statements and arguments are satisfactorily replied to, and fresh proofs given of the feasibility and advantage of the Government scheme. Although many petitions have been presented to Parliament from various shareholders of the companies against the scheme, yet, since the "bill was published, thirty chambers of commerce, and other public bodies, have petitioned in its favour."

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

NEW USES OF ELECTRO-MAGNETISM—ALARUM FOR MODERATOR LAMPS—NAPHTHALINE COLOURS—HAIR CUTTING BY MACHINERY.

THERE are many who look forward to a time when electro-magnetism will supersede steam as a motive power. It is quite possible that electricity may be employed as a motive force, but the amount of mechanical work which it is capable of doing is comparatively small, and it must be enormously expensive. There are circumstances, however, in which cost is a matter of small consideration, and in these electricity may sometimes be turned to useful account. A lady may wish for a sewing machine, but the labour of driving it is more than she can exert. For such, M. Cazal has invented an electro-magnetic machine which we have no doubt will be competent to do the work with light fabrics. The details of this machine we must defer until a more complete account than we have yet met with comes to hand. For ornamentation, too, electricity is coming into use. You may see at a fashionable ball at Paris, a lady, on the top of whose head sits a butterfly or a humming bird. The fly and the bird flutter their wings in the most natural way possible. How is it managed? Why, within the chignon are concealed a small battery and a minute Rhumkorff coil. On the bosom of another may be a brooch, with a head upon it, the eyes of which turn in all directions. This, too, is accomplished by the use of a battery and coil so minute as to be concealed within the brooch itself. These, and more useful things, small batteries for curative purposes, easily carried about the person, are the inventions of M. Trouvé. The batteries of zinc excited by solution of sulphate of mercury, are enclosed in vulcanite cells, so that the exciting solution cannot escape to the damage of the wearer.

There is another French invention that deserves a line. It is a contrivance by which a warning is given that a moderator lamp wants winding up. As the rackwork descends, it causes a small hammer to fall on a bell fixed to the side of the work. The means by which this is accomplished will be readily imagined by any mechanic.

Naphthaline colours, it is anticipated, may some day compete with, if not eclipse, those from aniline. The body has been recently studied by M. Vohl, who gives instructions for the preparation of naphthyl-carmin, and some other useful derivatives of naphthaline. We give the proportions as we find them, with the remark that here, as in most such cases, the experimenter will probably have to decide on the best for himself. M. Vohl first dissolves twelve parts of naphthaline in 109 parts of strong sulphuric acid, and then adds by degrees 89 per cent. of bichromate of potash. When the reaction which ensues has ended, boiling water is added, whereupon some carbonic acid is disengaged. Carbonate of soda is next added to neutralize the solution, and the whole is boiled for a quarter of an hour. It is now filtered, to separate the oxide of chromium. The filtered solution is now of a beautiful golden yellow colour, but the addition of hydrochloric or sulphuric acid causes an abundant precipitate of carmine red flocculi—the naphthyl-carmin. After this has been separated, the solution on evaporation will yield first the sulphate of potash, then chloride of sodium, and, lastly, phthalic acid, which only requires to be submitted to dry distillation with quicklime to yield pure benzol. Naphthyl-carmin, according to M. Vohl, is an acid giving, with alkalies, a golden yellow solution, which dyes silk and wool, without mordants, either orange or violet.

Hair cutting by machinery is now an accomplished fact, so far as horses and oxen are concerned, and it seems to us by no means impossible in the case of the human head. M. Nabat has invented a mechanical razor, which, in principle, is something like a lawn mower A helix, with steel blades tangent to a comb, is made to rotate by means of a flexible chain worked by a lever. One man works the lever, while the "operator" promenades the comb over the body of the animal, regulating the length of hair to be left by the inclination of the comb. It is said that horses and beasts enjoy being clipped by machinery. It, however, remains to be seen whether humanity will.

PARLIAMENTARY NOTES.

IN considering the bill for the Regulation of Railways, the House of Lords lately discussed the question of smoke-burning locomotives, which discussion was brought about by the fact of a railway company having been fined and unfined for allowing an engine to smoke which was constructed so as not to smoke. Let us state the case as put by the Duke of Richmond, who observed that, as the law now stood, every locomotive engine that used coal was required to be constructed on the principle of consuming, and so as to consume, its own smoke, and if an engine were not so constructed the company to which it belonged was liable to a penalty of £5 for every day during which it was used on their railway. A case had arisen as to the law on that subject, in which the Manchester, Sheffield, and Lincolnshire Railway Company was concerned. The magistrates convicted the company because one of its engines emitted smoke; but, on an appeal to a higher Court, the Lord Chief Justice and two other judges decided that the engine, being constructed to consume its own smoke, complied with the terms of the Act, and therefore they reversed the decision of the magistrates. In that, as in most instances, it was well to alter the existing law as little as possible, because, without due care, they might weaken rather than improve it. By the proposal of the Government the liability would remain upon the railway company, as at present, of constructing their engines upon the principle of consuming their own smoke; but if the company showed that this had been done, it would be an answer as far as they were concerned. The driver of the engine, however, through whose fault smoke had been emitted, would be liable for such neglect to a penalty not exceeding 40s.

Earl Grey hoped the noble duke would reconsider the decision he had arrived at. If the penalty were recoverable merely against the engineers and stokers, how were the persons complaining to discover the persons guilty of the offence? Cases had been brought under the notice of the noble duke in which persons had been exposed to great inconvenience, and their houses rendered almost uninhabitable by the continuing nuisance of engines vomiting clouds of smoke. Few people like to be put in the position of prosecutors, but one gentleman who had taken up the question energetically, thereby made himself obnoxious to the engine-drivers, who inflicted upon him every petty annoyance they could. Railway companies had a remedy in their own hands, for they had the power of dismissing their own servants, whereas the only remedy which the public could have lay in making the company responsible. In London the penalties against engines which did not consume their own smoke had never been enforced till the duty of enforcing them was placed in the hands of the police, and the odium thereby removed from private prosecutors. The clause of the noble duke really did not strengthen the law as it now existed at all.

The Duke of Cleveland said that the law was plain enough, but what was really wanted were facilities for carrying the law into execution. At present railway companies could afford to run the risk of an information being laid against them, because they knew that, practically, persons would not take the trouble to do so.

Lord Redesdale also thought it would be better to transfer the penalty from the driver to the railway company, and that the penalty might be advantageously increased from 40s. to £5. In other respects he approved the clause.

The Marquis of Salisbury believed that a penalty directed against the driver himself would be more likely to frighten him than one directed against the company; and it was through the carelessness of drivers that emissions of smoke mainly occurred. Their lordships, however, must not suppose that they could succeed in all cases in preventing this. While a train was in motion it was perfectly feasible to prevent smoke from being emitted, but, by a higher law than the omnipotence of Parliament, locomotives stopping still, when the fire at the same time required to be replenished, could not be prevented from sending out a certain quantity of opaque smoke. The wording of the clause suggested by Earl Grey was of Draconic stringency, for the penalty was to attach "every time that smoke was emitted," meaning, he supposed, every puff.

Matters were soon adjusted by the Lord Chancellor observing that there was a defect in one of the clauses of the Railways Clauses Act, 1845, which provided that locomotives should be constructed upon the principle of consuming their own smoke, but did not go on to say that, whenever practicable, they should actually do so. It was very desirable that this defect should be remedied, and the clause as now proposed by the Government would have that operation. As regarded the imposition of the penalty, the best course probably would be to make the railway company responsible in the first instance, leaving them to settle matters, as they would doubtless take care to do, with their own servants. After this the clause as amended was then agreed to. So railway companies know what they will soon have to expect.

In the House of Commons, at the close of last week, an amusing discussion occurred about the "Glutton," a vessel of which we then heard for the first time. The question was put by Captain Mackinnon, who asked the First Lord of the Admiralty if it was true that a vessel of only 2,700 tons, the "Glutton," could be built to carry two 25-ton guns, with from 12in. to 14in. of armour, to be available for the Mediterranean or wherever required, of what use would any of our four, five, or six thousand ton broadside ships be against her, with their 8in. and 9in. armour, except to run away; why should the "Glutton" turret-ship have only nine knots speed when the "Hotspur" ram, of less tonnage, was to have twelve knots; had Captain Coles been consulted or allowed to see the drawings of the turret-ships proposed and those now building for our colonies; and why should not the turret-ship "Glutton" be a ram as well as the "Hotspur"?

Mr. Corry availed himself of this opportunity to make an explanation with reference to the name of one of the vessels which, as it stood in the question of the hon. and gallant member, was not very complimentary to the good taste of the Admiralty. They might hope that if the ship in question should ever be engaged in action it would prove a very "glutton" in the fray; but, in fact, her name was not the "Glutton," but the "Glatton," and she was so called after a vessel, which, in the last century, performed some very extraordinary service in consequence of the large calibre of her guns. He would observe that vessels intended for defensive purposes were built on principles which were wholly inapplicable to vessels intended as seagoing ships in all weathers. He was quite certain the Controller of the Navy would be very grateful to the hon. and gallant member if he could show him how seagoing ships and ships constructed for defence could be made to combine the qualities of both. The drawings of the turret-ships proposed were in a forward state, and would be referred to Captain Coles.

Our ammunition does not appear to be quite up to the mark, for Mr. Herbert has had to ask the Secretary of State for War whether it was the case that the brigade of Guards had very lately been obliged to abandon the usual annual rifle practice at Aldershot, on account of some serious defects in the ammunition, which caused some of the rifles to burst, and others to be so damaged as to be

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useless; what was the cause of such serious defects; had any casualties happened to the men on account of them; how many rifles were damaged; and what steps would be taken to remedy these evils for the future?

Sir J. Pakington admitted that the accidents referred to had occurred, but he was not prepared to allow that they had been caused by any defects in the ammunition. One barrel had burst, and four others had been very slightly damaged. They had endeavoured as clearly as possible to trace the cause; and in one instance certainly—he believed in more than one—the accident was caused by a cartridge being defective. Then, Sir John *must* admit that there are defects somewhere in the ammunition. They had a most anxious desire to ascertain as far as possible whether there was any serious defect in the cartridges now in use. 7,000 of these had been sent out for immediate trial. The whole of the 7,000 were fired off, and no very serious defects in them were apparent. The War Department were endeavouring to ascertain whether any improvement could be effected upon the present composition of the cartridge, and he could assure the hon. member that no pains would be spared in endeavouring to supply the army with the most safe and useful cartridges that could be made. He was happy to say that, with one trifling exception, no casualties had happened to the men.

LAUNCH OF THE ARMOUR-CLAD TURRET-SHIP "MONARCH."

MONDAY last witnessed the completion of the first armour plated ship constructed on the turret principle at a Government establishment by the launch, or, more correctly speaking, the floating out of dock, at Chatham dockyard of the ironclad ship "Monarch." Although the "Monarch" is designated a turret-ship, yet, beyond carrying some portion of her powerful armament in two turrets, rising an enormous height above the water, there is little to distinguish her from an ordinary ironclad ship, of the broadside type, the main and generally accepted features of the true turret principle, as advocated by Captain Cowper Coles and other supporters of the turret theory, being altogether wanting—rendering, in fact, this last creation of the Admiralty a sort of nondescript vessel, of a cross between a broadside and a turret, while the distinguishing features of both are wanting. As a mere powerful mass of iron and wood the "Monarch," in her form of construction, surpasses any vessel yet built for the Admiralty—not even excepting, perhaps, the "Hercules," the last completed vessel at Chatham—but whether her ultimate performance, either at sea or in action will justify the quarter of a million sterling she will cost the nation is a problem which can only be satisfactorily worked out by time. Although the "Monarch" has been built from the designs furnished by Mr. Reed, it is only due to the Chief Constructor to remark that the present and former Boards of Admiralty are to be credited with all the numerous alterations and "improvements" effected from time to time in the first turret-ship produced by the Admiralty, the result being that the "Monarch" is already condemned as a turret-ship by Captain Coles, who is now building the "Captain" to show what a vessel constructed on the actual turret principle should be. In the construction of the "Monarch" Mr. Reed has adopted the bracket frame system, first introduced by the Chief Constructor in the "Bellerophon," and since adopted in all the iron turrets of war built in this country for our own and foreign governments. The ordinary features of this system of construction may be briefly described as a double cellular bottom, water-tight bulkheads and platforms, and iron decks, which combines lightness and strength to such an extent as enables the naval architect to greatly diminish the proportion formerly considered necessary between the weight of the hull proper and that of the defensive material carried. With the exception that the towering broadsides of the "Monarch" are destitute of ports, the arrangement of the armour-plating on the hull is very similar to that adopted in a broadside ironclad ship with a central gun-deck battery. It is, however, to the enormous height of the upper deck of the "Monarch" above the water for a vessel built on the turret principle, and the crowding of the forward upper deck with a high forecastle, that the advantages claimed for a turret-ship are rendered almost, if not entirely, nil. Instead of being waterborne some 2ft. or 3ft., the upper deck of the "Monarch" rises 14ft. above the water-line, while the turret-guns will be carried at a height of no less than 17ft. above the water. To protect the dead surface of the vessel's broadside, which will present so tempting a mark to the guns of an enemy, the sides of the "Monarch" amidships are protected by armour-plates 7in. in thickness, laid on a backing of teak of 12in., with an inner skin plating, in two thicknesses, of 1¼in., the whole being further stiffened and supported by 12-inch longitudinal girders worked outside the skin plating, and 10-inch vertical frames worked inside, both sets of stiffeners being placed at intervals of a couple of feet. A belt of armour-plating of 6in. in thickness extends below the water-line. Athwart the vessel, fore and aft, armour-plated bulkheads are constructed, corresponding to those usually placed at the ends of the central battery in a broadside ship. The armour bulkheads are similar in their construction to the sides, with the exception that the armour is from 4in. to 5in. thick, and the backing 10in.; the space amidships, thus enclosed, being protected from the upper deck down to about 5ft. below the water.

The "Monarch" will carry her turrets in the protected space in the centre of the ship, the turret-bed being built on the main deck, the protected portion of the turret beginning just at the level of the upper deck. Each turret is 26ft. in diameter, and both will mount two 25-ton guns, for the working of which ample space is provided. The turret-guns are protected by means of 10-inch armour-plates, on a wooden backing of 8in., with a skin plating all in two thicknesses, each ⅜in., stiffened by 7-inch horizontal frames, with an iron lining of ⅝-inch plating on the inside. In addition to the armour-plating of the sides, there are inside screens of iron plating to further protect the machinery of the turrets. At the portions of the turrets away from the guns the planking is 8in. in thickness, laid on 10in. of teak. To enable the turret guns to obtain a clear range, the bulwarks are made to fold outwards, while the fire of the guns will be interfered with as little as possible by the number of the shrouds to the lower masts being considerably reduced, compensation being made for the loss of support thus entailed by increasing the dimensions of the iron masts. From the circumstance of the Admiralty insisting on the "Monarch" carrying a forecastle on the upper deck, the guns in the forward turret cannot be fired at a less angle than 10deg. with the keel, while they have a limiting angle of the same amount in their training aft. In the after turret the guns can be fired at an angle of 10deg. with the keel towards the bow, and 6deg. towards the stern, the latter limit being determined by the space required for the deck fittings, stowage of boats, &c. In order, however, to obtain a direct fore and aft fire, the "Monarch" carries protected batteries at the bow and stern—a novelty altogether unique in a turret ship. On the upper deck the bow battery will contain two 6½-ton guns, each of which can be fired at a training of 3deg. within and 76deg. from the line of the ship's keel. In the stern battery, on the main deck, will be placed one 6½-ton gun, fought from a right-aft port, and having a range of 15deg. on each side of the line of keel.

The "Monarch" is a few feet longer than the "Hercules," the last-constructed ship at Chatham, the following being her principal dimensions:—Length between perpendiculars, 330ft.; extreme breadth, 57ft. 6in.; depth in hold, 18ft. 8in.; draught, with all her weights on board (forward), 22ft. 6in.; ditto (aft), 26ft. 3in.; burden, 5,098 70-94ths tons; launching displacement, 4,450 tons. The first plate for the keel was placed in the graving dock on October 21, 1866, and the "Monarch," which has thus been only nineteen months building, left the dock on Monday with the whole of her armour-plating, amounting to 1,152 tons, bolted to her sides and bulkheads. In her form of construction arrangements have been made to enable the "Monarch" to be used as a ram, the bow being specially strengthened for this purpose, while the handiness of the ship, both as a ram and under ordinary circumstances, is increased by the adoption of the balanced rudder as fitted to the "Bellerophon." As the "Monarch" is intended essentially for a seagoing ship, and space is provided for only some nine or ten days' consumption of coal at full steaming, she will naturally have to depend to a great extent on her sailing powers. She will accordingly be a full-rigged ship, arrangements being made to enable her to spread a large surface of canvas, by which means she will thus keep her place in a squadron under sail. Her lower masts are of iron, and her topmasts and yards of wood, made in the Chatham Dockyard, the main and foreyard being each 105ft. in length. The iron masts are the strongest yet manufactured for a vessel of war, the rigging being occasionally required to be let go to clear the ship for the fire of the turret guns.

The ceremony of christening the "Monarch" was allotted to Lady Cecilia Bingham, sister of Lord H. G. Lennox, M.P., Secretary of the Admiralty. From the circumstance of the "Monarch" being built in a graving dock, the ceremony attending the launching was unattended with the interest usually attaching to the launch of a large vessel of war. At the head of the dock a platform had been erected for the accommodation of visitors, and the officials connected with the Admiralty. Shortly after two o'clock, Lady Cecilia Bingham was conducted by Lord H. Lennox and Mr. Thornton, master shipwright, to the bow of the "Monarch," and having named the ship with the usual ceremony, the huge vessel was slowly hauled out of dock and safely moored in the harbour, amid the cheers of the spectators, the band playing "Rule Britannia." The launching draught was that indicated by the designer. The "Monarch" will at once be fitted with her engines and machinery, by Messrs. Humphrys, Tenant, and Co., consisting of a pair of direct-acting engines of 1,100-horse power (nominal), but capable of developing a power of 6,600 horse. The engines are fitted with all the latest improvements, and they are constructed to drive the vessel at a mean speed of fourteen knots per hour. The "Monarch" will be equipped for her first cruise at sea with all despatch.—"Times."

ON SOME NEW EXPERIMENTS ON LIGHT.*

By J. H. GLADSTONE, Ph.D., F.R.S.

THE speaker commenced by referring to the fact that we are constantly making new experiments or observations on light: in fact, all seeing is but a comparison of different degrees of light and shade, and the contrast of colours. Most of the rays that meet our eyes from surrounding objects are reflected rays, but some of the commonest things, such as the water-bottles and tumblers of cut-glass on our dining tables, exhibit beautifully the bending, the magnifying, the diminishing, and the production of coloured fringes, due to refraction. The purpose of this discourse was to rise from the simplest phenomenia of this kind to a consideration of refraction-equivalents, and to describe the state of our present knowledge in regard to them.

By means of the electric lamp it was shown that a piece of glass, or other transparent body, will throw a perfectly black shadow if the two surfaces through which the ray passes be not parallel; that the light is then bent on one side, and at the same time spread out into its component colours; that this bending (refraction) varies with the amount of inclination of the two surfaces to one another, but in such a way that the sine of the angle of refraction bears a constant ratio to the sine of the angle of incidence; that this constant number, termed the index of refraction, or μ, belongs only to the one substance, each solid, liquid, or gas having its own index; that there is no necessary connection between the amount of refraction and the length of the spectrum (dispersion) caused by different substances, whether gaseous, liquid, or solid—for instance, a solution of an iodide always disperses more than a solution of the chloride of the same metal, even though it be diluted to the same amount of refraction.

This index of refraction is affected by change of temperature. In liquids, and probably in all gases the bending decreases as the thermometer rises; in solids, on the contrary, as lately shown by Fizeau, the change is in the opposite direction, crown glass always remaining the same, and fluor spar being the only case where he observed a diminution. This was experimentally demonstrated in regard to liquids. Thus a yellow sodium ray, which had passed through a hollow prism filled with oil of nutmeg, and thence through another filled with bisulphide or carbon, moved some inches along the screen, when the nutmeg oil was warmed a few degrees by stirring it with heated iron wire. This index of refraction is still more materially affected when a body passes from the solid to the liquid, or from the liquid to the gaseous condition; a fact that was illustrated by the visibility of the water melted in crystalline spaces in the middle of a block of ice.

The index of refraction of a mixture is moreover not always the mean of the indices of its constituents. Thus a ray passed successively through two hollow prisms filled with equal quantities of alcohol and water respectively, fell on the screen in a certain position; but when the two liquids were mixed together, and divided between the two prisms, the ray was visibly reflected to a greater distance.

These changes depend on the alterations of volume which the substances undergo; and the speaker, in conjunction with the Rev. T. Pelham Dale, has observed in liquids that the index of refraction, minus unity, divided by the density (in symbolic language $\frac{\mu-1}{d}$) is constant for all temperatures, and for all mixtures, or rather that the coincidence is very close but not quite perfect on account of some other law not yet understood. This conclusion has been abundantly verified by Landolt of Bonn, Ketteler, and Wullner, and the former experimentor has founded upon it a method of analyzing mixtures of liquids.

This unchangeable number was termed the "specific refractive energy" of the substance, and it seemed to hold good notwithstanding a change from the solid to the liquid or the gaseous condition. It was early observed that the specific refractive energy of a compound bore a close

* Read before the Royal Institution.

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resemblance to the mean of the specific refractive energies of its components. Landolt, by multiplying this number by the chemical equivalent, facilitated the calculation greatly. He termed this new number the "refraction-equivalent," $P \frac{\mu-1}{d}$, and proofs have rapidly accumulated that the number is affected, not only by temperature, change of aggregate condition, mixture, or solution, but even by strong chemical combination.

Thus diamond, which is crystallized carbon, has the refraction-equivalent 5·0; sulphur has 16·0. Bisulphide of carbon, C S^2, which is nearly the most refractive liquid known, should therefore be represented by $5 + 2 \times 16$, that is 37·0. The experimental number is 37·3. But the diamond will burn in oxygen, and it is thus converted into carbonic anhydride, while it is possible to reduce this gas into another containing only half the amount of oxygen, namely, carbonic oxide. The refraction-equivalents of these gases, as deduced from Dulong's observations, are respectively 10·03 and 7·53; but the difference between C O_2 and C O is one equivalent of oxygen, and the difference between the above numbers is 2·5. This, then, may be taken as the refraction-equivalent of oxygen, and subtracting it from C O = 7·53 we have remaining C = 5·03, practically the same number as that obtained directly from crystallized carbon. Similarly, but generally by more indirect methods, it has been determined that this element, whether pure as diamond or combined with other elements to form gases as the above-mentioned, coal-gas, or cyanogen, or liquids as chloride of carbon, benzole, oil of turpentine, alcohol, or ether, or solids as paraffin, sugar, or camphor, is still exerting the same influence on the rays of light that set its particles in motion, an influence that we can express by the number 5·0.

Again to revert to sulphur, the two salts sulphocyanide and cyanide of potassium—K S Cy and K Cy—differ by one equivalent of this element, and their refraction-equivalents, as determined from their aqueous solutions, are respectively 33·4 and 17·1, numbers differing by 16·3, a number almost identical with that reckoned from molten sulphur. In this way the refraction-equivalents of a large number of the elements have been determined; and the following table comprises what seem the most probable numbers among those that have been hitherto published by Landolt, Haagen, and Schrauf, as well as the speaker:—

	Atomic weight.	Refraction-equivalent.
Hydrogen	1·0	1·3
Chlorine	35·5	9·8
Bromine	80·0	15·7
Iodine	127·0	24·4
Oxygen	16·0	3·0
Sulphur	32·0	16·0
Carbon	12·0	5·0
Silicium	28·0	6·2
Nitrogen	14·0	4·1
Phosphorus	31·0	18·5
Arsenic	75·0	6·0
Antimony	122·0	25·7
Vanadium	51·4	2·4
Sodium	23·0	4·9
Tin	118·0	19·2
Copper	63·4	11·8
Mercury	200·0	21·0

The above numbers are reckoned for the red ray. Most of them can as yet claim to be considered only as approximative; and it seems certain that some elements, as oxygen and sulphur, have more than one refraction-equivalent. Vanadium, though included in the above table, has only just been determined, and that from the oxy-trichloide which Professor Roscoe exhibited a few weeks before. It is interesting, as it supports his theory of the close analogy of phosphorus and vanadium, for these two bodies, with sulphur, exceed all others in refraction and especially in dispersion. The speaker stated that he was now engaged in examining the effect of salts in solution on the rays of light, and that he hoped to determine in this way the refraction-equivalents not only of a multitude of salts, but of the metallic elements themselves.

But the question may be asked, "If a substance has a refraction compounded of the refractin of its constituents, how can bodies such as Iceland spar have two refractive indices?" Now these are crystalline bodies, or if uncrystallized they have become doubly refracting by being unequally heated or compressed. In either case we may suppose a different amount of tension in different directions; and the fact of the two rays being oppositely polarized points to some such difference of molecular arrangement. It is easy to understand that the change of tension or internal structure may act in the same way as a change of density in modifying the velocity of transmitted light, and therefore the amount of its refraction. But if we take the crystal to pieces by dissolving it, there can then no longer be unequal tension or unsymmetrical arrangement of particles, and it must have one refraction-equivalent. And this is always the case. The numbers deduced from Brewster's observations of the two rays of crystallized nitre are 16·3 and 25·0, while the equivalent of nitre dissolved in water is the intermediate number 21·8.

McCULLOCH'S MICROSCOPE.

ONE of the most fascinating and improving pursuits is the study of nature through the microscope. Hitherto this enjoyment has been limited to those who could afford to purchase it at a high cost. Now, however, it is thrown open to the million by means of a very powerful but cheap microscope which has been invented and is made by Mr. A. McCulloch, of 18, Blucher-street, Birmingham. This instrument is divided into four parts, viz., the eye-piece, composed of two screws, in the centre, or between which, is placed the lens or magnifying glass; 2nd, the object-glass, on the centre of which the objects are placed, and which is fixed to No. 3, or the body or tube; 4th, the condenser of natural light, at the extreme end, which is to be used only by daylight, and taken off by gaslight, when the open end of the tube is pointed towards the gas or candle light to receive the rays direct. In inspecting objects by daylight with the condenser on, the observer must look towards the sky to get a light. This apparatus is of small size, but withal exceedingly powerful, magnifying about 30,000 times. Mr. McCulloch has devoted considerable time and attention to the special subject of single-lens making, and has been eminently successful in producing a good lens, as the microscope in question testifies. We have tried one of them, and its power and simplicity combined with its cheapness induce us to recommend it to all who are debarred the luxury of the larger instruments by reason of their expensiveness. As a pocket companion, no student of nature should be without one.

CENTRAL HORTICULTURAL SOCIETY.

AT the ordinary bi-monthly meeting of the members of this institution, held at Dr. Johnson's-rooms, Essex-street, Strand, on Tuesday last, Mr. Joseph Newton, of H. M. Mint, read a paper on horticulture and floriculture. After expatiating at considerable length upon the civilizing effects of the two branches of science in question, and pointing out the great value of the cottage allotment system to rural communities and the public generally, Mr. Newton proceeded to explain the law of diffusion as affecting the growth of plants. He clearly showed that many of the phenomena in regard to floral vegetation owed their existence to the action of this law, and gave many practical hints with regard to the ventilation of hothouses and conservatories. The reader also referred to the commercial value of vegetable products, and to the vast influence which floriculture had exercised upon the decorative and industrial arts in this and other countries. Painting, sculpture, and poetry, Mr. Newton said, were likewise deeply indebted to horticulturists and florists. The paper was listened to with much attention throughout, and at its termination a vote of thanks was unanimously awarded to the author.

A NEW EXPEDITION TO AFRICA.

A NEW African exploring expedition has been organized in Dublin by Captain Faulkner, who first proposed it, and Captain Norman, late of the 69th Regiment, who writes to the "Express" on the subject. Captain Faulkner states that he regretted being able to explore only a few miles of Lake Nyassa when engaged in the Livingstone search expedition in September last, and that he resolved to return at some future period. He will also be accompanied by Captain Casement, late of the 14th Regiment; Captain Gubbins, late of the 56th Regiment; and Mr. Perrin, an engineer in the shipbuilding yard of Messrs. Walpole, Webb, and Bewley. A small steam yacht has been built for the party by Messrs. Walpole, and is intended to be used in pursuing the exploration of Lake Nyassa from the point where Dr. Livingstone was last heard of. She is named the "Faugh-a-Ballagh," and Captain Faulkner says of her:—"The boat now ready for us, which is a credit to her Irish builders, both for the rapidity and perfection of their work, is a curiosity well worth seeing, and I have not a shade of doubt that she is well suited for the navigation of the rivers Shire and Zambesi, as well as the stormy Lake of Nyassa, and that no difficulty will be experienced in carrying her past the cataracts. The following are her dimensions:—Length, 50ft.; beam, 11ft. 6in.; depth moulded, 5ft. 6in. She is put together in sections, consisting of seventy-five sections, with over 8,000 bolts and nuts. Her engines are 8-horse power, and she will be propelled by one of Griffith's three-bladed propellers." Everything for the expedition has been provided in Dublin. The party will set out from Southampton on June 9 in the Union Company's Cape mail steamer for Natal, where they will charter a vessel to take them to the mouth of the Zambesi, and thence they will follow the track of the late expedition. Their first object will be to reach the extreme north, where they hope to hear of Livingstone, should he have abandoned the idea of coming down the Nile, and perhaps be on his way to Zanzibar

PENCIL-LEAD MINES AND LEAD PENCILS.

EVERYONE knows what a black-lead pencil is, but it is not generally known that there is not a particle of lead in the pencil. The material variously known as black lead, graphite, or plumbago, is almost wholly composed of carbon. It probably owes its misnomer to the fact that, previous to the employment of graphite for making pencils common lead was used, and this within the present century. For a long time the best graphite was obtained, not in very large quantities, at Borrowdale, in the English county of Cumberland, where it was discovered in 1564, early in the reign of Queen Elizabeth, and pencils, much like those still in general use, were produced in the year following. As the supply of the graphite (known in Cumberland, while in the mine, by the title of wad), was not large, the British Government, from the first, took great pains to prevent the exportation of the article, and even to limit its home sale to a supply just sufficient to meet the estimated demand. Graphite is found in various parts of Europe, and even in North America, but of very inferior quality. The Cumberland mines were worked only a few weeks in each year, yet the yield of wad was estimated at £40,000 a year. While the graphite lasted, England had a monopoly in supplying the best pencils to the world. Year after year, for a century past, the graphite deposit in Cumberland became "fine by degrees and gradually less." The result was that graphite powder had to be compressed into a solid cake from which pencils could be supplied. A French variation, said to be an improvement, was to mix the powdered and purified graphite with clay, which is largely done still.

Nearly 150 years ago, the pencil manufacture commenced in England, and improved in France, was transplanted to the village of Stein, near Nuremberg, in Bavaria, and, little more than a century since, Casper Faber there began to make the pencils which continue to be made by his descendants, and bear the family name through the world. The present John Lothair Faber, great grandson of Casper, has been head of the firm since 1839, and is not only very wealthy, but has recently been ennobled by the King of Bavaria. One of his brothers is associated with him at Stein, in the processes of manufacture; the youngest of the three, Eberhard Faber, represents the firm, for the Western World, at New York. Stein is literally a town of pencil factories, of which Baron Faber is the ruler, taking care of the health, government, education, industry, thrift, and amusements of the inhabitants, and always living in their midst.

It may be asked, how do the Fabers make lead pencils without the famous graphite from Cumberland? It appears that twenty years ago, John Peter Alibert, a Frenchman, resident in Asiatic Siberia, having heard of the gold discoveries in California, began to examine the sandy beds of various rivers flowing into the Arctic Ocean. He found samples of pure graphite, evidently brought a considerable distance by force of the stream, in one of the mountain gorges near Irkurtsk, and, pursuing his discovery, tracked back to a branch of the Salan Mountain range, on the very summit of Mount Batougol, 275 miles west of the town of Irkurtsk, near the Chinese frontier, in the midst of the rocky desert, and found pure graphite. After years of costly labour, Alibert found an exhaustless deposit of graphite equal to the best ever taken from Cumberland. Beside decorating and rewarding him, the Russian Government changed the name of Mount Batougol to that of Mount Alibert. Nearly every crowned head in Europe has honoured him. With the consent of the Russian Government, Alibert now supplies Faber's house exclusively with graphite from the mine in Asiatic Siberia. Pencils of this material were first made by Baron Faber in 1861, and were not introduced into the American market until 1865, from which time artists and others perceived and acknowledged their superiority. If the world were to endure a thousand years more, there is graphite in Mount Alibert to supply its population with good black-lead pencils.—"Philadelphia Press."

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THE DISINTEGRATOR.

BY MR. THOMAS CARR.

SCALE ONE INCH TO THE FOOT.

FIG. 1.

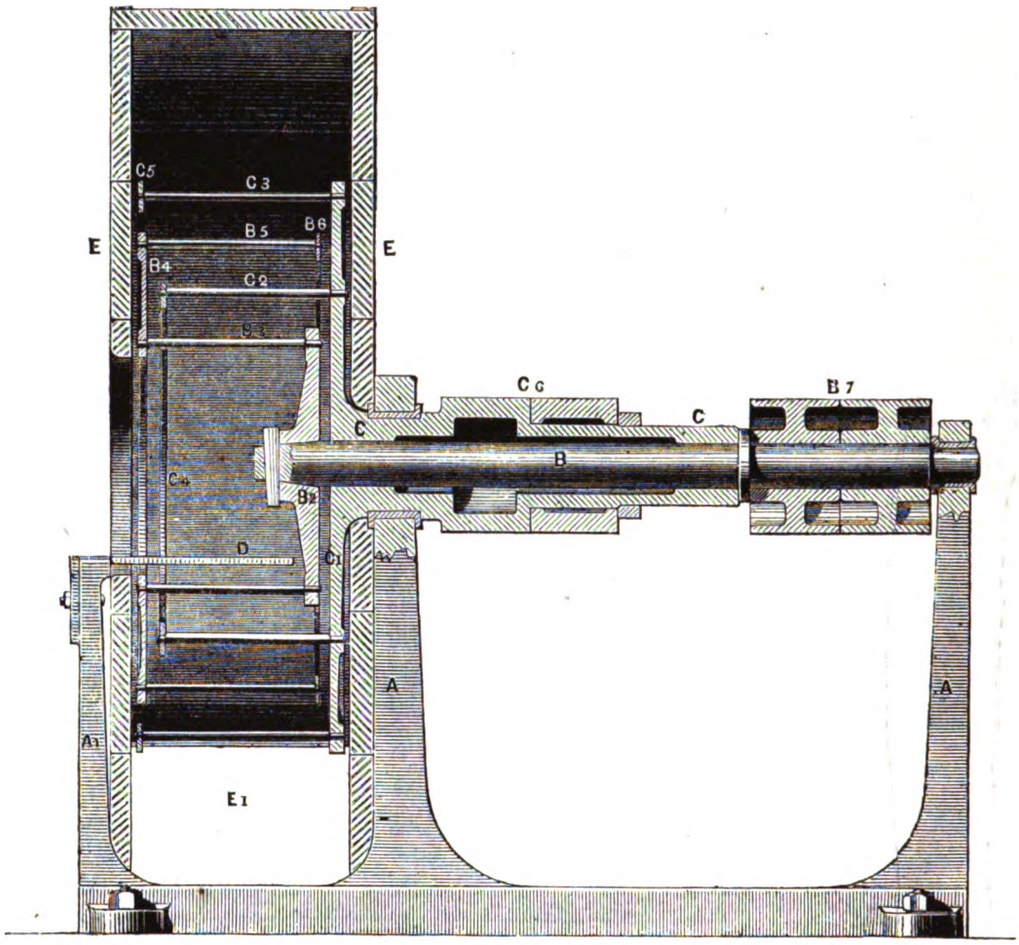
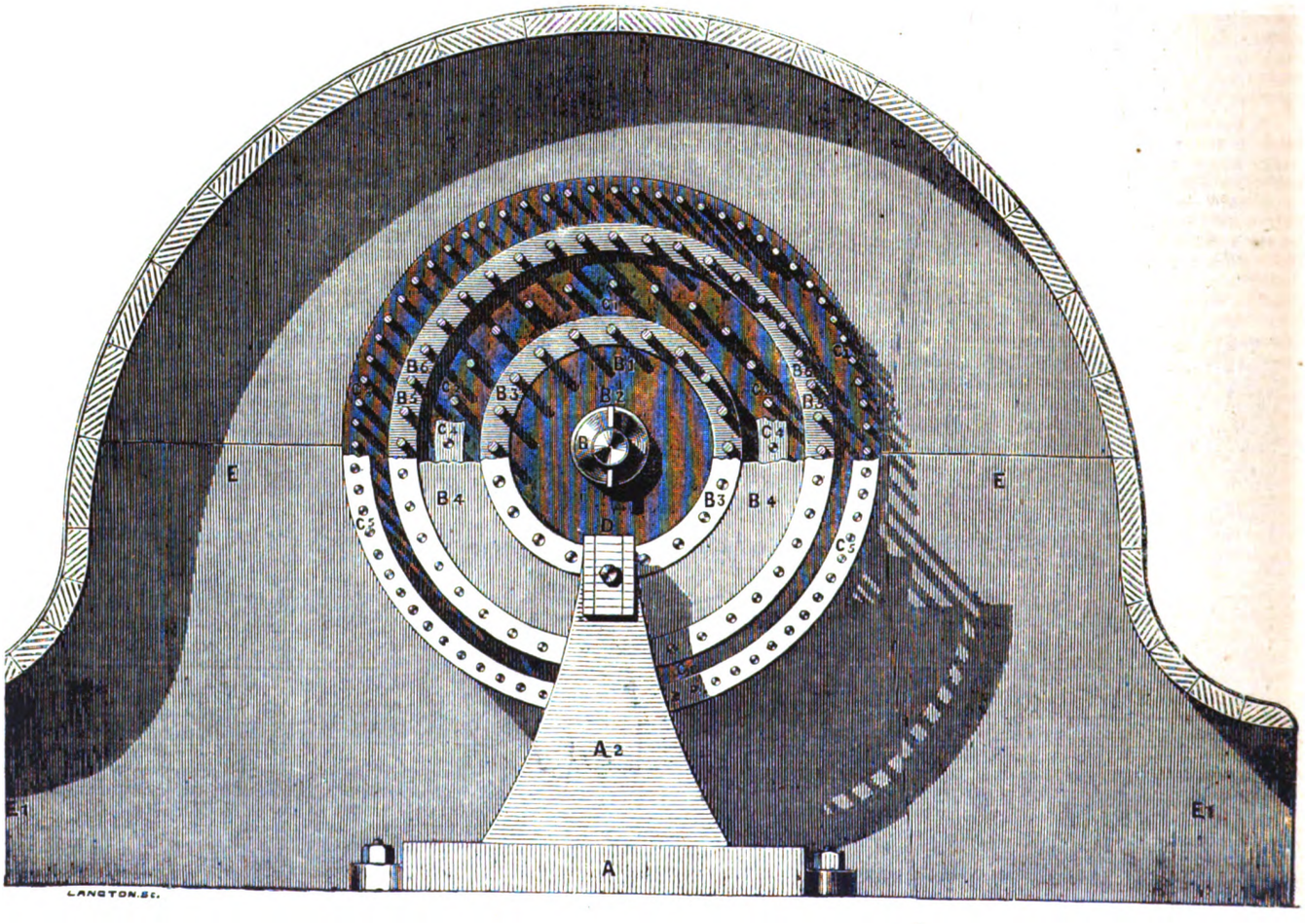


FIG. 2.



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CARR'S DISINTEGRATOR.

ON the opposite page we illustrate a very ingenious and efficient disintegrator, the patented invention of Mr. Thomas Carr, of Montpelier, Bristol. This machine, which has come into very extensive use, thoroughly breaks up, pulverizes, and perfectly mixes from sixty to seventy tons per day of either hard and dry, or soft and damp conglomerated phosphates, guano, &c., without any inconvenience from becoming clogged or choked in the operation. It consists of a series of four strong cylindrical iron cages, of various sizes, concentrically arranged one within another, on a horizontal axle, on which they are caused to revolve with great velocity in contrary directions to each other, by means of an open and crossed strap, the alternate cages being so arranged to intersect one another, that while, in reality, there are only two motions, there are relatively four—the first and third cages going to the right, the second and fourth to the left; one set being in a piece with the hollow axle or boss on which the cross strap is placed, and the other set keyed on to a solid shaft working within, on the outer end of which is the pulley of the open strap.

The material to be pulverized in its rough, lumpy condition, is fed through a central opening into the innermost cage, and is instantly delivered in a radiating shower from every part of the periphery of the outermost one into an external casing or hood, in a state of fine granulated powder. The granulating, or pulverizing, is effected in the following manner:—The centrifugal action of the machine drives the material from the centre to the periphery of the outermost cage; but before it can reach and escape from there, every grain of it meets with and receives four distinct cutting blows, delivered with great rapidity and violence, by the numerous (156) but open set bars of the intersecting cages that it encounters on its way, each of which blows is doubled in intensity by the four reverse actions of the several cages. A stout knife is fixed to a pillar, cast in a piece with the carrying frame, in such a manner that its blade extends into the interior of the innermost cage, which instantly arrests and cuts such pieces as are otherwise too large to pass between its bars. Immediately this first cage is passed, any unfibrous substance, if less tenaciously pasty than dough, or not much tougher than oilcake, or any brittle material, such as bone ash, boiled bone from the size makers, chemical crystals, coal, &c., is, in less than a second, thrashed, cut, and beaten to pieces, and the whole of it driven out with great force from the periphery in fine powder; which can be made either finer or coarser by increasing or diminishing the rotating speed: for it must be borne in mind that its pulverizing powers are in direct proportion to its speed.

In our engraving, fig. 1 is a longitudinal elevation in section, in which all the bars forming each cage, except the two in each cage which occur at the sectional line of the drawing, are omitted to avoid confusion; fig. 2 is an end elevation of the machine, one half of the outer end disc being broken away to show the cages more distinctly, the casing being also shown in section. The machine consists of a frame or headstock A, which can be bolted down to a suitable bed of stone or wood by bolts passing through the ears A^1. This headstock A forms the bearing of a solid shaft B and hollow boss or shaft C. The solid shaft is conical at the end, and carries a disc plate B^1, which is firmly secured to it by a key B^2 passing through a slot in the end of the shaft B. This disc plate B^1 carries a series of bars B^6 which are riveted into at one end, and at the other end in another disc B^4, in which one end of another series of bars B^5 are secured, the other end of these bars being connected together in a ring B^6; thus two circular cages, formed by the series of bars B^3 and B^5, are obtained, which will rotate with the shaft B. The hollow boss C working loose on the shaft B is solid, with the disc or face plate C^1 which carries the series of bars C^2 and C^3 forming the cages intermediate and alternate with the cages formed by the bars B^3 and B^6, and the outer ends of the bars C^2 and C^3 are respectively connected and secured in the rings C^4 and C^5. The shaft B and hollow boss C are rotated in opposite directions by belts (one of them being crossed and the other open) working on the fast and loose driving pulley B^7 and C^6. The hollow boss C is lubricated by passing the lubricating matter through holes formed in it, which are closed by screw plugs to prevent the lubricating matter from being thrown out when at work by centrifugal action. A standard A^2 from the headstock or frame A carries a bar or knife D, the object of which is to break up such lumps as will not pass between the bars of the internal cage. The covering E for the cages is made of wood, and in two parts, the upper part being arranged so that it can be readily removed by lifting it off from the lower part when the cages require to be got at. This cover has an opening opposite the internal cage, through which the material is passed which is to be operated upon, and openings are also left in the casing E at E^1 for the removal of the material disintegrated.

The ingenious nature and practical value of Mr. Carr's Disintegrator demand a few words from us respecting the principles upon which it is based. It differs widely from any of those principles on one or other of which all other mills, for whatever purpose, are constructed, in neither cutting, rasping, crushing, grinding, stamping, or tearing, but producing the required results solely by a continuous rotatory series of unarrested blows, striking in opposite directions the free unsupported materials in such a manner that, there being no unyielding medium to absorb, like an anvil, the surplus energy of the shock, the machine meets with no resistance but that which is justly due to the act of overcoming the cohesive strength and *vis inertia* of the material it is shattering. The heavier and more obdurate the materials operated on, the more severe the blows, and *vice versa*. Thus the rare desideratum is attained of having no expenditure of power beyond what is strictly equivalent to the effect produced. The machine combines in an advantageous manner direct with centrifugal force, for the same blows that destroy the cohesion of the material struck communicates to its fragments a tendency to escape from the machine immeasurably greater than mere gravity could give. Consequently, scarce a second of time can elapse after a shovelful is thrown in before the machine has thus freed itself entirely, and is ready for another. The reverse action of the several cages, it will be seen, not only doubles the force of each blow by giving it the aggregate impulses of the opposing cages, but, at the same time, quadruples the number of the blows. If the four cages revolved together in the same direction, the material, when struck by the bars of the first cage, would fly out at a tangent from the periphery, and thereby escape through the succeeding cages almost without further molestation.

The peculiar manner in which the material is struck, as it were, in mid air, and its constituents widely dispersed, as if suddenly under the influence of a mutual repulsion, renders the machine invaluable for such claggy materials as soluble phosphates, which it not only divides to an infinitesimal extent, but also from the peculiar manner in which it appears to charge them with air, greatly increases their bulk and specific lightness; and in a great measure prevents all future tendency to reunite, whereas the usual defect of other machines, as is well known, is their tendency to knead such materials into a closer and denser mass, and make them more pulpy and pasty than ever. For these and other characteristic advantages peculiar to itself, the disintegrator may not unjustly claim the credit of occupying alone a void in mechanical appliances hitherto unfilled; and of having a distinct individuality and sphere of usefulness of its own. This usefulness has been fully recognized in the general adoption in all parts of England and on the Continent of the disintegrator for the purposes to which we have alluded. Amongst other users we may mention Messrs. J. B. Lawes and Co., of the Chemical Manure Works, Deptford Creek, where, to our knowledge, the disintegrators are giving perfect satisfaction. Larger sized ones, capable of pulverizing thirty tons an hour of hard materials, are also coming into extensive use at manufactories of fire-bricks, sanitary tubes, tiles, potteries, metal smelting works, patent fuel and sugar factories, &c.

THE RANEEGUNGE POTTERY WORKS.

ALMOST imperceptibly, and within a short space of time, what may be called a new branch of industry has sprung up amongst us, says the Calcutta "Engineers' Journal." No one who has seen the bricks, tiles, and other earthenware manufactured by the Raneegunge Pottery Company, will, we think, disagree with us when we call their manufacture a new branch of industry in Bengal, instead of connecting it with the manufacture of those specimens of half-burnt, mis-shaped pieces of clay that we in Calcutta are accustomed to call tiles. The company is a limited liability company, and will be looked upon by many as being in consequence ephemeral; but if the importance of the objects it has in view, and the facilities for attaining those objects which are presented at Raneegunge, be taken into consideration, the shares of the company appear to us to be a most promising investment. So long ago as 1860, specimens of the clay were sent home, and forwarded to managers of pottery works, in various parts of England, with a request to have the clays fairly tried, and that a report of their fitness or otherwise for the purposes intended should be afterwards submitted. These reports were universally favourable as to the quality of the clay; and the question of the establishment of the company turned altogether upon the fitness or otherwise of the Raneegunge coal for the purpose of firing the more finely glazed description of earthenware. The conclusion arrived at seems to have been that the coal was suitable, because we see that this company has started, and we have seen specimens of their work—glazed, unglazed, and vitrified—and they are everything that could possibly be required for the purposes intended.

The value of coal for such a purpose depends upon the absence of sulphur, and as no coal has been discovered which is absolutely free from that element it is its comparative absence or presence that must be taken as a criterion. The Raneegunge coal, compared with that used at the best pottery works in England, contains an excess of sulphur; this for unglazed work is a matter of no moment, and for glazed work the specimens of the work have only to be seen to lead to the conclusion that sulphur is not present in sufficient quantity to interfere with the value of the coal as a heating agent, even where glaze is employed. The company has now on hand as much work as it can manage to execute; it manufactures roofing and flooring tiles (glazed, and vitrified), drainage pipes, water-pipes, firebricks, telegraph insulators, and any description of pottery work. Several articles of household use—jugs, serais, &c.—have been made experimentally, and the success is such as to prove that the only necessary which is wanting to enable the company to carry on a large business, even in that small branch of their manufacture, is the want of competent workmen. For these the company must depend principally upon the Government School of Art in Calcutta; but even the men turned out from this institution require a great deal of practice and further instruction before they can be called skilled workman.

The encouragement of local industry and local trade is in all cases desirable as a matter of policy; but when that industry supplies articles as well suited for the purposes intended as any that can be procured in England or elsewhere, there can be no doubt that, as this company and it manufactures come to be better known, their difficulty will be to keep the supply equal to the demand that is sure to arise for some, if not all, of the articles they manufacture. We wish them every success, and hope, at some future time, to have an opportunity of visiting their works, and giving our readers a full description of the various clays found at Raneegunge, and an account of the mode of manufacture adopted by their manager. The proverbial cleanliness of the Dutch is owing chiefly to the fact that their rooms are floored, and partly panelled, with small glazed tiles which can be thoroughly washed daily, and become perfectly dry in a few minutes. We cannot conceive a greater luxury in this climate than having rooms that can be so cleansed instead of being compelled to endure the dust and vermin that collect in the mats which we are at present obliged to use. To natives, whose forms of religion require that their apartments should be purified by the use of water, such floors would be invaluable.

DOUBLE CYLINDER STEAM-HAMMER.

MESSRS. THWAITES AND CARBUTT, of Bradford, have perfected two novel forms of steam-hammer, one of which is illustrated on the other side. Under the new system the weight of the standards and pistons in one case, and standards and cylinders in the other, are made available in striking the blow. In the first case the cylinders are fixed in the ground, and the pistons connected by a powerful crosshead, carrying the hammer between them; in the second, the pistons are fixed to the foundation, and the cylinders move, having the hammer-block incorporated with them. In the case of the stationary cylinders the steam is admitted by the same valve to both, the distance which it has to travel being, of course, exactly equal for both cylinders. In the machine in which the pistons stand, and the cylinders move, the valve levers are connected by a rod, so that they must move simultaneously. The difficulty of obtaining this simultaneous motion has been urged against the system, but Messrs. Thwaites and Carbutt have had so much experience in making the valve machinery for Mr. Ramsbottom's duplex hammer act together, that they are confident of success. If successful, the plan will effect a great saving in the weight

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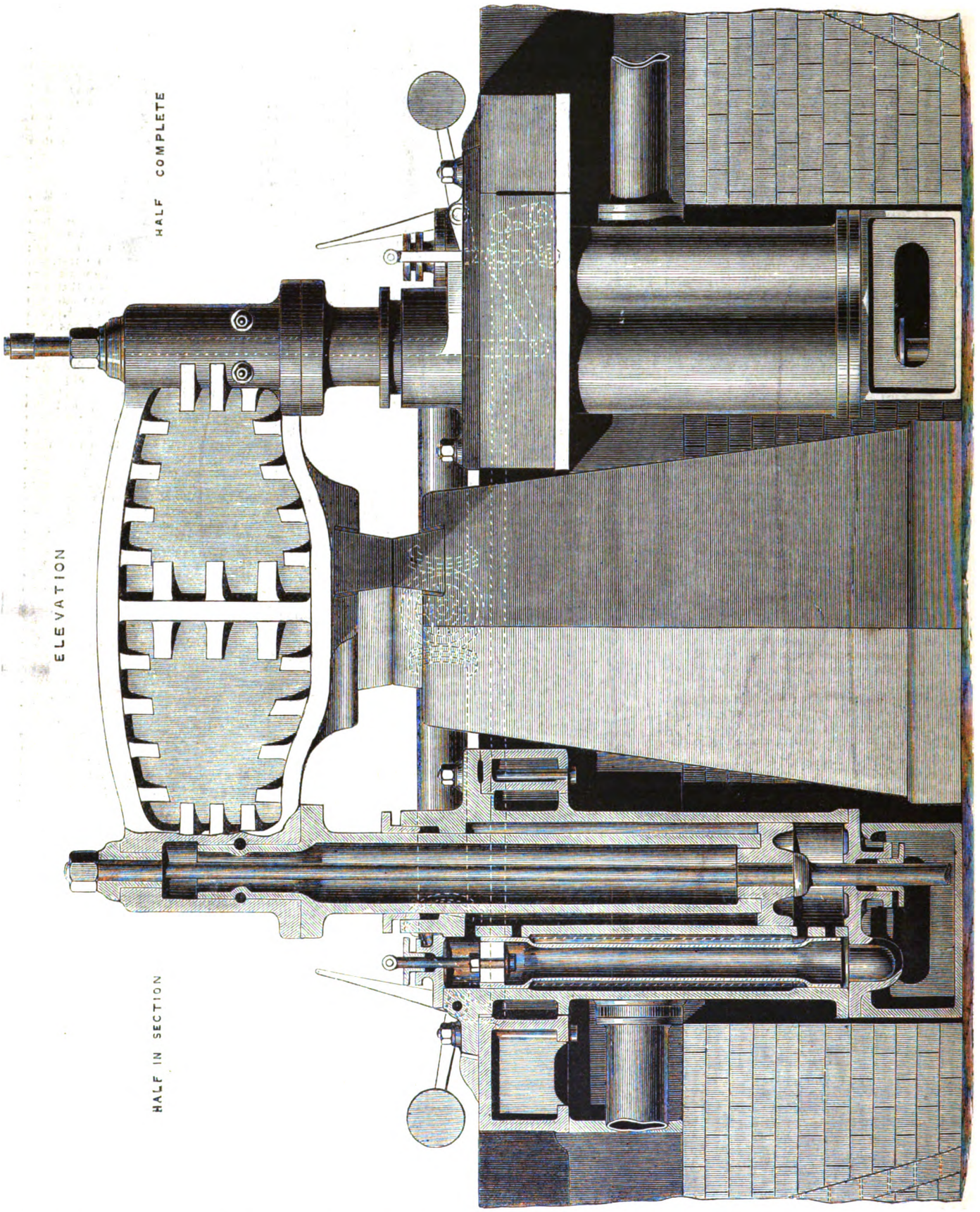
DOUBLE-CYLINDER STEAM HAMMER.

BY MESSRS. THWAITES AND CARBUTT.



of the heavier class of hammers, and also in the height and ground space they will occupy. A 25-ton hammer requires a building upwards of 35ft. high, and its two standards weigh, perhaps, 25 tons each. In Messrs. Carbutt's system it will easily be seen that much of this size and weight can be dispensed with. The hammer we illustrate has two fixed cylinders, arranged at the angles of a heavy anvil block disposed equi-distantly between them. The pistons have differential areas, as the greatest force is, of course, required to raise the tup, or hammer. The rods pass through the bottoms of the cylinders, and the crosshead is so massive that no distortion or twisting can take place; indeed, the only course for such twisting would lie in a variation in the friction of the pistons and stuffing-boxes, which must be very small. The valves are cylindrical, and balanced. They are worked either by hand, or by means of a tappet rod connected with the left-hand piston-rod and cam gear, shown by dotted lines.

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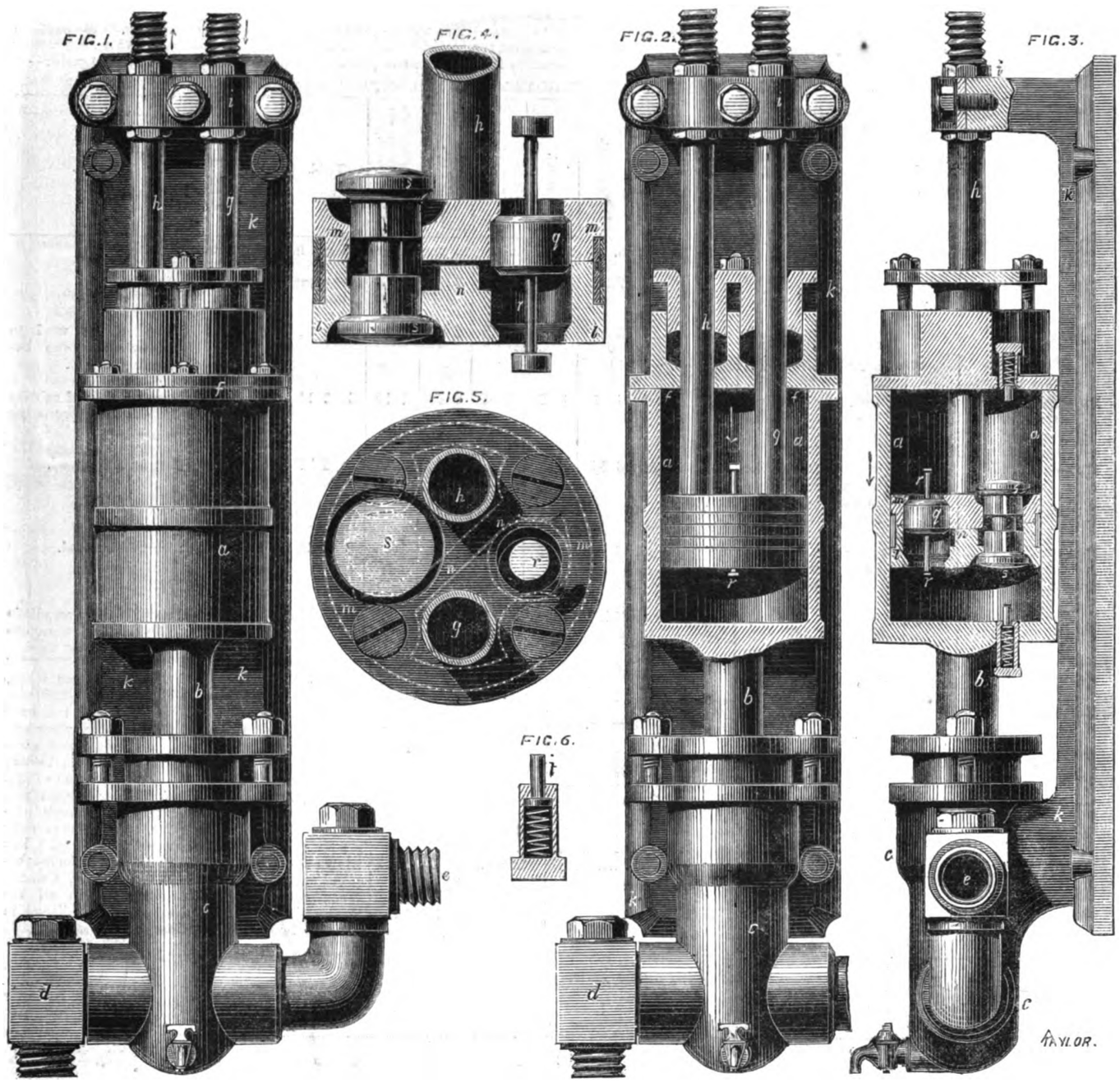
DIRECT-ACTION DONKEY PUMP.

BY MESSRS. WAYGOOD AND CO.



DIRECT-ACTION DONKEY PUMP.

THERE has been much discussion of late on the subject of donkey pumps. Whatever the merits or demerits of those in general use may be, there can be no question of the value of the one illustrated in the accompanying engraving. It is the patented invention of the proprietors of Waygood's Newington Ironworks, Brunswick-street, Dover-road, London, where we inspected one at work, and a number in course of manufacture. The pump certainly works most efficiently, and although but recently perfected is deservedly gaining favour with engineers, and has been adopted by the Government. Referring to our engraving, which represents one of these donkey engines, fig. 1 is a front elevation; fig. 2 is the same elevation with the cylinders in section; fig. 3 is a side elevation with the cylinder and piston in section; figs. 4 and 5 are respectively a vertical section, and a plan of the piston on a larger scale. *a* is the cylinder which has no inlet or outlet ports. *b* is the plunger or bucket rod which is attached to the lower end of the cylinder *a*. *c* is the pump barrel, *d* the suction pipe, and *e* the outlet or force pipe. The upper end of the cylinder *a* is provided with a cover *f*, through which two pipes *g h* are passed; the pipe *g* acts as the supply pipe, and the pipe *h* as the exhaust pipe for the steam or other motive fluid. These pipes *g h* are connected at their upper end to a fixed crosshead *i* forming part of the framing *k*, while the lower ends of the pipes are attached to the cover of the piston. The pipes *g h* serve as guide rods for the movements of the cylinder *a*. The piston is composed of two parts, the body *l* and the cover *m*; the body *l* is hollowed out on the upper side, and has a partition *n* which divides the hollowed-out portion into two chambers *p*, in which the pipes *g h* terminate. The piston body and cover *l* and *m* have each two apertures in which valves are free to move. One of these valves *q* is the inlet valve, and has two opposite faces to take the seats on the interior of the piston; it has two pins *r r* projecting from it which are acted upon by the respective ends of the cylinder *a* at the completion of each stroke, whereby this valve is shifted. The other valve is the exhaust valve, and is composed of two puppet valves *s s* made in one piece so as to act in two directions. The opposite faces of this valve work on seats on the outside of the piston. On the completion of each stroke the double valve *s s* is closed by a spring pin *t* in the cylinder end and the other valve *s* opened for the exhaust in the return stroke. Fig. 6 is a section on a larger scale, showing one of the spring pins *t*. The pressure of the steam on the surface of the piston on either side keeps the valve *s s* upon its seat during the movement of the cylinder *a* in either direction. The simplicity and efficiency of this apparatus induce us to recommend our engineering friends to give it a trial. Mr. Waygood exhibited one of these pumps at the conversazione of the Institution of Civil Engineers on Tuesday evening, where it attracted considerable notice, and was greatly approved of.

THE display of fireworks at the Crystal Palace, on Monday evening last, was the most brilliant ever witnessed there. Whether we take the beauty of the colours, the elegance of the designs, or the extensive character of the display, we can but pronounce it a triumph of pyrotechnic art. We advise our readers not to miss the next opportunity of witnessing the magnificent effects produced, which the mingling of the fountains render the most striking and remarkable ever seen.

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ON CERTAIN POINTS IN THE MANUFACTURE OF MALLEABLE IRON, WITH SPECIAL REFERENCE TO THE RICHARDSON PROCESS.*

By Mr. St. John Vincent Day, C.E.

(Continued from page 389).

HAVING now shown the general nature of previous attempts, I proceed to explain the different course of action that Mr. Richardson adopts. In place of continuous blowing the blast is introduced through a tubular rabble connected with a blast receiver immediately after the charge is melted, and continued until the metal is brought to "the boil," when it is withdrawn. The period from the melting to the boil with the iron used at Parkhead under the common method of puddling occupies from 25min. to 40min.; this by the Richardson process, is reduced to 10min. The temperature of the furnace being higher, the period from the commencement of the boil to that when decarburization and desilicatization are completed, and the iron separates from the slag and cinder, is again reduced. But the balling operation is of a little longer duration than under the old method on account also of the greater temperature, the granules of iron requiring more time to cool down to that temperature at which they adhere when pressed together. The following table, No. 1, of some of the first experiments made at the Glasgow Ironworks shows the time occupied in conducting each stage of the process, as well as the yield:—

Table No. I.—EXPERIMENTS AT THE GLASGOW IRON COMPANY'S WORKS.

Date of Experiment, and Number of Furnace.	Weight of Charge.	Charge composed of.	Time of Charging.	Iron melted at.	Blast put in at.	Blast on till.	First Ball out.	Last Ball out.	Time occupied from charging until the Iron was fined.	Yield.	Diminution of Charge.	Remarks.
	cwt. lbs.		h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	cwt. qrs. lbs	cwt. qrs. lbs.	
May 30, 1867. Furnace No. 17 ...	4 0	Pig iron exclusively...	7 0	7 27	7 28	7 36	8 4	8 8	1 8	Not ascertained.	Not ascertained.	
June 11. Furnace No. 17 ...	4 0	Pig iron exclusively...	6 12	6 42	6 43	6 47	7 18	7 22	1 10	3 3 14	0 0 14	Three rabbles used to prevent any one becoming too hot.
June 11. Furnace No. 17 ... Refettled.	4 0	3 cwt. pig iron and 1 cwt. refined or plate-metal.	7 30	8 1	8 1·5	8 6·5	8 35	8 40	1 10	3 2 14	0 1 14	Same number of rabbles used as in the preceding experiment.
June 13. Furnace No. 17 ...	4 0	Common pig of the worst quality used in the works for a long time.	6 5	6 35	6 35	6 43	7 16	7 20	1 15	3 2 7	0 1 21	Three rabbles used.
June 13. Furnace No. 17 ... Furnace refettled, and again charged.	4 0	Same as in the preceding experiment.	7 30	8 3	8 4	8 12	8 36	8 41	1 15	3 3 18	0 0 10	Five rabbles used.
Means	4 0		Mean time of blowing in 6·36 minutes ...						1 11	3 2 27·25	0 1 0·75	The rabbles are very little affected, and therefore will last a long time.

In these experiments the time of working a charge composed entirely of Scotch pig was brought down to 1hr. 8min. whereas the usual time is from 1hr. 30min. to 1hr. 45min. under the old method; the yield is considerably higher; so high, indeed, as to require only 21cwt. 1qr. 17lb. of pig iron to produce a ton of malleable iron, showing a loss on the conversion of only about six per cent. Then as to the purity of the iron, it is most remarkable; two samples which I sent to Dr. Stevenson Macadam, of Edinburgh, to be analysed have given the following results:—

Analysis.

Name of Element.	Square Bar.	Round Bar.
Iron	99·569	99·648
Carbon	0·035	0·031
Silicon	0·076	0·075
Sulphur	0·025	0·028
Phosphorus	0·031	0·034
Manganese	Trace.	Trace.
	99·736	99·816

We see the sulphur and phosphorus are withi, the merest shadow of being entirely eliminated evidently showing that some special influence must be present when puddling iron according to Richardson's system that is not found elsewhere; iron never has been made from British ores, on a commercial scale, so pure as in these two instances. Made from inferior Scotch pig, which always contains such a very large percentage of these two elements, the extent of their elimination is all the more remarkable. But not to draw any hasty conclusions, I have prepared tables Nos. 2, 3, 4, 5, 6, 7, and 8, showing the percentages of these elements in all the British pig irons, from the analysis published in the Blue Book "On Cast-iron Experiments."

Table II.—HÆMATITES. SULPHUR AND PHOSPHORUS COMBINED IN PIG IRON MADE IN WHITEHAVEN AND ULVERSTONE DISTRICTS FROM HÆMATITE ORES.

Particulars as to the Ores from which the Pig Iron was made.	Sulphur per cent.	Means of Sulphur.	Phosphorus per cent.	Means of Phosphorus.	Remarks.
Red Hæmatite from Whitehaven, Cumberland, and Cleator Moor.	0·01, 0·10, 0·05	0·053	0·05, 0·03, 0·06, 00·5	0·0475	Whitehaven Foundry, Pig, Nos. 1, 2, 3, 4, hot blast.
Ulverstone Ore.....	0·03	0·03	0·10	0·10	Pig iron made at the Newland Furnaces, Ulverstone.
Ores in the locality of Durham	0·06, 0·04, 0·12, 0·04, 0·230, 0·06	0·09	0·07, 0·19, 0·19, 0·14, 0·12, 0·14	0·141	Iron smelted by the Weardale Iron Company, and by the Forest of Dean Company, at Parkhead Ironworks.
Ulverstone Hæmatite (Anhydrous sesquioxide), 25 parts; Forest of Dean Hæmatite (Hydrated sesquioxide), 5 parts; Brown Hæmatite, believed to be from Froghall, 25 parts; Gubbin Ironstone, 10 parts (roasted); Bottom Whitestone, 5 parts (roasted).	0·05	0·05	0·29	0·29	Pig iron made by Messrs. Firmstone and Co., Lays Ironworks.
	Mean of Means,	0·056	Mean of Means,	0·1446	

Table III.—CHIEFLY ARGILLACEOUS ORES FROM THE COAL MEASURES. SULPHUR AND PHOSPHORUS COMBINED IN PIG IRON MADE IN SOUTH WALES,

Particulars as to the Ores from which the Pig Iron was made.	Sulphur per cent.	Means of Sulphur.	Phosphorus per cent.	Means of Phosphorus.	Remarks.
Wholly of Welsh Mine without cinder or red ore.	0·11, 0·28, 0·46, 0·09	0·235	0·63, 0·63, 0·64, 0·63	0·032	Pig iron made at Dowlais, of which the first three samples were of No. 3 best mine pig, cold blast; mottled mine pig, cold blast; and white mine pig, cold blast respectively; whilst the fourth was best mine pig, melted in a furnace with three twyers, of which two were hot and one cold blast.
Black Pins, Pwll Llacca Bottom, Vein, Ball Mine and Grey Vein.	0·06, 0·07, 0·08, 0·08	0·074	0·38, 0·29, 0·27, 0·38	0·32	Made at Blanaevon with cold blast.

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TABLE III.—CHIEFLY ARGILLACEOUS ORES FROM THE COAL MEASURES. SULPHUR AND PHOSPHORUS COMBINED IN PIG IRON MADE IN SOUTH WALES.
(Continued).

Particulars as to the Ores from which the Pig Iron was made.	Sulphur per cent.	Means of Sulphur.	Phosphorus per cent.	Means of Phosphorus.	Remarks.
From the coal measures of the locality; the precise names of ore unknown.	0·06, 0·07, 0·04	0·059	0·32, 0·28, 0·33	0·31	Made at Blanaevon, and specified as cold blast grey pig iron, analyzed at the Arsenal, Woolwich.
Red or Welsh Mine and cinder	0·77, 0·73	0·75	0·82, 0·76	0·79	The first of these samples cast in chills, the second in sand, to ascertain the difference chemically by the two modes of being cooled. It is surprising that whilst so small a proportionate difference shows itself in the carbon, the proportionate difference in the phosphorus is very great.
From the coal measures in the locality of Pontypool.	0·12, 0·08, 0·09	0·096	0·32, 0·46, 0·50	0·426	Cold blast grey pig made at Pontypool.
Caus-y-Glo or Cheese Mine, Pimmelyn Mine; or Yellow Pin with Red Hæmatite from Ulverstone.	0·05, 0·06, 0·05, 0·05, 0·09, 0·06	0·06	0·41, 0·29, 0·38, 0·42, 0·38, 0·27	0·36 nearly	Made at Ystalyfera, near Swansea, hot blast.
	Mean of Means,	0·098	Mean of Means,	0·473	

TABLE IV.—ARGILLACEOUS ORES FROM THE COAL MEASURES. SULPHUR AND PHOSPHORUS COMBINED IN PIG IRON MADE IN SOUTH STAFFORDSHIRE.

Particulars as to the Ores from which the Pig Iron was made.	Sulphur per cent.	Means of Sulphur.	Phosphorus per cent.	Means of Phosphorus.	Remarks.
Binds, Whitestone, Gubbin, and Grains, proportions unknown.	0·04, 0·04, 0·03, 0·06, 0·05	0·044	0·34, 0·31, 0·43, 0·29, 0·44	0·362	
Ibid.	0·08, 0·07, 0·04, 0·08	0·0675	0·42, 0·42, 0·34, 0·45	0·40	Cold blast grey pig iron.
Bottomstone and Binds, two-thirds Gubbin; and Rubble one-third.	0·06, 0·03, 0·10	0·63	0·58, 0·55, 0·48	0·53	Pig, grey—forge, and forge pig respectively, cold blast iron made at the Parkhead Furnaces, Dudley.
Ibid.	0·08, 0·08, 0 05, 0·05, 0·07, 0·05	0·063	0·55, 0·51, 0·48, 0·49, 0·58, 0·60	0·53	Cold blast grey pig made at the Parkhead Furnaces, Dudley.
Gubbin one-half, Whitestone the other half.	0·04, 0·05	0·045	0·72, 0·63	0·67	Hot blast and cold blast respectively, from Earl Dudley's Level Ironworks, Brierley Hill.
Whitestone, Gubbin, Grains, Pins, Balls, and Poor Robins, with a little Red Hæmatite from Ulverstone.	0·03, 0·04, 0·07, 0·11	0·0625	0·38, 0·63, 0·55, 0·41	0·49	Pig iron made by Messrs. Badger and Co., Old Hill Furnaces, Dudley; whether by hot or cold blast is unknown.
Uncertain as to name	0·08, 0·09, 0·09, 0·07, 0·07	0·08	0·36, 0·30, 0·41, 0·55, 0·23	0·39	Grey pig, both hot and cold blast, from Lays Ironworks, Dudley.
	Mean of Means,	0·0614	Mean of Means,	0·48	

TABLE V.—ARGILLACEOUS ORES FROM THE COAL MEASURES. SULPHUR AND PHOSPHORUS COMBINED IN PIG IRON MADE IN YORKSHIRE.

Particulars as to the Ores from which the Pig Iron was made.	Sulphur per cent.	Means of Sulphur.	Phosphorus per cent.	Means of Phosphorus.	Remarks.
Black Bed Ironstone from the Coal Measures of this locality.	0·05, 0·04, 0·06, 0·03, 0·06, 0·07, 0·04	0·05	0·50, 0·57, 0·56, 0·49, 0·44, 0·67, 0·52	0·54	Various kinds specified as pig and grey pig made at the Bowling Ironworks.
Ibid.	0·06, 0·07, 0·05, 0·05, 0·04	0·054	0·52, 0·53, 0·64, 0·55, 0·55	0·558	Cold blast pig iron made by Messrs. Harding and Co., Beeston Manor Ironworks, Leeds.
	Mean of Means,	0·052	Mean of Means,	0·549	

TABLE VI.—ARGILLACEOUS ORES FROM THE COAL MEASURES. SULPHUR AND PHOSPHORUS COMBINED IN PIG IRON MADE IN DERBYSHIRE.

Particulars as to the Ores from which the Pig Iron was made.	Sulphur per cent.	Means of Sulphur.	Phosphorus per cent.	Means of Phosphorus.	Remarks.
The first three samples in this case made of Brown Rake Ironstone, and the fourth from Blue Rake Ironstone (ore roasted).	0·02, 0·02, 0·04, 0·11	0·0475	1·09, 1·21, 1·15, 0·75	1·05	Pig Nos. 1, 2, 3, 4, made by Messrs. Needham, Butterley Ironworks, near Alfreton, Derbyshire, hot blast.
Black and Grey Rake two-thirds, and Honeycroft, or Striped Rake, one-third.	0·02, 0·06, 0·05, 0·03, 0·05	0·042	0·72, 0·34, 0·72, 0·95, 0·70	0·68	Various, foundry pig, and grey forge pig, made at the West Hallam Ironworks.
	Mean of Means,	0·0447	Means of Means,	0·865	

TABLE VII.—SULPHUR AND PHOSPHORUS COMBINED IN PIG IRON MADE ENTIRELY OF NORTHAMPTONSHIRE ORES.

Particulars as to the Ores from which the Pig Iron was made.	Sulphur per cent.	Means of Sulphur.	Phosphorus per cent.	Means of Phosphorus.	Remarks.
The usual ores of this neighbourhood.	0·197, 0·414 0·702, 0·440	0·438	0·936, 1·807 1·368, 1·300	1·127	
Ibid.	0·10, 0·13, 0·07	0·10	1·19, 1·07, 1·31	1·16	Made by Messrs. Battlin and Co., with cold blast.
	Mean of Means,	0·269	Mean of Means,	1·1435	

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TABLE VIII.—SULPHUR AND PHOSPHORUS COMBINED IN PIG IRON MADE FROM CLEVELAND ORES.

Particulars as to the Ores from which the Pig Iron was made.	Sulphur per cent.	Means of Sulphur.	Phosphorus per cent.	Means of Phosphorus.	Remarks.
Uncertain	0·03, 0·04	0·035	1·24, 1·30	1·27	Iron known as No. 2 foundry pig, made at South Bank Furnaces, Middlesborough-on-Tees, hot blast.
Cleveland ore from Belmont Mines, and a little Red Hematite.	0·04, 0·03	0·035	1·38, 1·36	1·37	Made by Messrs. Holdsworth, Bennington, and Byers, at Stockton, hot blast.
	Mean of Means,	0·035	Mean of Means,	1·32	

The only analysis of pig iron from North Staffordshire that I possess contains the very high proportion of 1·07 of phosphorus, and 0·04 of sulphur.

It is a very remarkable fact that I have not been able to obtain many reliable analysis of black band pig iron, or indeed of the other Scottish irons that are guaranteed by authority; this is not only a peculiarly striking fact, it is moreover one to be greatly deplored. It is true that I am in possession of several analyses in which phosphorus does not present itself at all; this certainly is notorious, as it is well known that the black band pig irons do contain a very large percentage of phosphorus, and I can therefore only suppose that this element, always most difficult of detection, has not been carefully sought for. The paucity of analyses in this respect is no doubt principally due to the fact that so much of the Scotch pig iron is used and exported from the country as "foundry iron." Now it is perfectly evident that for foundry purposes the presence of phosphorus is of considerably less importance than would result if the pigs were so largely used for making malleable iron as the English, Welsh, and Continental ores. It being certain that the presence of phosphorus has so much to do with the tensile strength of malleable iron, this, no doubt, has been the chief incentive to the undertaking so many careful analyses of those pig irons from which malleable iron is principally made, in order that to produce the highest quality of finished iron, ores containing the least amount of phosphorus might be selected.

(To be continued.)

Legal Intelligence.

VICE-CHANCELLOR'S COURT.

May 26.

(Before Vice-Chancellor GIFFARD.)

THE ATTORNEY GENERAL *v.* LEONARD EDMUNDS.

ON Tuesday last, this celebrated case, best known to our readers as the Edmunds scandal, was opened by the Attorney-General, Sir J. B. Karslake. It will be remembered that the information which was filed on the part of Sir R. Palmer, when Attorney-General, asks that an account may be taken of all fees and moneys received by the defendant as Clerk of the Patents and as Clerk of the Commissioners of Patents since the date of his appointment, and also of all moneys received by him from the Lords of the Treasury for the expenses of Clerk of the Commissioners of Patents, and of the application by the defendant of all such fees and moneys respectively. It further asks that it may be declared that in taking such accounts the defendant ought to account for all profits made by the purchase and resale of stamps, and that he is not entitled to make any deduction whatever for or in respect of the parchment used in the preparation or engrossment of any document issued by him as Clerk of the Patents, or from the office of the Clerk of the Patents, or any other deduction in respect of the preparation of any such document; and that the defendant may be ordered to pay what may be found due from him, with interest on the balances in his hands from time to time.

The defendant, in his answer, submitted that the Court of Exchequer was the proper court to try this case; but, as he was anxious to meet the charges affecting his character contained in the information, he made his answer without prejudice to his right to demur to the information. So far from offering any objection to the taking of the accounts prayed for by the information, he was most anxious that they should be taken, provided that they should be taken in a just and equitable manner, and that all just and due allowances were made to him, having regard to the circumstances in which he was placed, and also to the true intent of the several Acts of Parliament under which he held the aforesaid appointments; and he was advised, and believed, that, instead of being indebted to the Crown, he was fairly entitled to receive from the Exchequer (independent of the amount due to him in respect of discount for stamps) the sum of £7,715 17s. 11d., and from the Suitors' Fee Fund the sum of £130 17s. 2d., amounting together to £7,846 15s. 1d.

The Attorney-General contended that the defendant, since 1844, had made deductions which were not justified by the Acts of Parliament, and that, as, by means of money belonging to the Crown, he for a long series of years made large profits by purchasing from the Crown stamps at prices lower than those at which he sold them to the persons to whom he issued patents, he must account for that profit.

Sir R. Palmer, who followed on the same side, said the defendant in his answer distinctly admitted that, as an accountant to the Crown, he for a long series of years received sums for which he had not regularly given any account, in consequence of circumstances preventing him from doing so. There could be no doubt that, for the purpose of taking accounts such as these, this court had as complete jurisdiction as the Court of Exchequer. The defendant, on the ground that the expenses of his office were too great in comparison with his salary, undertook to make alterations in the practice of the office in his own favour, alterations which were in direct contravention of the Act of Parliament. No employé, without the consent of the employer, could be justified in taking such a course as that.

At this stage of the proceedings the court adjourned, and on resuming its sitting on Wednesday, Mr. Digby Seymour, Q.C., on behalf of Mr. Edmunds, contended that, according to the evidence of the officials in the public departments, he was entitled to invest the balances of public money in his hands in any way that he might think most profitable, and that the profit accruing from such investment belonged to him. The only duty that devolved upon Mr. Edmunds with regard to these balances was that when he was called upon to account for them he should be ready to do so. It was a most tyrannical proceeding on the part of the Crown now to call upon Mr. Edmunds to account for matters extending over a period of thirty years. If, instead of filing this information, the Crown had preferred an indictment charging him with having wilfully misappropriated money, the verdict of the jury would have been speedily pronounced. But the present proceeding was worse than an indictment. When could the accounts which were asked for be completed? They might as well open the floor of the court and bury him 100ft. deep, as subject him to the long torture of taking accounts extending over a period of thirty years. Mr. Edmunds had groaned over the long delay that had already taken place in the investigation of this affair. What new light could be gained by referring these accounts to chambers? Already a sort of Star Chamber inquiry, from which the gaze of the public eye was excluded, had been carried on against him. In the name of justice he (Mr. Seymour) protested against the tyrannical proceedings which the Crown had adopted against Mr. Edmunds, and in using that emphatic language he was ready with all his heart and soul to accept the consequences of it.

The case is still proceeding, and we shall resume our report next week.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 8d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

ERRATUM.—In an article on "Testing and Annealing Steel Plates," which appeared in our issue of the 15th inst., occur the following words:—"The following is a remarkable illustration of the superiority of the system of drilling holes in *armour* plates to that of punching them." The word "armour" should be "steel."

RECEIVED.—N. M.—T. C.—Messrs. D. and B.—W. B.—B. F.—H. D. R.—G. G.—E. M.—Messrs. E. and H. O.—A. C.—W. N.—G. W. H.—T. C.—P. D. T.—H. L.—H. D. R.—H. W.—J. B.—A. M.—T. B.—J. N.—A. T.—R. I.—J. H.—H. O.—J. B. T.—G. N.—S. E. N.—B. S.—T. C.—H. W. H.—R. F.—T. J.—Messrs. J. B. and Co.—R. H. S.—F. H.—G. E. P.—J. L. N.—B. T.—J. K.—T. C.—J. N.—B. F.—E. A. C.—G. H. B.—W. J.—E. M.—R. A.

Meetings for the Week.

MON.—Royal United Service Institution.—Mr. J. R. Hamilton, late C S. Navy, on "The American Navy: its Organization, Ships, Armament, and Recent Experiences," at 8.30 p.m.

Royal Institution.—General Monthly Meeting, at 2 p.m.

TUES.—Royal Institution.—Dr. M. Foster on "The Development of Animals," at 3 p.m.

THURS. — Royal Institution.—Sir J. Lubbock on "Savages," at 3 p.m.

FRI.—Royal Institution.—Sir S. Baker on "Abyssinia," at 8 p.m.

Royal United Service Institution.—Colonel H. Lane Fox, late Grenadier Guards, on "Primitive Warfare, Section 2. On the Resemblance of the Weapons of Early Races: their Variations, Continuity, and Development of Form," at 3 p.m.

SAT.—Royal Institution.—Sir J. Lubbock on "Savages," at 3 p.m.

Naval, Military, and Gunnery Items.

DURING the past week 31 wrecks have been reported, making for the present year a total of 925.

WE hear that General Sir Duncan Cameron has accepted the post of Governor of the Military College at Sandhurst.

WE understand that the volunteer review proposed to be held in Windsor Park, on Whit-Monday, has been finally abandoned, owing to her Majesty's intention to review the volunteers later in June.

IT is announced in Ottawa, Canada, that the English Government have agreed to fix the tax on American vessels fishing in Canadian waters at two dollars a ton, and dispense with the three warnings heretofore given to such vessels.

THE "Moniteur de l'Armee" publishes a report from Marshal Niel, dated the 20th inst., confirming the excellence of the Chassepot rifle, and stating that its incomparable qualities assure to it the first rank among the arms of war now employed. The report adds that the whole of the French infantry are now armed with the Chassepot. The manufacture is actively carried on; the mean daily number turned out last week was 1,600.

ACCORDING to the "Bureau Veritas" of Paris, the number of vessels reported as totally lost during the month of April was 202, including 93 English, 27 American, 19 French, 15 German, 9 Norwegian, 6 Dutch, and 33 bearing various other flags. The number of total losses during the first four months of the present year was 883, which, as compared with the corresponding period of 1867, shows a diminution of 284 in the list of such disasters.

A LETTER from Toulon, quoted by the "Temps," says that the ironclad monitor "Rochambeau," brought from the United States, will not cost more than ten millions of francs (£400,000), all reparations included. It is said that it is a splendid instrument of war, but that it leaks like a sieve—as much as 100 tons of water in twenty-four hours. This, it is stated, does not arise from any bad construction, but from the bad quality of the wood, which is half rotten.

THE docks are being prepared at Chatham for laying down the keels of two new powerful ironclad ships which are ordered to be constructed at that

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establishment. The "Triumph" and the "Sultan," the two vessels, will be of the broadside class, of the "Hercules" type, the "Sultan" being the most powerful of the two, both for offensive and defensive purposes, her armour-plating being 9in. in thickness, while that of the "Triumph" will be of a maximum thickness of 8in. The "Triumph" is to have her bottom sheathed with wood, overlaid with copper.

WIMBLEDON meeting, next July, will be distinguished by some new features. Not less than £10,125 will be distributed in prizes to the competitors. On former occasions the money would have been divided among the Volunteers only, but this year, by a happy innovation, it has been determined to summon picked infantry soldiers of the regular army to Wimbledon, and reward the successful for their skill. Not only are there money prizes for individual men given by the Association but there is in addition a challenge shield, which will be held by the regiment whose marksmen may win it.

THE pensions for distinguished or meritorious service, vacant by the appointment of Generals Horn, Longfield, and Gratten to regimental colonelcies, have been given to Colonels K. D. Mackenzie, Deputy Adjutant-General in Ireland, Robert Pratt, 23rd Fusiliers, and R. J. Eagar, 31st Regiment. These rewards are well deserved. The "Army and Navy Gazette" states that Colonel Mackenzie has been 37 years in the army, and served with great ability on the Staff in the Crimea, and in China in 1860. Colonel Pratt has been in the army since 1837, was with the 41st in the Afghan Campaign of 1842, in the Crimea, and in the Indian mutiny in 1858 and 1859. Colonel Eagar's first commission bears date 1830, and his services also comprise the Afghan and Crimean campaigns.

Miscellanea.

A SYCAMORE tree 110ft. high, with a hollow 14ft. in the clear, is reported to be standing in Calhoun county, Illinois.

ALL the diamond cutting in America is done by one firm in Boston, and their business is confined to the re-cutting of stones which have been nicked or otherwise rendered imperfect.

WE remind our readers of the treat at the Horticultural Gardens, South Kensington, in the great flower show, which takes place on Tuesday, and the three following days of next week.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending May 23, was 2,396; total number since the opening of the museum, free daily (May 12, 1858), 1,300,543.

INTELLIGENCE from Newfoundland received at St. John's on the 8th says that the seal fishery has been, on the whole, successful up to the 28th ult. Two hundred and fifty thousand seals had arrived at St. John and Harbour Grace.

DURING the month of March twelve ships, with 1,066 emigrants, sailed from Genoa for South America. Of this number 267 were natives of Genoa; 150 of Sondrio; 118 of Como; 96 of Milan; 59 of Potenza; 45 of Cuneo; 44 of Turin; 36 of Alessandria; 29 of Salerno; and 27 of Pavia.

THE shock of earthquake at Tachkent, on the 5th inst., lasted nearly a minute, the direction being from south-west to north-east. All the buildings were shaken, and most of them seriously damaged. Nine men, four women, and two children were killed by the fall of houses, and six other persons slightly injured.

THE Supreme King of Siam has published an official list, with the names of his children, the dates of their birth, and of the dates of those deceased. The whole number is 81, of whom the eldest was born in 1823, the youngest in 1868. Sixty-six are now living. The late Second King had 63 children, of whom 30 are now living.

ONE of the most important products in Italy is olive oil. The average annual production is upwards of 1,500,000 hectolitres (33,000,000 gallons), representing the value of about 200,000,000f. (£8,000,000 sterling). A large amount is consumed in the country, and the exports do not exceed 70,000,000f. (£2,800,000).

A SUCCESSFUL attempt at growing opium has been made in Victoria. A few plants have been raised this year, and the produce has been pronounced by good judges to be of first-rate quality. The Chinese horticulturists in those districts will no doubt avail themselves of this experience, and it is expected that opium crops will be largely cultivated.

WE are glad to inform our readers that a number of Mr. Dobson's mules for spinning and doubling, one of which we described and illustrated last week, are at work, and are giving very satisfactory results. They spin equally well the highest or the lowest number of cotton or wool, and can work with single speed for coarse or double speed, for fine numbers, as may be required.

AT the South Kensington Museum the visitors during the week ending May 23, 1868, were on Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., 7,740; on Wednesday, Thursday, and Friday (admission, 6d.), from 10 a.m. till 6 p.m. 1,678. National Portrait Exhibition, by payment, 2,359; total, 11,786. Average of corresponding week in former years, 9,673. Total from the opening of the museum, 7,397,969.

THE experimental trains over Mont Cenis, ordered by the French and Italian Governments, have worked daily with great regularity and success. The Duke of Sutherland, Messrs. Brassey, Blount, Buddicom, Brogden, and Fell, directors; Mr. Brunlees, engineer; Count Arrivabene, a member of the Italian Parliament, and about fifty more, travelled over the line on the 22nd and 23rd inst. The opening for public traffic is fixed for June 8.

AT a meeting of the Fellows of the Royal Botanic Society, on Saturday, Lord Tredegar in the chair, the names of the following candidates for the fellowship were read:—Sir Lionel Darell, Bart., Julian Goldsmid, Esq., M.P., Captain W. E. P. O'Brien, Mrs. Van Raalte, Miss Cancellor, John Walker Anderson, Esq., Henry H. Temple, Esq., R. P. Wilson, Esq., Cyril M. M. Rawlings, Esq., Mrs. George Burleigh, Miss Harvey, Richard H. Barnes, Esq. Mrs. Cornmell, Thomas O. Hutton, Esq., Mrs. Cook, Mrs. Chase, Miss Arbonni, and Lieutenant-Colonel, Revell, in addition to seven elected on the same day.

THE "Daily Telegraph" of this week has borrowed, without acknowledgment, some of our thunder. Last week, in an article on the "Silver Coinage of Great Britain," we demonstrated that the whole of the shillings, sixpences, and subordinate silver coins of this country of a date anterior to that of the accession of Queen Victoria, ought to be re-cast and re-coined. The "Daily Telegraph" of yesterday, evidently acting upon the inspiration of the MECHANICS' MAGAZINE, virtually recommends a similar course, and borrows some of its identical expressions. It does not, however, acknowledge the source of inspiration.

WITH much pleasure we announce that the Council of the Society of Arts have this year awarded the Albert gold medal to Mr. Joseph Whitworth "for the invention and manufacture of instruments of measurement and uniform standards by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the advancement of arts, manufactures, and commerce." The medal was instituted to reward "distinguished merit in promoting arts, manufactures, or commerce," and among the recipients in former years have been Sir Rowland Hill, Professor Faraday, and Messrs. Cooke and Wheatstone.

THE Directors of the Metropolitan Railway have made an inspection of the works in progress on the extension of that line between Paddington and Gloucester-road, Kensington. They were accompanied by Lord Gort, and other directors of the Metropolitan District Railway; the contractors, Messrs. Kelk, Waring, Brothers, and Lucas; the engineers, Messrs. Fowler and Johnson, and by other officers of the company. The whole of the works were found to be in an advanced state, and it is confidently hoped that in the course of the summer this very important link of the inner circle of the Metropolitan Railways will be opened for public traffic.

AT the meeting of the Metropolitan Board of Works a report was presented on the proposals of the Metropolitan District Railway as to the construction of their line between the Temple and Blackfriars Bridge. A provisional agreement had been entered into for the construction of a solid embankment with a 100ft. roadway thereon from the Temple-gardens to Blackfriars Bridge, and the company to construct their railway within the embankment; the railway company to commence their works for the construction of the railway on the embankment from Westminster Bridge to the Temple on July 1 next, and the other works to be carried on simultaneously with the works of the board; the railway company to deposit £10,000 on July 1 next; the payment of the £200,000 to be paid to the board to be spread over three years. The report was adopted.

A MIRAGE was strikingly conspicuous on Sunday afternoon and evening at Dover. The "Dover Chronicle" states that the dome of the Cathedral and Napoleon's Pillar at Boulogne were to be seen from the Crescent Walk by the naked eye, but with a telescope of ordinary power, the entrance of the port, its lighthouse, its shipping, and the surrounding houses, the valley of the hillside of Capecure, and the little fishing village of Portel, were distinctly visible; whilst on the eastern side the principal features of the country, the lighthouse of Cape-Grinez, the adjacent windmill, numerous farms and villages, with their windows illuminated by the setting sun, stood out with extraordinary clearness. Whilst these were under observation, a locomotive was seen to leave Boulogne, and travel some miles in the Calais direction by its puffs and wreaths of white steam. Shortly after sunset the mirage subsided.

MR. E. D. YOUNG, a friend and companion of Dr. Livingstone, has been lecturing at Long Sutton, Lincolnshire, on the course probably taken that distinguished traveller. When an expedition in search of Dr. Livingstone was determined on, Mr. Young was consulted on the subject; his plans were approved, and he was entrusted with the command. The expedition left England in June, 1867. Mr. Young found traces of Dr. Livingstone, but was compelled to return to the mouth of the Zambesi again in December. In speaking at Long Sutton, Mr. Young pointed out the route probably taken by Dr. Livingstone, viz., along Lake Nyassa, and thence by Lake Tanganyika, of which only the southern and northern ends are explored, leaving the immense middle undetermined. Mr. Young expressed his opinion that it would be found one wonderful lake, and the real source of the Nile. He added his belief that Dr. Livingstone would take Speke's and Grant's, or a similar route, and return through Egypt.

THE foundation stone of Her Majesty's Theatre has just been exhumed. Upon its being raised, in a cavity in the bed of the stone, were found a guinea, date 1788; half-guinea, date 1789; a shilling, date 1787; a sixpence, date 1787; a fourpenny-piece, date 1786; a threepenny-piece, date 1772; a twopenny-piece, date 1786; and a silver penny-piece, date 1786. The position of the stone was in the north wall of the box corridor, on the centre line of the auditorium, under the opening leading from the hall to the pit corridor, at a depth of 2ft. 3in. below the paving of the hall. The dimensions of the stone are 2ft. 1in. long, 1ft. 1½in. wide, and 1ft. deep. The inscriptions on the stone are as follows:—On the top, "The first stone of this new theatre was laid on the 3rd of April, 1790, in the 30th year of the reign of King George III., by the Right Hon. John Hobart, Earl of Buckingham—*Auctor pretiosa facit.*" On the front—"The King's Theatre, in the Haymarket, first built in 1703." At the right end—"But unfortunately destroyed by fire on the 17th of June, 1789." On the back—"*Prevalebit justitia.*"

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3179, 3180, 3200, 3212, 3245
BUILDINGS AND BUILDING MATERIALS—3206, 3220, 3234
CHEMISTRY AND PHOTOGRAPHY—3191, 3217, 3232
CULTIVATION OF THE SOIL, including agricultural implements and machines—3199
ELECTRICAL APPARATUS—None.
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3173, 3177, 3190, 3227, 3236, 3242, 3249
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—3182
GENERAL MACHINERY—3174, 3176, 3183, 3186, 3194, 3196, 3203, 3208, 3228, 3230, 3237, 3246
LIGHTING, HEATING, AND VENTILATING—3171, 3172, 3181, 3194, 3198, 3208, 3209
METALS, including apparatus for their manufacture—3205, 3226, 3248
MISCELLANEOUS—3175, 3188, 3193, 3195, 3197, 3201, 3202, 3204, 3207, 3210, 3213, 3215, 3222, 3224, 3225, 3229, 3233, 3235, 3238, 3239, 3240, 3244, 3250
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3178, 3223
SHIPS AND BOATS, including their fittings—3231, 3247
STEAM ENGINES—3219, 3221
WARFARE—3185, 3187, 3189, 3211, 3214, 3216, 3241

3171 M. ROLLASON. *Improvements in suspended gas lamps* Dated November 9, 1867.

The patentee claims the improvements described and illustrated in the drawings in raising and lowering the lower part of the globes or shades of suspended gas lamps, that is to say, by means of a rod or tube connected with the ring of the upper or fixed part of the globe or shade, the said sliding rod or tube being supported in the fixed tube either by springs or by a stuffing box, and fixed, when in its raised position, by a bayonet joint fastening, substantially as described and illustrated.—Patent completed

3172 T. W. INGRAM and E. C. KEMP. *Improvements in gas lamps.* Dated November 9, 1867.

The patentee claims making the suspended chains of the lower half of the globe or shade of the lamps work in a frame of tubes, substantially as described. Suspending the globes or shades, made in one piece, of the said lamps by hooking or engaging the ends of the suspending rods to the said globes or shades, or to a gallery supporting the said globes or shades, substantially as described. Supporting and adjusting the height of the smoke condensers or smoke tops by means of a screwed rod taking into a screw in a tripod, resting on the top of the shade or globe, substantially as described and illustrated; also making the tripod capable of expanding and contracting to fit shades or globes having different size openings at top, substantially as described.—Patent completed.

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3173 C. BEDELLS. *Improvements in the manufacture of elastic fabrics, part of which invention is especially applicable to the production of shaped slipper fronts and similar articles.* Dated November 9, 1867.

The patentee claims the manufacture of elastic fabrics by cementing cords or tapes of vulcanized india-rubber in an unstretched state between two pieces of looped fabric, distended in the direction opposite to that in which the elasticity is required, and in which the india-rubber cords or tapes run. He also claims the manufacture of slipper fronts and similar articles in the manner described.—Patent completed.

3174 G. FARREN. *Improvements in apparatus for taking and registering votes in deliberative assemblies.* Dated November 9, 1867.

For this purpose the inventor provides each seat in the chamber with two finger keys, an aye and a no; by moving these keys electric circuits are made or broken. In this way each finger key when moved gives motion to a lever or instrument, of which there are a series arranged in a glass or other case in front of the chairman, or in other convenient position. The movement of each lever or instrument liberates a small weight, which, by a conducting channel, is led into the scale pan of a balance. There are two such balances provided, one for the ayes, the other for the noes; they should be enclosed in a glass case. By weighing, the number of weights in the pan is immediately ascertained, and the balances should be so arranged as to indicate this number visibly; a delicately-made spring balance is suitable. The apparatus is furnished with a handle or other instrument, by means of which the chairman or other person can keep the finger keys at the members' seats out of action, until the moment when it is desired to take the votes. The levers or instruments corresponding with the finger keys in front of the members' seats also carry pencils or markers, so that when they move they record the vote on a list suitably placed in relation to the series of pencils or markers. When one finger key has been moved, the other key belonging to the same seat is inoperative.—Patent abandoned.

3175 G. F. PARRATT. *Improvements in the manufacture of flexible air-tight cylinders or cases to be used as pontoons and in forming rafts.* Dated November 9, 1867.

According to this invention, the inventor protects flexible air-tight cylinders or vessels so as to render them very durable by cementing over them a strong case of closely-woven fabric, and then painting with a rapidly-drying paint over the surface of the case so applied.—Patent abandoned.

3176 W. LAWRIE. *Improvements in apparatus for burning mineral oils or other hydrocarbons to obtain heat therefrom.* Dated November 9, 1867.

For this purpose the mineral oil or other hydrocarbon to be burnt is placed in a tank, in the interior of which is a coil of pipe, through which steam is passed, in order to keep the hydrocarbon in a sufficiently fluid state. Near the bottom of the tank is a tap by which the oil or liquid passes away to be burnt, and the amount so passing away can be regulated by means of the tap. The oil or liquid passing out by the tap is received into a pipe, which conducts it into a closed retort, one end of the steam pipe being led from the tank near to the tap above mentioned, and is led down the interior of the pipe which conducts the oil to the retort, and just before this pipe enters the retort the end of the steam pipe is taken out through its side, and this end of the steam pipe is left open so that the steam may escape from it. The hydrocarbon in the pipe is thus kept in a sufficiently fluid state. The pipe leading into the retort passes in at its front end and is led along nearly to the back, and the oil or liquid passes into the retort from this end of the pipe. Below the retort, and extending back beyond it, are burners at which the vapours or gases produced in the retort are burnt, and the retort is thus kept heated, pummice stone, or other rough material, being placed over the bottom of the retort, so as to fill it up to the level of the oil pipe, and present a considerable extent of heated surface to the vapours formed from the hydrocarbon.—Patent abandoned.

3177 J. H. W. and A. W. BIGGS. *Improvements in joining warp ends, and in apparatus employed therein.* Dated November 9, 1867.

Heretofore, when a warp has been woven up in the loom, it has been usual to twist or knot the ends of the old threads on to the ends of a new warp. This operation has been, up to the present time, performed thread by thread by hand. According to this invention this operation is performed by the aid of machinery; the ends of the two warps, or of portions of the warps, are distended on a frame, and the ends which are to be joined are approximated each to each, and twisting, knotting, or cementing instruments spin, tie, or cement them together in pairs, simultaneously or in succession. Similar means and apparatus are applicable in joining warp ends in the dressing operation, when the warp threads are wound off beams or rollers, dressed, and then wound on to the warp beam, when the beams or rollers from which the warp threads are drawn become empty, the ends of threads on other beams or rollers are joined up to them.—Patent completed.

3178 W. THOMPSON. *Improvements in omnibuses and similar vehicles, and in apparatus in connection therewith, parts of which improvements are also applicable to railway and other carriages.* Dated November 11, 1867.

The patentee claims, first, the application to omnibuses and vehicles of a similar character of self-registering turnstiles, arranged and operating substantially as and for the purposes set forth. Second, the application to omnibuses, and vehicles of a similar character, of a system of check tickets or counters, substantially as and for the purposes set forth. Third, the improved dust blind and ventilator, constructed and arranged substantially as set forth. Fourth, the application to omnibuses of speaking tubes with branches for intercommunication between passengers, conductor, and driver, substantially as and for the purposes set forth.—Patent completed.

3179 W. PAYNE. *Improvements in clack and bucket door pieces for pumps.* Dated November 11, 1867.

The improvements in clack and bucket door-pieces for pumps herein contained, and consisting substantially in casting on or attaching to each side of the opening of the clack or bucket door-piece, grooves into which the door may slide, giving such a slope or inclination to the inside face of the groove and the outside of the door, which fits against it, as shall have the effect, when the door is let down, of causing it to present against the face of the clack or bucket door-piece, so as to make a tight joint, and the patentee claims the manner of making a more perfect joint in case of need, by using set screws in the manner described, or by inserting in the groove in the inner face of the door, cork, india-rubber, wood, or some more elastic substance than iron, as explained.—Patent completed.

3180 C. B. HODGETTS. *Improvements in tuyeres for blast furnaces.* Dated November 11, 1867.

This invention relates to the construction and arrangement of the parts of tuyeres for blast furnaces, whereby the tuyere is protected against the injurious action of the heat of the furnace, and kept so cool that, in blast furnaces used for the smelting of iron, the melted metal does not attach itself to the tuyere. Tuyeres made according to this invention last longer than ordinary tuyeres. In making a tuyere according to this invention the patentee makes the body of the tuyure in the usual manner, that is, of two hollow cones of different sizes, the smaller one being fixed concentrically within the larger one by annual ends. In the space between the two hollow cones a water pipe is fixed. The said pipe proceeds from the wide to nearly the narrow end of the tuyere. The pipe terminates in a hollow ring surrounding the inner cone. The hollow ring is pierced with a series of holes or jets on the side turned towards the small end of the tuyere. The water with which the hollow conical space is filled is introduced by means of the pipe, and, passing out at the holes or jets in the hollow ring, is delivered directly against the end of the tuyere which is exposed to the greatest heat. The water returns from the narrow end of the tuyere to the wide end, from which it passes away. In order to cause the water on its return passage to play against the outer hollow cone, a collar is made on the inner cone at the back of the hollow ring. The collar directs the water on its return against the outer cone, and keeps it cool.—Patent completed.

3181 S. BUXTON and W. GARDAM. *Improvements in the construction of safety lamps for mines.* Dated November 11, 1867.

The patentees claim, first, a shooting bolt working with a spring, and to withdraw the same they prefer to use a screwed key, screwed either internally or externally, but by preference internally, and by preference with a left-hand thread, and having its fulcrum by means of a shoulder larger than the hole upon the bottom of the oil receiver, and the allowing of the pin's return when the top and bottom parts are put together by the self-action of the spring upon the pin. And, second, the mode of attachment between the top and bottom parts of the lamp by the use of bayonet joints. And, third, the mode of attaching the gauze to the ring, in the manner explained. And, fourth, the use of malleable iron, for the purpose explained.—Patent completed.

3182 G. ELLIS and M. JACOBSON. *A new secret safety desk.* (Partly a communication.) Dated November 11, 1867.

This invention consists in combining with articles of useful and ornamental furniture, a writing desk and cabinet so enclosed as to economize space.—Patent abandoned.

3183 C. E. BROOMAN. *Improvements in apparatus for burning and distilling petroleum and other oils to generate steam, and for other purposes.* (A communication.) Dated November 11, 1867.

This apparatus is constructed with a retort for containing oil, having a steam jacket, or its equivalent, in tubes or chambers, into which steam or its equivalent is thrown for the purpose of heating the oil in the retort. The steam, or its equivalent, rests on the upper or other surface of the oil in the retort, for the purpose of forcing it out through a pipe to a combustion chamber, which pipe is also enclosed in a steam jacket. Atmospheric air is also employed to assist combustion in connection with decomposed steam, both of which are forced in a chamber and distributed in proper proportions with the oil or oil vapour as they all issue from the orifices of the pipes into the combustion chamber. The details of this invention are voluminous.—Patent abandoned.

3184 T. J. LEONARD. *Improved machinery for rolling iron into bars, strips, and sheets.* Dated November 11, 1867.

The object of this invention is to facilitate the rolling of iron by returning the heated metal, after it has passed between the rolls, back to the front of the rolls, so as to repeat the operation with the least possible expenditure of time. By thus quickening the return of the metal to the rolls, the loss of heat is, compared with what takes place with the metal when subjected to the ordinary process of rolling, diminished sufficiently to admit of longer lengths of bars, strips, or sheets being operated upon than heretofore, whereby a great economy will be effected in the process of rolling.—Patent abandoned.

3185 W. R. LAKE. *Improvements in defensive armour for war vessels and forts.* (A communication.) Dated November 11, 1867.

This invention consists in the employment of metal plates made up of alternate layers of iron and steel plates welded together.—Patent completed.

3186 W. R. LAKE. *Improvements in cylinder printing machines, more especially designed for producing coloured patterns upon textile fabrics and paper hangings.* (A communication.) Dated November 11, 1867.

This invention is not described apart from the drawings.—Patent completed.

3187 W. R. LAKE. *Improvements in cartridges for breech-loading firearms.* (A communication.) Dated November 11, 1867.

This invention relates to cartridges provided with an internal cup-shaped anvil, which also serves to strengthen the base portion of the shell. The invention consists, partly, in contracting that portion of the shell in front of the anvil in such manner as to firmly secure the latter, and prevent its displacement by the blow of the hammer or other striker, and to prevent its being dislodged by the action of any gas that may find its way or be generated between the anvil and the base of the shell in firing. The invention further consists in the peculiar construction of the bases of the shell and anvil, and in the means for holding the percussive priming, whereby any liability of accidentally exploding the cartridge, by dropping the same upon a hard surface, is effectually provided against, and whereby the primer is made to serve as a gas check. The gas eliminated by the explosion of the charge, is, by this means, kept from getting between the anvil and the base of the shell, and from driving forward the anvil in the shell, and setting the same tight in the chamber of the barrel.—Patent completed.

3188 W. R. LAKE. *An improved castor for tables, chairs, and other articles of furniture.* (A communication.) Dated November 11, 1867.

This invention consists in the employment in combination with the ordinary parts of such castors of an auxiliary antifriction roller, with a convex periphery, which is supported to turn freely upon a stud or pin attached to the frame of the castor, and arranged to roll upon a concave surface formed upon the foot or leg to which the castor is attached, or upon a circular plate secured upon the same.—Patent abandoned.

3189 W. R. LAKE. *Improvements in breech-loading firearms.* (A communication.) Dated November 11, 1867.

This invention relates more especially to that class of breech-loading firearms wherein the breech is closed by a sliding bolt which is locked and unlocked by turning on its axis, provision being made for inserting the cartridge through an aperture in the barrel or breech receiver when the bolt is drawn back to a suitable position, and the firing of the cartridges being effected by a pin passing through the bolt, and struck by a hammer at the rear of the same. The said invention consists, partly, in the novel construction of the said aperture in the barrel or breech receiver, whereby, while provision is made for easily inserting the cartridges in a proper position relatively to the shell ejector, a firm support is given to the upper part of the breech block or bolt, and its tipping up is prevented. The invention also consists in the novel combination with the block or bolt of a cover for closing the aperture in the barrel or breech receiver when the breech is closed and the bolt locked, which cover is also made to serve as a means for locking the bolt. Also in the peculiar construction of the firing pin and hammer, whereby the possibility of firing the cartridge prematurely or before the recoil bolt is closed and locked, is effectually prevented, while, at the same time, the firing pin is allowed to pass the hammer when drawn back with the bolt in opening the breech. The invention also consists in the construction of the cartridge shell ejector, and in a certain simple provision for cleaning the recoil bolt and breech receiver. The invention cannot be fully described without reference to the drawings.—Patent completed.

3190 W. and W. CAMPION. *Improvements in knitting machinery.* Dated November 11, 1867.

This invention has for its object improvements in knitting machinery, and relates to a novel combination and arrangement whereby ribbed work is produced, and slack courses and welts formed by self-acting machinery. The details of the invention are too voluminous for insertion here.—Patent completed.

3191 F. L. DE GERBETH. *Improvements in treating oils and spirits.* Dated November 11, 1867.

The patentee claims the production of an oil resembling linseed oil, and applicable to printing and varnish making, from a mixture of petroleum or coal iron, or such like hydrocarbon and rosin oil, such oils being treated with oxidizing agents, ozonized air, galvanic electricity, and driers, as described. He also claims the treating petroleum, coal oil, or other similar hydrocarbon oil, with oxidizing agents and galvanic electricity, so as to improve the colour, as described. He also claims the production of a spirit similar to turpentine from a mixture of light petroleum or coil oil, or other similar light hydrocarbon oil or spirit, and light rosin, oil or spirit, such oils or spirits being treated with oxidizing agents, ozonized air, and galvanic electricity, as described. He also claims the apparatus described for the treatment of oils and spirits by means of ozonized air.—Patent completed.

3193 F. and E. L. RANSOME and H. BESSEMER. *Improvements in the manufacture of grindstones and other blocks or forms of artificial stone.* Dated November 11, 1867.

Firstly, the patentees claim, in the manufacture of grindstones and other blocks or moulded pieces of artificial or concrete stone, the moulding or compressing the materials of which such grindstones, blocks, or moulded pieces of artificial stone by means of a vacuum or by pressure, or by both vacuum and pressure combined, substantially in the manner described. Secondly, they claim in moulding articles in artificial or concrete stone, the employment of perforated tubes and hollow or pervious cores for the purpose of facilitating the saturation, washing, or drying of such articles by the employment of exhaust apparatus, or by pressure. Thirdly, they claim moulding artificial or concrete stone on hollow or pervious revolving cores, the requisite pattern or configuration being "struck up" by the employment of suitable scrapers, the material being caused to adhere to and be retained on such revolving core by external atmospheric pressure operating in consequence of the exhausting of such hollow core. Fourthly, they claim rendering waterproof or impervious pipes or other articles moulded in artificial or concrete stone by drawing into the pores thereof, by means of a partial vacuum, in the manner described, fluid asphalte, and bituminous or other matters capable of improving the quality of the stone. Fifthly, they claim making tiles or slabs of artificial or concrete stone having designs or patterns formed of different coloured materials, in the manner described. Sixthly, they claim in the manufacture of grindstones, embedding an iron bush or axis in the material, and also embedding hoops therein, in the manner and for the purposes described. Seventhly, they claim moulding the material known as "Ransome's concrete stone" around the circumference of an iron wheel, having suitable flanges for retaining the same, as described. Eighthly, they claim employing crushed flints in lieu of sand in the manufacture of grindstones of artificial or concrete stone, as described. Lastly, they claim the employment of titaniferous iron, sand alone, or mixed with common silicious sand, in the manufacture of grindstones, as described.—Patent completed.

3194 J. C. BAYLEY and D. CAMPBELL. *Improvements in fire-lighters and fire-revivers.* Dated November 12, 1867.

The composition consists of a mixture of wood, saw-dust, turnings or shavings, tar, and rosin in about the following proportions:—Wood and saw-dust, 28lb.; tar, 18lb.; and rosin, 10lb. The patentees prefer that instead of 28lb. of saw-dust that about one-fourth part of this quantity be wood turnings or shavings.—Patent completed.

3195 H. A. BONNEVILLE. *New and useful improvements in lubricating bores.* (A communication.) Dated November 12, 1867.

This invention consists, first, in so disposing about the shaft, axle, journal, or other bearing, a reservoir or reservoirs for oil or other suitable lubricating medium, and so connecting such reservoir or reservoirs by one or more tubes or other communicating passages extending between it or them, and the bearing of the shaft, axle, or journal, that, by the revolution of the said shaft, axle, or

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journal, the lubricating medium contained in the reservoir or reservoirs will be drawn or sucked up, as it were, therefrom to the bearing, and, being carried around by the journal, shaft, or axle, is made to lubricate the same. Second, in combination with the above, the invention further consists in providing communication between the bearings of the journal, axle, or shaft, and the oil reservoir or reservoirs for the surplus oil or other lubricating medium to flow back into the same. Third, in so supporting a bearing plate or other surface for the journal, which bearing plate is provided with a communication between it and the oil reservoir or reservoirs, as to have a yielding elastic pressure against the journal. And, fourth, in combination with the same, so constructing such plate upon its outside, and projecting into the reservoir about the communicating tubes, as to form an air chamber or cushion or cushions about the same, and thus, as the journal revolves, drawing the oil up through the communication by its own action, or the action of the air cushion or cushions, or both combined, if any movement occurs to the plate, an additional impetus is given to the oil, and it is made the more perfectly and fully to be diffused or supplied about the journal or axle.—Patent completed.

3196 H. A. BONNEVILLE. *Improvements in machines for pressing or moulding bricks, tiles, or other blocks.* (A communication.) Dated November 12, 1867.

This invention (the details of which we cannot give space to here), will probably be described and illustrated in a future number.—Patent completed.

3197 R. P. FAUCHEUX. *Improvements in tobacco pouches, purses, cigar cases, and bags of various kinds.* Dated November 12, 1867.

The inventor fixes on each side of the opening of such articles, a flat steel or other suitable spring, such springs being connected together at their end in any suitable manner, so that, by pressing upon the ends thereof, the tobacco pouch or other article is opened, and by relieving the springs from pressure, the mouth of such article is closed.—Patent abandoned.

3198 W. H. CRISPIN. *Improvements in the manufacture of artificial fuel.* Dated November 12, 1867.

This invention consists in an improved method of combining coal, coke, charcoal, and other substances adapted for the formation of artificial fuel, when in a state of powder or minute division.—Patent abandoned.

3199 J. T. B. PORTER. *Improvements in rotary spaders or digging machines for tilling land, also applicable to other implements, agricultural or otherwise.* Dated November 12, 1867.

This invention has reference to a previous patent dated March 10, 1865 (No. 671). According to the aforesaid invention a number of spading blades or lines are carried around fixed cams, and forced thereby into the ground as the machine is drawn forward, and the said blades are folded up clear of the ground to allow the machine to be conveniently removed from one field or locality to another. The object of the present improvement is to obviate the necessity of this folding-up of the blades or lines, and the said improvements consist chiefly in the combination with the said machines of a pair of wheels whereon the machine is supported with the blades clear of the ground in travelling from place to place. The said improvements also consist in the devices employed for adjusting the machine into position for either working or travelling.—Patent abandoned.

3200 C. E. BROOMAN. *Improvements in furnaces or heating apparatus.* (A communication.) Dated November 12, 1867.

The object of this invention is the construction of smoke-consuming gasogeneous apparatus which will transform solid combustible matters into combustible gases, and thus satisfy, in an industrial point of view, all that is required of a powerful and smoke-consuming heating apparatus. The essential features which characterize this apparatus or furnace are, first, complete and successive reduction of the fuel in the same apparatus, without interruption of heat, in several communicating fireplaces. Second, ascent and descent of the gases arising from the first combustion or injection of steam or water into the channels which lead these gases from one fireplace to another, or even the draught or suction of a blowing apparatus, as means of increasing their draught, of increasing their pressure, of producing hydrogen by the decomposition of this steam or water, and of facilitating the leading of the gases from one point to another, and of directing them with a certain pressure out of this apparatus. Third, the hermetic and almost continuous mode of charging, owing to the reduced volume of the charge. Fourth, the complete enrichment of the gases developed in all the parts of the apparatus, by causing the gases to return into the apparatus which has generated them in order that they may not issue therefrom until they have been enriched therein through a layer of incandescent fuel. Fifth, the simple and economical mode of heating the new air for burning the combustible gases in a special combustion chamber; and, sixth, a combustion chamber, one of the sides or walls of which is formed with holes by which the burnt gases pass, as through a sieve, in order to enter the apparatus to be heated.—Patent abandoned.

3201 T. EVANS. *Improvements in the manufacture of certain descriptions of buckles.* Dated November 12, 1867.

This invention consists in making double buckles in such manner that both parts of the buckles are movable upon a centre or centres.—Patent abandoned.

3202 M. B. WESTHEAD and R. SMITH. *Improvements in arranging tapes, or other narrow fabrics, in boxes or other receptacles for use.* Dated November 12, 1867.

This invention relates, first, to that system of arranging tapes or other narrow fabrics, for which letters patent were granted to M. B. Westhead, dated November 21, 1863 (No. 2940). According to that invention an elastic medium was used for detaining the coils of fabric and keeping them in form. The patentees now propose to dispense with the elastic medium, and to place the coils or rolls of narrow fabric upon or against each other, with a disc of paper or other thin substance between them. The ends are brought through a slit or slits in the receptacle, and any desired lengths may be drawn off for use without a general disarrangement, for which letters patent were granted to them, dated April 27, 1867 (No. 1242), and consists in placing the narrow fabrics described in a box or other receptacle, in which a slit or slits are formed, and through which the ends of the pieces are drawn, to afford any required lengths for use.—Patent completed.

3203 A. M'KENZIE. *An improved apparatus for opening and closing the heads of landaus, barouches, and other open carriages.* Dated November 12, 1867.

This invention consists of an arrangement of apparatus whereby the heads of carriages may be opened or closed by means of a lever or handle from the driver's seat, the required movement being obtained by revolving "props" in connection with the ordinary outside joints.—Patent abandoned.

3204 L. A. BADIN. *Improvements in bungs for casks, tuns, or other similar vessels for containing liquids.* Dated November 12, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

3205 J. HUMBY. *Improvements in the manufacture of compound metallic plates.* Dated November 12, 1867.

These improvements consist, first, in coating or covering plates of iron with spelter or zinc instead of with tin or other metals, as commonly practised, whereby they are rendered considerably cheaper than tin or terne plates. Second, in coating or covering flat plates or shaped plates of spelter or zinc with copper, whereby they are rendered cheaper than plates of solid copper, or the inventor coats or covers with copper plates of iron coated or covered, with spelter or zinc, as above stated.—Patent abandoned.

3206 J. CARTER and T. CHALMERS. *Improvements in the details and fittings of windows, doors, and other similar contrivances applied to buildings and other structures.* Dated November 12, 1867.

This invention has reference to two former patents, dated respectively June 14, 1876 (No. 1616), and February 16, 1867 (No. 432), and consists in forming the "architraves," "facings," "plates," and other ornamental details, wholly or partly of cast iron, brass, steel, marble, slate, porcelain, glass, encaustic tile or terra-cotta work. The porcelain, glass, or other materials, may be used in different colours, as in encaustic tile work. These can be fixed to the cases by screws very quickly, and, when so fixed, present a more finished external appearance (and at half the cost of masonry) than where cutting or hewing of stone is required. The invention also includes the formation of bases, string courses, corners, and coping of every description of the materials mentioned to be used in combination with stone and brickwork, and will be of great value for covering, protecting, and ornamenting lintels, wood, beams, and other contrivances for the outside of buildings. In brickwork where the walls are 9in. thick, or thereabouts, the wood lintel may be kept all the breadth of the wall, and the outside edge of the same may be protected from the weather by means of an ornamental metal plate and flange.—Patent completed.

3207 J. D. SCALLY. *Improvements in treating casks to render them impervious.* Dated November 12, 1867.

For this purpose the patentee treats the casks with an hydrocarbon, that which he employs being a pure paraffin. The paraffin may be applied to casks in various ways. For example, the cask may first be heated by fire, or by filling it with hot air; some melted paraffin may be then run into it, and the cask rolled about so that the paraffin may be brought into contact with every part of its inner surface. If it be desired to impregnate the pores of the wood still more thoroughly with the paraffin, a pressure of steam or air may be applied to the interior of the cask, so as to force the paraffin into the pores.—Patent completed.

3208 A. F. GAIDAN. *Improvements in compressed or patent fuel.* (Partly a communication.) Dated November 13, 1867.

One part of this invention consists of an improved manufacture of compressed or patent fuel without the admixture of pitch, as at present. For this purpose the patentee mixes together rosin, glue, and salt in a pulverous state, and then mixes this compound with coal dust in the proportions of about from forty to fifty pounds weight of the compound to one ton of coal dust; the latter is at the time warmed sufficiently to render the former adhesive, after which the compound is compressed in the ordinary manner. Another part of the invention has reference to an improved mode of manufacturing patent fuel with pitch. Heretofore, the pitch has first been melted before admixture with the coal dust. Now these improvements consist in pulverizing the pitch, and then mixing it in the pulverous state with the coal dust, the latter being at the time warmed sufficiently to render the pitch adhesive. After incorporation the compound is subjected to the requisite pressure.—Patent completed.

3209 J. W. LOWTHER and T. BENNETT. *Improvements in safety lamps.* Dated November 13, 1867.

This invention consists in improvements in safety lamps for mining and other purposes. The vessel containing the oil is made of any desired shape, but instead of allowing the rods and wire gauze to be attached by screws or catches to the oil vessel, the inventors cause them to be immovably fixed to the said vessel, so that the protecting gauze cannot possibly be removed unless wilfully broken.—Patent abandoned.

3210 F. ANDREW and E. WHITTAKER. *Improvements in printing rollers used for printing colours on hanks of yarns or threads.* Dated November 13, 1867.

This invention relates to those printing machines in which there are two printing rollers having longitudinal ribs of equal or different thicknesses, and consists in so arranging the ribs that two colours can be printed on the hanks instead of one. In these machines all the ribs of the two rollers have hitherto been of equal heights, but, in the patentees' improved rollers, they make them of different heights, and cause the higher ribs of one roller to correspond with the lower ribs of the other roller, so that, by using two colour boxes and two colour rollers, the higher ribs of one roller can print one colour on the hanks, and the higher ribs of the other roller another colour. The invention cannot be fully described without reference to the drawings.—Patent completed.

3211 T. WILSON. *Improvements in the construction of breech-loading firearms, and in the manufacture and construction of cartridges for breech-loading firearms.* Dated November 13, 1867.

The great length of this specification precludes our quoting it here at sufficient length for an intelligible abstract. The invention will probably be described and illustrated in a future number of this journal.—Patent completed.

3212 A. M. CLARK. *Improvements in tubular boilers.* (A communication.) Dated November 13, 1867.

This invention consists in creating a continuous circulation in the tubes, and around the flues, by means of diaphragms or partitions in a much simpler manner than hitherto. This invention is not described apart from the drawings.—Patent completed.

3213 T. TAYLOR. *New or improved implements or apparatus for playing games of skill and chance.* Dated November 13, 1867.

This invention consists in the arrangement of a board or table formed of any suitable material, and with a number of recesses in the central portion thereof, upon which board or table are used pieces of ivory, or other suitable material, formed so as to slide easily along the surface of the said board, to rebound freely from one another, and to fit the recesses. The pieces may be of a circular, diamond, heart, or other suitable shape. The sides of the board are fitted with an elastic cushion, and a semicircular piece, which forms the head of the board, has a similar cushion upon it, and is made so that it can be reversed to enable another person to play from the opposite end of the board. The pieces are struck with a flat circular-headed mace or hammer of ivory or other suitable material, or they may be struck in any other convenient manner.—Patent abandoned.

3214 W. R. LAKE. *Improvements in breech-loading firearms.* (A communication.) Dated November 13, 1867.

This invention relates, first, to the construction of firearms the breech of which is closed by a cylindrical block or bolt which slides and turns in its chamber, and through which extends a pin or rod for exploding the cartridges. The improvements consist, chiefly, in the novel construction of the said block or bolt, in the construction and arrangement of the devices for extracting or removing the shells of the exploded cartridges from the charge chamber, in the peculiar formation of the end of the barrel at the rear of the said chamber, and in the combination with the same of the said bolt and extracting devices. The said improvements, with certain modifications, are applicable to needle guns, and more especially to the so-called "Chassepot" gun. This invention is not fully described apart from the drawings.—Patent completed.

3215 U. PERRENOUD-WURPLEIN. *Improvements in instruments for joining blind cords and other cords.* Dated November 13, 1867.

Here, in order to form a union between the ends of such cords, the patentee employs two coiled springs of wire, into the end of one of which a hook is screwed or fixed, whilst the end of the other receives a corresponding eye in a similar manner. The coiled springs are respectively screwed on to the two ends of the cord to be joined until the ends have entered sufficiently far into the springs to be firmly held. The two ends of the cord thus furnished are then hooked together, and so an endless cord is obtained, which is able to pass very freely over pulleys, such as blind pulleys, and the elasticity of the springs serves to keep the cord tight upon the pulleys, and to compensate for any change in the length of the cord arising from variation in the moisture of the atmosphere.—Patent completed.

3216 R. ADAMS. *Improvements in breech-loading firearms.* Dated November 13, 1867.

This invention is not described apart from the drawings. —Patent completed.

3217 E. MADGE. *Improvements in the mode of, and apparatus for, the reduction of sulphate of iron crystals.* (Partly a communication.) Dated November 13, 1867.

The object here is to effect the reduction of sulphate of iron crystals, commonly called green vitriol, in an economical manner. This product is largely obtained from the spent liquor or pickle used in the manufacture of tinned or terne plates, and it is mainly to the utilization of the product so derived that the invention is directed. The sulphate of iron is first placed on a drying plate, and heat is applied thereto from above, the charge during the process of drying being exposed as much as possible to the action of the air. When the whole, or nearly the whole, of the combined water is evaporated, the product will be a soft porous substance retaining more or less the form of the original crystals. The charge thus prepared is then calcined on a hearth heated from below, but so arranged as to admit the air freely to the charge. The calcination is continued at a sub-red heat until the charge has absorbed a sufficient quantity of oxygen, which will be known by its assuming a light brown-yellow colour, and if not already reduced to powder, it will crush with slight pressure being applied thereto, when it will be in the best possible form for being admitted to distillation. The charge is next placed in retorts, and sulphur fumes are distilled off in the ordinary way. The fumes may be condensed in the usual manner in a leaden chamber, or in simple condensers, as fuming sulphuric acid. The residue is peroxide of iron.—Patent completed.

3218 E. MADGE. *Improved apparatus for feeding metal plates to rolls.* Dated November 13, 1867.

This invention relates to the automatic feeding of plates to rolls. The patentee places the plates which are to be submitted to the rolls in a pile upon a table, which may be conveniently fitted with adjustable side and end pieces for determining the position of the pile thereon, and he brings down upon the pile a sucker or pneumatic holder, which will adhere by slight pressure to a flat surface. This sucker when raised will lift the top plate, and deposit it upon a shute, so situated as to lead the plate to the bite of the rolls. The sucker may consist of an elastic cup fitted in a holder, which may be carried by a transverse frame, or other suitable contrivance, for moving the sucker to and fro between the pile of plates and the shute. The holder he makes hollow to admit air to the cup when the adhesion between the cup and the lifted plate is required to cease, and a valve fitted to the top of the holder will close the air passage. The weight and pressure of the depressed transverse frame will bring the sucker which it carries into close contact with the top plate, and cause its adherence thereto; and the frame with its load will then, by means of suitable gearing, carry the top plate from the pile and bring it over the shute leading to the rolls. At this time air will be admitted to the cup by the raising of the air valve, and the plate will fall upon the shute. This shute is so formed as to reject the feed if by accident two plates are deposited upon it instead of one. A provision of this kind is requisite, as not unfrequently two or more plates will adhere together and be carried up by the sucker and be deposited in the shute.—Patent completed.

3219 A. V. NEWTON. *Improvements in rotary engines applicable as motors, pumps, meters, and for other purposes; also in indicators applicable to such and other engines or meters and other purposes.* (A communication.) Dated November 13, 1867.

The object of the first part of this invention is the con-

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struction of a rotary engine or device applicable, among other purposes, as a motor, pump, or meter, which, while of a simple character, and free in its movement, is comparatively tight or close against leakage, and readily accommodates itself to inequalities of temperature, as affecting the fit of the revolving slides or pistons, and their attachments with which it is provided, and this part of the invention consists of or includes two cylinders, one within and eccentric to the other, and sliding pistons arranged radially to the inner cylinder, and connected together in a free or loose manner by links to or through the intervention of a loose rivet or pin that forms the centre of motion around which the said pistons with the inner cylinder revolves, by which construction an interior fixed crank pin or eccentric is dispensed with, and the working parts or pistons with their connections are left more free to work close and to accommodate themselves to the various conditions incident to expansion and contraction from changes of temperature. In some cases, however, the said rivet or pin may be stationary and fast to the head of the outer cylinder, with the interior of which it is concentric. The second part of the invention consists in a similar arrangement of cylinders with radially sliding pistons and links connecting them in a free or loose manner with a central rivet or pin, but combines with the same a close chamber arrangement for the sliding pistons within the inner cylinder, and sliding rods connecting the pistons with the links, as aforesaid, for the more effectual prevention of leakage when working the engine with an aeriform fluid. These two divisions of the invention also include or have combined with them revolving heads or end discs to the revolving cylinder with its pistons, the one of which heads may be removable, and the one of which may be left open at its centre, to facilitate adjustment, repair, and oiling of the interior parts. The remaining portion of the invention consists in a novel construction of indicator or registering apparatus applicable to engines or devices contracted as described in the first part of the invention, and which is also applicable to other engines or meters, and for other purposes where quantities or measures of various kinds are required to be recorded, and in which are arranged or combined a series of ratchet wheels disposed one above or in advance of the other, about or around the same axial line, an actuating lever operated at intervals by the engine or meter, and separate or independent pawls to effect the movement of the said wheels, which have pointers connected with them for traverse over a graduated dial plate, and which wheels, or second, and after series of them, are moved for a given distance by a stud or pin attached to the preceding wheel, and operating the ratchet that gives motion to the next wheel in succession, by which combination a compact and simple, yet correct, indicator of measures or quantities is secured.—Patent completed.

3221 R. F. FAIRLIE. *Improvements in the construction of locomotive engines for mountain rail or tramways.* Dated November 14, 1867.

This invention consists in applying to engines for mountain rail or tramways a species of bogie frame, which, together with various other novel arrangements, has the effect of causing the weight of the engine and passengers to assist in enabling the wheels of the engine to bite or take firm hold of the rails.—Patent completed.

3222 J. MORRISON. *Improvements in hem folders and tuckers for sewing machines.* Dated November 14, 1867.

This invention has reference to hem folders of the kind described in the specification of a former patent dated September 30, 1858 (No. 2175). In constructing hem folders according to the present invention, the patentee forms the folder at the end of an arm hinged to a base plate, the arm being capable of being turned on its hinge in a vertical plane for the purpose of introducing the fabric to be hemmed. The base plate is not fixed directly to the sewing machine, but is jointed by a rule joint or other joint to a connecting piece fixed to the sewing machine. By means of the joint the base plate can be turned at pleasure in a horizontal plane out of the way of the needle of the sewing machine. The arm carrying the folder is graduated into inches, and parts of inches, and upon the arm is a spring slide, by regulating the position of which on the arm the width of the hem or of the tuck when the instrument is used as a tucker, as hereinafter explained, may be determined. The slide also serves to fix down the arm carrying the folder, the slide having a finger or projection which engages under the edge of a slot in the base plate parallel to the said arm. When it is wished to raise the arm, the slide is pushed back on the arm till the finger or projection comes opposite to a cross slot, when the arm can be raised, the finger or projection being disengaged from under the edge of the slot. To the end of the arm, and immediately over the folder, a spring plate may be placed, the spring plate having a slot in it through which the needle works. The spring plate serves to guide the edge of the hem, if desirable. When the instrument is used as a tucker, the fabric is passed under the folder and arm carrying it until it comes against the slide, which has been adjusted on the arm to the required width of the tuck.—Patent completed.

3223 P. D. BAVAY. *A method of attenuating the effect of shocks or concussions between engines, carriages, or waggons composing a railway train.* Dated November 14, 1867.

Here a strong iron framework is arranged so as to enclose the locomotive and tender, such framework being supported by guides in which it works freely. It is composed of two rods placed longitudinally, the same being divided at the space between the engine and tender. The ends of the rods are furnished at those parts with buffer heads, and the longitudinal rods are connected at the extremities thereof by two cross pieces, having also buffer heads in the centre. Each carriage of which the train is composed is furnishhd with a strong iron rod, which rod is placed horizontally somewhat above the axles in the axis of the carriage. The rods are provided at both ends with buffer heads, and are supported in guides in which they move freely. The position of the rod of the last carriage is regulated by a screw working in a thread cut in a strong piece of iron firmly fixed to the carriage. All the buffer heads should be so arranged as to touch each other. The apparatus having been thus arranged, and the train started, if the buffer head on the cross piece of the before-mentioned framework which is in front of the engine meets with any resistance which cannot be overcome, the frame will be forced back, as well as all the rods of the carriages, and the last carriage of the train will consequently be the first to stop. The remainder of the train will, by its impetus, continue to pull at the last carriage by means of the draw springs and rods which connect the whole train, and the intermediate carriages, with the tender and locomotive, will be sucessively and not simultaneously stopped, thus preventing the shock which ordinarily occurs when the motion of a train is suddenly arrested. Springs are placed upon the bars which couple the carriages and contribute in a great degree to deaden the shock.—Patent completed.

3224 G. KENT. *Improvements in kneading machines.* (A communication.) Dated November 14, 1867.

The patentee claims constructing kneading apparatus with upright rollers within the kneading vessel, between which rollers the dough is caused to pass, in consequence of the rollers whilst revolving on their own axes being carried round within or performing a circular course in respect to the mixing vessels and its contents. He also claims the arrangement of kneading machines, substantially as described.—Patent completed.

3225 R. HARRISON. *Improvements in cocks or taps.* Dated November 14, 1867.

This invention relates to certain improvements in cocks or taps, suitable either for high pressure water taps or cocks for steam, air, or gases under pressure, the object being to obtain an efficient steam or fluid-tight cock or tap without the use of a stuffing box or packing, as hitherto required for that purpose. The thoroughfare through the cock is closed by means of a valve resting upon a horizontal valve seat, with a packing or facing of leather, in some cases applied either to the face of the valve or to its seat; or the valve may be conical, and fit a conical valve seat, in which case all packing will be dispensed with. This valve is opened and closed by means of a screw spindle, which is either carried by the valve, and works inside a female screw made in a conical cap rotated by the usual "crutch," or by a removable key, if preferred; or the screw spindle may engage with a female screw made in the centre of the valve itself, in which case the crutch for turning the screw spindle is fitted directly thereon, and a conical portion or enlargement is formed on the upper part of the spindle, which is caused to fit accurately into the chamber of the tap or cock, which is also tapered or made conical to correspond to the said enlargement. The accurate fitting together of these two conical surfaces prevents any leakage from the cock, and obviates the necessity for the usual stuffing box or packing. The valve itself is prevented from rotating whilst under the action of the female or male screw, by having a square or other suitably shaped guiding stem formed on its under side, which engages into a corresponding chamber or recess in a hollow cup which closes the lower part of the body of the tap or cock.—Patent completed.

3226 W. H. RICHARDSON. *Certain improvements in the manufacture of iron and steel, and in the means or apparatus for effecting the same.* Dated November 14, 1867.

This invention has reference to three former patents granted to the present patentee, the following being the years and numbers of said patents, which is all that is required for reference thereto:—No. 3189, of the year 1866; No. 1635, of the year 1867; No. 1905, of the year 1867. The patentee claims, first, the employment of hollow tubular tools, either perforated or not, for the purpose of introducing air, steam, or gas into molten metal in puddling furnaces or refineries, whilst the liquid metal is or is not also being stirred about by an ordinary solid rabble, constructed as set forth and shown in the drawings. Second, the employment of a tubular tool or passage for injecting air, steam, or other gas into puddling furnaces or refineries, whilst the metal is also being worked by an ordinary rabble or other solid tool. Third, the arrangement and construction of the hollow revolving tool shown in the drawings.—Patent completed.

3227 J. COMBE. *An improved arrangement of machinery for making cops.* Dated November 14, 1867.

This invention is not described apart from the drawings. —Patent completed.

3228 L. A. WAINMAN. *Improved apparatus for raising water.* Dated November 14, 1867.

The chief objects of this invention are to raise water from mines or wells, or to force water to a great height from a reservoir or water run for driving a water wheel or other purposes. The apparatus can either be worked immersed in the water at the bottom of a mine or well to the depth of the receivers, or out of the water, as may be most convenient. In the latter case the receivers will be fixed as near down to the water as convenient, and the suction pipes carried down into the water. The apparatus is intended to be used with an atmosphere of steam or air admitted to the receivers at any required pressure, which will, of course, entirely depend upon the distance the water has to be forced.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated January 17, 1868.

157 J. Batchelor, contractor, and J. Smith, machinist, Kidderminster, Worcestershire. An improved power loom for weaving Brussels carpets.

Dated January 31, 1868.

339 H. A. Bonneville, Sackville-street, Piccadilly. A new and improved advertising vehicle. (A communication.)

Dated March 24, 1868.

995 E. Gray, Sheffield, steel, saw, file, edge tool, and machine knife manufacturer. An improved mode or method of strengthening or increasing the durability of rails, points, and crossings for railways.

Dated April 1, 1868.

1098 H. H Doty, Bury-street, S.W., Middlesex, and G. Graveley, engineer, Alfred-street, Bow, Middlesex. Improvements in the means or apparatus for producing the more complete combustion of gas, paraffin, and other liquid hydrocarbons.

Dated April 9, 1868.

1192 J. Fitter, Birmingham, gun maker. Improvements in alarums of the kind known as detonating alarums.

Dated April 14, 1868.

1234 B. and A. B. Blackburn, Hans-place, Chelsea, Middlesex. Improvements in rafts or stages to carry passengers, merchandize, articles, and things at sea, and other navigable places, and in the means of propelling the same.

Dated April 17, 1868.

1252 H. G. Fairburn, Goswell-road, E.C., engineer Improvements in portable machinery for turning, screw cutting, boring, and slotting, also for cutting off tubes or solid bars into any required lengths.

1259 W. E. Gedge, Wellington-street, Strand. A novel apparatus for putting boots and shoes on the feet. (A communication.)

1261 J. Erskine, Newton Stewart, Wigtown, Scotland, gun maker. An improvement in the manufacture of breech-loading firearms.

Dated April 20, 1868.

1276 T. A. Warrington, Carlton-road, Kentish Town, St. Pancras. Improvements in candlesticks ann other like articles for holding candles and tapers.

Dated March 21, 1868.

1290 J. Woolfield, St. James-road, Handsworth, Staffordshire. Improvements in the method of, and machinery for, corrugating or fluting sheets of metal.

Dated April 22, 1868.

1312 T. D. Scowen, Allen-road, South Hornsey, Middlesex. A new button hook for boots, shoes, and other articles of clothing.

1319 H. D. Chard, Feniton, Devonshire. Improvements in the construction of buildings.

1322 D. Skeoch, Stewarton, Ayrshire. Improvements in spindles used for spinning or twisting yarn.

Dated April 23, 1868.

1332 J. Armstrong, Masbro' Yorkshire. Improvements in crossings, and in switch apparatus to be used with the permanent way of railways.

1336 J. Rogers, Baxter-road, Islington. Improvements in the preparation and utilization of certain vegetable and bituminous products.

Dated April 24, 1868.

1340 M. Z. D'Aschau, Winsley-street, Oxford-street, analytical chemist. A new vegetable medicinal compound, to be used as a remedy for the cure of scalds, burns, open wounds, swellings, stiff joints, rheumatics, the gout, and other complaints.

1341 I. Baggs, High Holborn. Improvements in the manufacture of white lead, and in the use and application of certain machinery and apparatus for such purposes.

Dated April 27, 1868.

1373 D. Geraci, Florence, Italy. The manufacture of an armour or armour-plating material.

1378 R. Holt, merchant, R. Burlison, mechanic, and H. Sampson, stuff finisher, Bradford, Yorkshire. Improvements in papering and pressing in the finishing of woven fabrics, and in the means or apparatus employed therein.

Dated April 28, 1868.

1387 A. Baal and C. Gann, Jersey. Improvements in reefing fore and aft sails.

Dated April 29, 1868.

1394 S. Robotham, Birmingham, manufacturer. Improvements in bird cages.

1397 W. Wright, Mostyn, Flintshire, copper smelter. Improvements in the manufacture of iron and steel.

1398 A. Geary, Horfield-road, Bristol, ironmonger. A new or improved method of or means for preventing the moustache from dipping into soup when eating it from a spoon.

Dated April 30, 1868.

1409 J. Gough, Kirby-street, Hatton-garden, Holborn-hill, engineer. Improved gearing for actuating the knife in paper-cutting machines.

1411 J. Dendy, and J. B. Beard, Manchester. Improvements in woven fabrics.

1412 J. Betteley, Cavendish House, Bottle, near Liverpool. Improvements in shipbuilding, and in fastenings, bolts, and sheet metal to be used therefor, and for other purposes.

1413 R. Ward, "North of England Advertiser" office, Newcastle-upon-Tyne. Improvements in machinery for spinning or twisting tobacco, and otherwise preparing it for sale.

1415 S. Chatwood, Bolton, Lancashire, safe and lock engineer. Improvements in the construction of safes.

1417 J. W. Goundry, Old Shildon, Durham. Improvements in the means of carrying railway and other tickets, cards, and labels, ready for exhibition or delivery.

1418 B. F. Weatherdon, Law Chambers, Chancery-lane. A new or improved mode of soldering tin boxes, canisters, or cases. (A communication.)

1419 M. A. F. Mennons, Rue de la Chaussee d'Antin, Paris. An improvement in planing, polishing, turning, and other machine tools or apparatus of like description. (A communication.)

1421 T. Beeley, Hyde Junction Iron Works, Chester. Improvements in boilers, and in apparatus for effecting the consumption of smoke in the furnaces of boilers.

Dated May 1, 1868.

1423 J. Lillie, Manchester, engineer. Improvements in apparatus for regulating, measuring, and registering the flow of liquids.

1424 C. D. Abel, Southampton-buildings, Chancery-lane. The production of a new or improved colouring matter from aniline. (A communication.)

1425 E. Leheup, Octagon-place, Upper Summerford-street, Bethnal Green. Improvements in the manufacture of wooden boxes.

1427 A. B. Childs, Mark-lane, City, engineer. An improved apparatus or machine for separating mixed, powdered, or other substances.

1428 J. Warne, Blackfriars-road, Surrey, beer engine manufacturer. A new or improved union junction or fastening for pipes and tubes.

1429 W. E. Everitt, Birmingham, tube manufacturer. Improvements in the manufacture of copper, brass, and metal tubes.

1431 J. H. Johnson, Lincoln's Inn-fields. Improvements in machinery or apparatus for burling and shearing textile fabrics. (A communication.)

Dated May 2, 1868.

1432 J. Heaton, Langley Mill, Derbyshire. Improvements in reverberatory and other furnaces.

1433 F. Barnett, Rue de Rivoli, Paris, merchant. An improved unspillable pail or vase.

1436 T. Hawkes, F. W. and G. Spencer, agricultural engineers, and J. Stenner, foreman, Tiverton, Devonshire. An improved seed and manure drill, parts of which invention are also applicable to other similar agricultural implements.

1437 E. G. Camp, College Green, Bristol, toy vendor. Improvements in mallets used in playing the game of croquet and in similar games.

1438 L. Binns, Brighouse, Yorkshire, worsted manufacturer. Improvements in looms for weaving.

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1439 H. Y. D. Scott, Ealing, Middlesex, Lieut.-Colonel in the Royal Engineers. Improvements in kilns for burning lime and cement.

1441 A. Smith, Stratford, Essex. Improvements in apparatus to be used in connection with furnaces for burning creosote and other combustible liquids.

1441 J. E. Boyce, manufacturer, and R. Harrington, warehouseman, Birmingham. Improvements in umbrellas and parasols.

1443 J. H. Johnson, Lincoln's Inn-fields. Improvements in apparatus for exhibiting minute photographic pictures, and in pictures or slides to be used therewith. (A communication.)

1445 J. L. Budden, Fenchurch-street, City. Improvements in machinery or apparatus for drying wool or for discharging moisture from fibrous, granular, or other materials. (A communication.)

1447 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in dynamometers. (A communication.)

Dated May 4, 1868.

1448 H. Glover, New Church-street, Bermondsey, Surrey, engineer. Improvements in means for retaining corks or other stoppers in bottles.

1449 W. E. Gedge, Wellington-street, Strand. An improved process of applying a coating of silver upon any animal, vegetable, or mineral substance. (A communication.)

1450 A. Vickers, Inverness-terrace, Bayswater. An improved mode of locking the nuts of screw bolts. (A communication.)

1451 I. Mather, Anvers, Belgium, merchant. Improved apparatus for warehousing petroleum, mineral or essential oils, and other liquids.

1452 C. P. Aston, Chelsea, Middlesex. Improvements in chimney tops or pots.

1453 J. Wertheim and L. Hirschhorn, carrying on business as M. Goldschmidt and Son, Hatton-garden, Holborn-hill. Improvements in lockets. (A communication.)

1454 T. and G. A. Pemberton, Birmingham, brass founders. Improvements in alarm bells, call bells, and other bells.

1455 E. and G. H. Morgan, Edgware-road, Middlesex. Improvements in carriages.

1456 W. Marshall, Old Basford, Nottingham, clipper of lace. Improvements in machinery or apparatus employed in the clipping of lace and other fabrics.

Dated May 5, 1868.

1459 D. P. Wright, Birmingham, lamp manufacturer. Improvements in the manufacture of certain descriptions of taps.

1460 W. Taylor, Woodstock-road, Poplar, Middlesex. Improvements in the construction of iron and steel ships, and other floating bodies, and in the mode of attaching or connecting and fixing wood planks to the sides and bottoms thereof, to receive the metal sheathing and other external and also internal fittings of iron and steel ships, and other floating bodies.

1461 W. Sketchley, Weymouth, Dorsetshire, machinist. Improvements in machinery for wood cutting, joinery, and mortising.

1462 C. W. Siemens, Great George-street, Westminster. Improvements in the manufacture of cast steel, and in working furnaces in connection therewith.

1463 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in axle-boxes for the rolling stock of railways. (A communication.)

1464 F. W. Gerhard, Wolverhampton, chemist. Improvements in motive power engines actuated by steam or other vapour.

1465 J. Dawber, Over Darwen, Lancashire, engineer. Certain improvements in steam engines.

1466 J. Clough, Grove Mill, Keighley, Yorkshire. Improvements in screw gill boxes for preparing wool and other fibrous substances.

1467 J. Hickmott, Clapham, Surrey, engineer. Improvements in preserving metallic articles from oxidation and decay.

1468 J. Court, Sheerness, Kent. Improvements in traps or apparatus for receiving sewage matters, and separating the solid from the liquid portion thereof.

1469 G. Kent, High Holborn. Improvements in ice preservers, refrigerators, and ice safes.

1471 W. Beale, Taunton, Somersetshire, builder. Improvements in step and other ladders.

1472 W. Walker and H. F. Smith, Hull, seed crushers. Improvements in apparatus employed for expressing oils from seeds or other substances.

1473 F. J. King, Leadenhall-street, City, manufacturer. Improvements in the mode of preparing potatoes for preservation.

1474 J. Lamb, machinist, and S. Tovey, auctioneer, Kidderminster, Worcestershire. Improvements in bobbin frames for carpet looms.

1475 W. E. Newton, Chancery-lane. Improvements in machinery for forming pickaxes and other tools. (A communication.)

1476 J. Wilkinson, jun., St. Helen's Mills, Hunslet, Leeds. Improved machinery for printing carpets.

Dated May 6, 1868.

1477 A. Scott, Blomfield-crescent, Paddington. Improvements in the present method or means of attaching clothes to the person.

1479 R. Lublinski, City-road, Middlesex, stick manufacturer. Improvements in fasteners for the tips of umbrellas and parasols.

1480 T. Warren, Glasgow, glass manufacturer. Improvements in glass and other furnaces.

1482 C. J. Chubb, Canterbury House, West End, Hampstead. An improved mode of getting coal, slate, or other minerals, and an improved apparatus for effecting the purpose, which apparatus is also applicable to other uses.

1483 J. and J. B. Palmer, Palace Works, Old Ford-road, Bow. Improvements in the manufacture of friction matches and fuzees. (A communication.)

1484 H. J. Davies, Dalton in Furness, Lancashire. Improvements in compositions for cleaning gold, silver, and plated goods.

1486 S. Drummond, Ardwick, Manchester, salesman, J. Clare, Greenfield, Saddleworth, Yorkshire, manufacturer, and R. Hughes, Didsbury, Lancashire, salesman. Improvements applicable to the prevention of fraud in the collection of fares in omnibuses and other carriages, and in apparatus connected therewith.

1488 W. E. Newton, Chancery-lane. Improvements in combs. (A communication.)

1489 M. Henry, Fleet-street, City. Improvements in the manufacture of steel and iron and other metals, and in furnaces employed in the said manufacture. (A communication.)

1490 S. Holt, colliery agent, and J. Kearsley, carriage builder, Manchester. Improvements in means or arrangements for making observations on railways for the purpose of preventing accidents, and in signalling or communicating between one part of a railway train and another.

1491 J. G. Walker, Bonnington, Mid Lothian, and C. Stein, Leith, Mid Lothian. Improvements in separating tares and other impurities from grain and other seeds, and in the apparatus or means connected therewith. (A communication.)

1492 J. G. Walker, Bonnington Steam Mills, Bonnington, Mid Lothian. Improvements in dressing millstones, and in the machinery or apparatus employed therefor.

1493 W. Harvie, Glasgow. Improvements in the construction of lamps and lanterns, and in lenses employed therewith.

1494 J. H. Johnson, Lincoln's Inn-fields. Improved means for increasing the draught in steam boiler and other furnaces or fireplaces. (A communication.)

Dated May 7, 1868.

1495 M. A. Muir and J. M'Ilwham, Glasgow, machinists. Improvements in power looms.

1496 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in spring mattresses and seats. (A communication.)

1498 R. A. Green, Strand. Improvements in bearings, shafts or pivots, applicable to machinery, apparatus, instruments, and other useful purposes.

1499 A. C. Henderson, Charing-cross. Improvements in the manufacture of plates for hellographic engraving. (A communication.)

1500 A. C. Henderson, Charing-cross. An improved mode of renovating files by an electro-chemical process. (A communication.)

1502 R. Harlow, Heaton-Norris, Lancashire, brass founder. Improvements in apparatus for supplying water to, and withdrawing water from, baths, wash-basins, and other receptacles.

1504 J. H. Johnson, Lincoln's Inn-fields. Improvements in sewing machines. (A communication.)

1506 W. E. Gedge, Wellington-street, Strand. An improvement in throstle frames for spinning flax, tow, hemp, jute, silk, wool, or cotton. (A communication.)

1508 J. Bruce, engineer, and R. Evans, miller, Birmingham. Improvements in bolters used for dressing flour, and for other like purposes.

Dated May 8, 1868.

1512 W. Husband, Hayle, Cornwall, and F. B. Doering, Victoria-street, Westminster, civil engineers. An improved mode of, and apparatus for, securing or holding the stands or frames of rock-boring or excavating machines, part of which apparatus is applicable to connecting such machines with their stands or frames.

1514 A. James, Redditch, Worcestershire, needle manufacturer. Improvements in machinery for polishing needles.

1516 J. A. Jones, Middlesborough, Yorkshire, engineer. Improvements in the manufacture of iron and steel.

Dated May 9, 1868.

1518 J. C. Bowler, Bowden, Cheshire. Certain improvements in castors or similar rolling supports for furniture.

1520 W. E. Everitt, Birmingham, tube manufacturer. Improvements in casting copper tubes and cylinders.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated May 13, 1868.

1559 J. W. Chamberlain, Massachusetts, U.S. An improvement in steam engines. (A communication.)

Dated May 16, 1868.

1619 M. A. Hamilton, Southampton-buildings, Chancery-lane. An improved churn.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," May 26, 1868.

3723 J. G. Crompton. Apparatus for the manufacture of felt hats.

114 T. S. Ellin. Self-securing skate. (A communication.)

127 A. B. Boyer. Construction of aerial cradles.

130 L. M. Becker. Laying and supporting the wires used for electric telegraph.

131 G. Nimmo. Composition for furnace linings.

135 W. Ayliffe. Boats, and in the means of steering the same.

148 J. Wood. Windows.

152 T. Nash. Stoves.

155 F. Postill. Kilns for burning bricks.

157 J. Batchelor and J. Smith. Power loom for weaving Brussels carpets.

159 J. Moorhouse. Machinery known as cone drawing employed in preparing wool.

162 J. Hosking. The cutting heads of instruments used in drilling rock.

164 H. Aitken. Treating iron ores.

167 D. A. Fyfe. Manufacturing paper pulp from wood.

172 J. Millward. Apparatus for propelling ships. (A communication.)

176 E. Dorsett. Utilization of coal tar.

185 W. E. Newton. Kilns for baking porcelain. (A communication.)

191 J. Davies. Machinery for shaping malleable materials.

192 T. G. F. Dolby. Feeding bottles.

194 M. Robinson. Manufacture of expanding and contracting combs or reeds.

199 A. M. Clark. Steam boilers. (A communication.)

201 J. Parsons. Double-barrel breech-loading firearms.

214 J. H. Johnson. Apparatus for indicating the relative positions and movements of certain of the heavenly bodies. (A communication.)

216 W. Davis. The method of fastening bags made of paper for the conveyance by post of samples of grain.

220 A. B. Brown. Actuating the valves of engines worked by steam.

222 J. Dixon. Construction of floating saloon baths.

226 W. Thompson and T. Stather. Mills for grinding.

229 E. Tomlinson. Apparatus for ornamenting and manufacturing articles from wood.

231 T. Goune. Canteen.

232 C. S. Barker. Construction of organs.

244 H. J. Dickinson. Tables for playing billiards.

250 G. Severn. Valvular apparatus for giving vent to casks.

252 J. and D. Storer. Vessels for holding liquids.

268 E. J. W. Parnacott. Manufacture of elastic rollers.

270 A. M'Dougall. Apparatus for burning sulphur ores.

279 W. E. Rendle. Structures for protecting fruit trees from frost.

303 W. H. Richardson and W. Beardmore. Process to be used in the manufacture of iron and steel.

315 S. M. Martin and S. A. Varley. Electrical train intercommunication.

336 J. Walker and J. Hudson. Machinery for turning wood.

347 A. M. Clark. Steam engines. (A communication.)

364 J. H. Johnson. Treatment of bones. (A communication.)

371 J. H. Johnson. Treatment of compressed wood. (A communication.)

384 J. Webster. Means of preventing incrustation in steam boilers.

485 R. George. Gas stoves.

538 A. M. Keighley. Apparatus for signalling from one part of a railway train to another.

587 W. Wilson. Apparatus for lubricating the sliding valves of steam engines. (A communication.)

595 J. J. Aston. Propellers applicable for the propulsion of ships.

627 J. C. Davies and E. Zahn. Muffs.

965 H. Bessemer. Manufacture of refined iron.

967 H. Bessemer. Manufacture of malleable iron and steel.

1095 H. Bessemer. Manufacture of malleable iron and steel, and in the melting of metals.

1366 A. Parkes. Manufacture of varnishes.

1403 H. Deacon. Manufacture of chlorine.

1462 C. W. Siemens. Manufacture of cast steel.

1465 J. Dawber. Steam engines.

1475 W. E. Newton. Machinery for forming pickaxes. (A communication.)

1559 J. W. Chamberlain. Steam engines. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed May 22, 1868.

3325	M. A. Hamilton	3521	G. H. Nick
3326	T. Barton	3689	W. E. Newton
3327	F. Brown	3690	W. E. Newton
3328	G. Turner	296	W. R. Lake
3333	T. Chalmers	307	W. Snell
3337	W. Sim	308	W. Snell
3339	J. P. Smith	337	J. H. Johnson
3340	J. P. Smith	389	S. G. Taylor
3425	G. Breen	599	W. R. Lake
3443	N. Grew	677	C. E. Brooman
3482	P. R. Hodge	756	J. J. F. Stevens
3495	E. Keirby	1110	W. R. Lake

Sealed May 26, 1868.

3356	W. Fowler and J. Griffiths	3391	H. S. Cowan
		3397	J. J. Parkes
3360	H. F. Gardner	3399	W. E. Gedge
3370	E. T. Hughes	3409	R. Clay
3371	T. and B. Carter and J. Lisle	3415	E. Price
		3439	W. Brown and C. N May
3372	W. Cotton		
3374	E. T. Hughes	3440	J. Gjers
3382	J. Scholefield	3491	C. M. Barker
3387	J. Fraser and G. Duncan	3498	W. Clark
		3507	W. Palliser
3388	T. Rose and R. E. Gibson	3616	J. Kerr
		3719	J. H. Johnson
3394	A. Turner and W. E. Newton	1037	W. Manwaring
		1075	B. Mitford

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1393	J. A. Coffey	1480	J. Hibell
1398	J. Armstrong	1501	F. and J. G. Richmond and H. Chandler
1423	G. Ashcroft		
1425	J. Ramsbottom		
1440	H. E. Newton	1656	W. Clark
1452	C. Frazer	1734	W. E. Newton
1456	R. A. Brooman	1941	A. V. Newton

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1286	G. E. Donisthorpe	1339	G. Asher
1302	G. E. Donisthorpe	1379	R. C. Ransome
1306	C. Nuttall		

LIST OF SPECIFICATIONS PUBLISHED

For the week ending May 23, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d		s. d		s. d.		s. d.		s. d.		s. d.
2691	1 0	2813	1 2	2854	1 2	2884	0 4	2911	0 8	2937	0 4
2743	8 4	2817	0 8	2857	0 10	2885	0 8	2915	0 4	2938	0 4
2768	0 8	2818	0 4	2857	0 8	2886	0 8	2921	0 4	2940	0 4
2778	0 8	2821	0 8	2863	0 8	2891	0 8	2922	0 4	2945	0 4
2779	1 8	2826	0 8	2868	0 8	2893	0 8	2929	0 4	2946	0 4
2779	5 8	2857	0 8	2874	0 10	2897	0 4	2933	0 8	2947	0 4
2779	1 0	2858	1 0	2874	0 8	2899	1 0	2937	0 4	2950	0 4
2810	0 6	2859	0 6	2886	0 4	2902	0 4	2933	0 4	2986	0 6
2811	2 0	2851	0 10	2881	0 4	2909	0 4	2938	0 4		

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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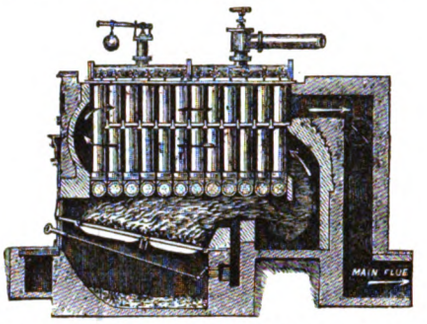
HOWARD'S SAFETY BOILER.

AND SUPERHEATER.



IS NOW AT WORK IN LONDON AND VARIOUS PARTS OF ENGLAND.

ADVANTAGES:—

Perfect Safety from Explosion.
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No Seams or Rivets.
Saving of Cost and Time in Repairs.
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Can be fixed in places Inaccessible to Cornish Boilers.
High Pressure and Dry Steam with Perfect Safety.
No Leaky Joints.
Perfect Circulation, consequently little or no Incrustation.

COST.

When all the above considerations are weighed, J. and F. HOWARD'S Boilers will be found the Cheapest and Best ever produced.

Boilers which have been in use many months are now perfectly clean.
They can be seen at work, and tubes taken from them for examination, on application to

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BRITANNIA IRON WORKS, BEDFORD.

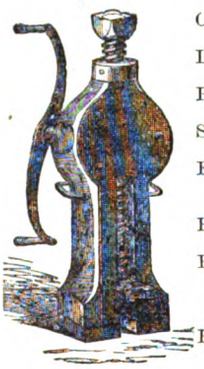
PATENTEES AND MANUFACTURERS OF AGRICULTURAL MACHINERY, INCLUDING
STEAM CULTIVATORS, STEAM PLOUGHS, CHAMPION PLOUGHS, HARROWS, HORSE RAKES, HAYMAKERS
MOWING AND REAPING MACHINES.

THE FIRST GOLD MEDAL AS WELL AS A GRAND PRIZE AT PARIS, 1867.

LONDON OFFICE:—4, CHEAPSIDE, THREE DOORS FROM SAINT PAUL'S,
Where Boiler Tubes, Models, and Drawings can be seen. B 19

THOMAS WORSDELL,

MANUFACTURER OF



Cranes, Crabs, Pile Drivers, Steam or Hand.
Overhead Traversers, Chains, Blocks, &c.
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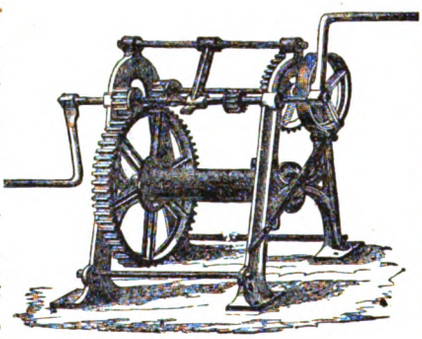
Pulley Blocks and Patent Differential ditto.
Screwing Tackle for Engineers, Gas, &c.
Engineers' Tools, Ratchet Drills, Bear Punches, Smiths' Forges, Anvils, Vices, &c.
Hydraulic Machines to Test Girders, Bars, Hoops, and Wire.
Platelayers' Tools, Rail Presses, Jim Crows, Hammers, Levers, Picks, Drilling and Punching Machines, &c.
Railway Screw Couplings, Wire Strainers, Screw Bolts, Washers, Rivets, Chains, &c.



N.B—PRICES CONSIDERABLY REDUCED.

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PATENT OBLIQUE TRANSVERSE TUBES

For the Flues of Cornish Steam Boilers.

THESE Tubes are exceedingly simple in construction and application, and very durable. They give a greater amount of heating surface than any other transverse tube that can be put in a flue of the same piameter, consequently will generate more steam with greater economy of fuel, and they can be repaired or replaced much more readily than any others.

As these Tubes are put in obliquely, and at a proper inclination, having the flanches at both ends inside the flue, they may be put in or taken out of their places through the flue without passing inside the boiler at all, thus giving the opportunity of applying them to boilers already in use without disturbing them or taking out the flues, whatever be the relative dimensions of the shell and flue.

FOR PRICES, AND A LITHOGRAPH OF THE BOILERS, APPLY TO

WOOD BROTHERS, DON BOILER WORKS, SHEFFIELD

B 1

THE BEST REMEDY FOR INDIGESTION.

NORTON'S CAMOMILE PILLS are confidently recommended as a simple but certain remedy for Indigestion. They act as a powerful tonic and gentle aperient, are mild in their operation; safe under any circumstances; and thousands of persons can now bear testimony to the benefits to be derived from their use.

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CAUTION!—Be sure to ask for "NORTON'S PILLS," and do not bepersuaded to purchase the various imitations. A 54

WM. WARNE and Co., Sole Manufacturers of the PATENT VOLUTE HOSE; Consolidated Emery Wheels, Improved Junction Rubber for Valves, Pump Buckets, Steam Packing, Hydraulic Rams, Gas Works, &c. Ferruginous Cement Packing, India-rubber Mats for doorways, baths, &c.; the Sultan's Bath Brush and Hand Emollient; the Prince of Wales's Self-closing Pinches; the Junction Rubber Soles for boots and shoes, &c., and the Mineralized (Red) India-rubber for Valves, &c. Manufacturers also of all descriptions of Vulcanized India-rubber Sheet, Valves, Washers, &c.; Hose Pipes, Tubing, &c.; Waterproof and Air-proof Goods, &c.

WM. WARNE & Co., 9, Gresham-street West, E.C., and Tottenham, N. A 33

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(Successors to Samuel Cocker and Son),
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ESTABLISHED 1752,
MANUFACTURERS OF STEEL FILES AND WIRE; Also of "COCKER'S" PATENT STEEL ROPE WIRE
In long lengths, from 10lb. to 40lb. pieces, without welding, and capable of bearing as high a breaking strain as any in the market. Each piece warranted to twist round its own diameter.

Three First-Class PRIZE MEDALS were awarded to SAMUEL COCKER and SON, Sheffield, at the Great Exhibition of Industry, London, 1851,

First-class PRIZE MEDAL was awarded to COCKER BROTHERS at the Universal Exhibition of Industry, Paris, 1855, and MEDAL of HONOUR awarded to COCKER BROTHERS, by the Society of Arts and Industry, London, 1856. A 26

MOULTON'S PATENT EMBEDDED STEEL AND INDIA-RUBBER SPRINGS for Railway Carriages, Locomotive Engines, Buffers, &c., possess greatly-increased power, as compared with the ordinary India-rubber Springs; are more uniform in their action, counteract the compressibility of India-rubber alone, and are not liable to break from sudden concussion, or the inequalities of the permanent way.

Prices and further particulars may be had on application to the Patentees, S. MOULTON & CO., Manufacturers of India-rubber Springs, Steam Packing, Washers, Hose, Tubing, Machine Belting, Garments, Blankets, Sheeting, Elastic Hot Water Beds, Cushions, &c., &c.
Kingston India-rubber Mills, Bradford, Wilts. A 34

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GIRDERS, FUNNELS, &c., Plain or Galvanized.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JUNE 5, 1868.

THE CUBA AND FLORIDA CABLE

IN our remarks of last week we referred with gratification to the activity now going on in submarine telegraphy. We alluded to the various submarine cables in course of construction, and those about to be commenced. We propose, as each one is completed, to give full details of its construction and manufacture, so that our readers, and especially those interested in telegraphy, may be *au fait* as to the recent improvements that will, as a matter of course, be constantly brought forward. We commence by first giving—carrying out our promise of last week—a description of the Cuba cable, to which we have made allusion on more than one occasion. The passage across the Gulf Stream from Key West to Florida is one of great danger to a submarine cable. On the American side it must necessarily pass through a great number of coral reefs; it then crosses the main portion of the Gulf Stream in deep water, and is landed on the Havana side on a precipitous rocky coast, for the water deepens almost immediately into about 1,000 fathoms. Being, we believe, somewhat afraid of the cable laid last year not lasting (from the causes mentioned) a great length of time, the International Ocean Company decided upon laying a new cable across between the same points. The fact of their being able to raise the money for another cable is great evidence in favour of the large commercial business that must be transacted between Cuba and the United States, and in view of the probable extensions to Panama and to Jamaica, we doubt not that plenty of business will be found to accommodate both wires.

General Smith, the President of the American Company, came over some short time back to arrange for the manufacture of the cable. Terms were arranged, and the India-Rubber, Gutta-Percha, and Telegraph Works Company were entrusted with the manufacture of this cable at their works at Silvertown, as they had been with that of the previous cable. They were bound to have it made and shipped on board the "Narva" within a certain time. This part of the contract has been speedily fulfilled, and the "Narva" is now away with the cable on board bound for Key West.

The cable is of a somewhat similar character to that submerged last year, differing principally in the fact that it is protected externally with Clark's bituminous compound. In length it is 105 miles, and is divided into three sizes—main deep-sea cable, intermediate, and heavy shore end, of the lengths of 91, 7½, and 6½ miles respectively. The major portion of the intermediate and heavy shore ends will be submerged in comparatively shallow water amongst the coral reefs off Key West; the shore at Havana shelving so abruptly necessitates only a very short amount of shore end. The conductor of seven copper wires, weighing 107lb. per nautical mile, was stranded and coated with the dielectric at the Silvertown Works, and consisted of three coats of gutta-percha, laid on with alternate coatings of a compound of tar and percha, the first coating of compound being placed next the stranded conductor. The weight of gutta-percha was 166lb., making the combined weight of conductor and insulator equal to 273lb. per nautical mile. The conductor thus insulated was carefully tested, after being kept for twenty-four hours in water at a temperature of 75deg. Fah. It was then served with two servings of tanned jute, and coiled in tanks ready to be protected with its external sheathing.

The core for each sort of cable remained the same, the difference being only in the size of the wires used for the outer sheathing; this for the main deep sea cable consisted of 12 B.B. galvanized iron wires of No. 9 gauge, further protected by two servings of tarred jute, each coated with a good coating of Clark's bituminous asphalte compound. The intermediate cable was sheathed with 12 B.B. galvanized iron wires of No. 5 gauge, protected with two servings of jute and compound similar to the main cable. The heavy shore end consisted of intermediate cable, further protected by an extra sheathing of 14 B.B. galvanized wire No. 1 gauge, and covered with jute and compound. This made a most substantial cable, and one that will evidently prove a hard job for the coral reefs. The weights of the various sizes were respectively three, ten, and twenty tons per nautical mile. The cables as manufactured are as fine specimens of submarine cables as we have ever seen, and the insulator and conductor are the best of a similar kind that have as yet been sent away from any factory. Too much credit cannot be given to the Silvertown Company for the attention they have given to gutta-percha as an insulator, and to the high state of perfection to which they have brought it. Although the quality of the gum is only slightly better than that from which the Cuba cable of last year was manufactured, yet the manufacture of the article has so much improved that the present core tests, being reduced to a temperature of 75deg. Fah., above 87 per cent. better than that of last year. Several gentlemen, well known for their experience in testing submarine cables, have experimented and reported most favourably upon it; and by the permission of Mr. Matthew Gray, the managing director of the company, we are enabled to give for the information of our readers a *resumé* of the final tests taken by their electrician, Mr. Hawkins, which we ourselves have had an opportunity of verifying. This information we tabulate, and for the sake of comparison give similar details of last year's cable :—

	1868.	1867.
Conductor, weight per knot	107	107
Insulator, weight per knot	166	166
Conductor, resistance per knot at 75 Fah.	11·8 Ohms.	12·38 Ohms
Conductor, specific conductivity, pure copper, 100	94·4	90·01
Dielectric, resistance per knot at 75 Fah.*	871 Megohms.	464 Megohms.
Dielectric, electrostatic capacity per knot	0·3663	0·3507 Farads†

The contract specified the conductivity of the conductor to be 85 per cent. of pure copper, and the resistance of the dielectric at 75deg. Fah. to be not less than 250 Megohms. A reference to the table will show the superior quality of the materials supplied.

We must not omit to mention that the wire was supplied by Messrs. Johnsons, of Manchester, and the larger size is something really very fine. It is of rolled iron, and is produced in longer lengths than wire usually is. The lengths average about 140lb. each, without weld. The advantage of using such long unbroken lengths is very great, as it dispenses with a great number of welds. The only ones that are now necessary are those made at the closing machine, which, from the amount of attention they receive, have always been superior to any others.

The engineering supervision of the works was placed under Sir Charles Bright, who was also engaged by the company to submerge the cable. For this purpose the "Narva," Captain Nisbet, was again chartered. She was last year fitted up for the Silvertown Company, expressly for the work, with iron water-tight tanks, and a most complete set of machinery, by Mr. F. C. Webb, C.E., from his own designs, many of which were quite novel. All these have again come into use, as the Silvertown Company agreed to fit the ship up in a manner similar to last year's expedition, and our readers can imagine that a large amount of labour and expense has been saved by their being able to use a complete set of apparatus that had only to be put in the places which were formerly occupied by them. The "Narva" is now on her way to Key West; she leaves a month earlier than the expedition of last year, and as she has much less work to perform, we trust that she may be able to accomplish all before the dreaded "vomito" makes its appearance. After the experience of last year, we cannot help again expressing our surprise that the work should be undertaken at such a season, but now that they have done so, we cannot but, in the interests of submarine telegraphy and commercial enterprise, wish them every success.

* For comparison with other cables, see Latimer Clark's table published in our number of April 24 last.

† The Farad. is the standard unit of capacity appointed by the British Association.

IMPERIAL ESTABLISHMENTS ON THE LOIRE.—No. I.

TO the discovery of the wonderful powers of steam, and the universality of its application, may be fairly attributed the condition of decay and disuse into which water power has fallen, not only in our own country, but in others where the new motor has been introduced. Had it not been for the birth of that invincible force, the enormous amount of water power existing even in the comparatively insignificant streams of the United Kingdom, would have been utilized to a maximum, instead of being permitted to remain, at the best, useless and idle, and, at the worst, a scourge and a terror to those dwelling within reach of its influence. Were our rivers more under command, their channels less winding, their beds less obstructed, their depth more constant, and their flow more uniform, the plea so often put forward by the manufacturer and the mill-owner, that he cannot obtain a constant supply of water, and must, therefore, have recourse to the agency of steam, would not be so forcible or so incontrovertible as it unfortunately is. One might imagine that although rivers are but little used as a source of power, yet means would have been taken to restrain them within their channels, and so avert the consequences which inevitably attend their annual inundations. But it is not the case. Neither in England or in France have the great rivers been placed under any restraint, except in a few isolated instances, and then only for a distance so short that it merely suffices to render the stream more impetuous after escaping from its temporary fetters. Of the continental rivers, the Loire is one of the most important, not only in actual size, but also for the extent of its course. Rising within a few miles of the source of the Rhone, it traverses France from east to west, and, together with its tributaries, which are numerous and considerable, it irrigates an extent of country forming nearly half the empire. If the works and operations commenced by the Valois had been continued by their successors, this enormous area of land would have been irrigated in the true and beneficial sense of the term, instead of being visited, upon the average, every ten years with inundations that spread far and wide ruin, terror, and desolation.

Among the numerous establishments situated upon the Loire, that upon the Isle of Indret has the merit of antiquity, and enjoys the favour of governmental patronage. This little island was selected about the year 650, as a suitable spot for a colony of ecclesiastics,

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who, from the number of caves in it, bestowed upon it the name of Antrum. In the process of time, when the Latin tongue fell into disuse, and other than monks and nuns resorted to the locality, the original name was altered to Aindre or Aindrette, and ultimately to Indret, which is its present denomination. It was not until the year 1650 that Indret became the property of the Crown, and was used as a dockyard for the construction of the ships of that period. In 1777, a cannon foundry was established there by order of Louis XVI.; the celebrated English engineer, Wilkinson, was appointed manager, and the works were carried on with an energy and activity that always characterized the industrial projects of that monarch. After the departure of Wilkinson, which took place some five years subsequently, the premises became the property of a company, and during their occupation a large fire pump was manufactured, one of the first steam machines constructed in France, and contemporary with that put up at Creusot. Unfortunately, not only this curious relic of early machinery, but all its numerous adjuncts and accessories, have been either purposely destroyed or suffered to decay, when their services were superseded by those of more modern agents. At the beginning of the present century, Indret passed into the hands of the French naval authorities, and, in 1827, the Minister of the Navy determined upon employing the foundry and other workshops upon a much larger scale than had been hitherto attempted. The situation of Indret upon a navigable river offered at that time, when railways had not been created, facilities not possessed by other localities farther inland. From this time the resources of the imperial establishment began to receive a considerable development, and the result of its capabilities was demonstrated at the recent "Exposition" by the display of a motive agent equal to 4,000-horse power, constructed with a skill and workmanship that may challenge those of any specimen of machinery. Among the machines upon the premises are a Whitworth planing machine of 1841, which is still at work, although the principle has been nearly superseded by more modern examples of the same implement. There are numerous others bearing the names of Fox, Sharpe, Roberts, Harvey, Mazeline, Elvell, and Ducommun, thereby indicating the various alterations that have been introduced from time to time by mechanical genius. If the older examples of machinery be contrasted with those of a modern date, it will be found that the complicated has been invariably succeeded by the simple, and that the aim of the designer is no longer to introduce fanciful and conceited novelties of construction, but to effect the maximum production of work with the minimum expenditure of labour.

Formerly it was a labour to even file iron: now it is planed like wood, melted like wax, and cut and pierced like a piece of cardboard. At Indret there are machines powerful enough to plane off a strip of wrought iron more than 1½in. in thickness and 40ft. in length, the cutter being carried backwards and forwards by a slide weighing nearly fifteen tons. The majority of the work is effected by portable engines of fifteen horse-power, and placed in pairs close together, so as to relieve one another, and thus prevent any interruption in the operations in progress. A machine, or, rather, an apparatus, invented by M. Joessel, for testing castings by the determination of their powers of resistance to rupture, and also ascertaining their elasticity, is in constant use upon the premises. It consists of a steelyard which registers the loads and the deflections at any particular moment of the testing, by means of the movable drum attached to an indicator of M. Garnier. All the bars to be tested are reduced to the standard dimensions of 2in. square, and the registering portion of the apparatus is composed of a lever movable upon a centre, and carrying a weight at one of its extremities. Between the weight and the fulcrum a knife is fixed, the point of which transmits to the bar the pressure of the weight. Two other knives are placed under the bar, and it is at the middle of the distance that separates them that the point of the upper knife acts. This knife and the weight can be shifted by means of a screw to any position upon the lever. In proportion as the weight is moved towards the extremity of the beam, so the pressure increases, and its amount is recorded by a pointer upon a scale. A lever, terminated by a needle movable about a dial, registers the deflections multiplied ten times. Reliance must not be placed solely upon the indications of this apparatus in judging of the strength of castings. Due regard must be had to the method of casting employed, especially to the temperature of the metal and that of the mould, and precautions must be taken that the iron is of good quality, and that the specimens selected are fair representatives of the usual productions of the foundry. Nothing is more common in all testing operations than to select specimens which are superior in many points to those that would be employed in actual practice, whereas the reverse of this should be the manner of proceeding, as the results would always be upon the safe side. It would appear that the object of an experimentalist is not to obtain the strength of a fair average specimen of the material under test, but to procure a result as high as possible; not to demonstrate what the material will withstand under the ordinary conditions of practice, but what it is capable of withstanding under the most favourable circumstances in which it could possibly be situated. It is this that has led among practical men to so great a distrust of the results of experiments, and to their placing so little reliance upon tables prepared expressly for their guidance and reference. They do not for a moment deny that those results are true for the experiments in question, but they do deny, and with reason, too, that they are, therefore, necessarily true for conditions other than those which attended their own production. The foundry at Indret, upon an emergency, can turn out at one running nearly 100 tons of metal, but a third of this is the usual amount. In a future number we shall revert to this subject, and give some particulars respecting the casting and treatment of steel, and the manufacture of boilers at this establishment.

CONVERSAZIONE OF THE INSTITUTION OF CIVIL ENGINEERS.

IN resuming our observations upon the interesting exhibition at the Institution of Civil Engineers last week, we will first notice a selected collection of samples of fractured materials of various kinds, which was sent by Mr. Kirkaldy, but to which, for want of space, was assigned a somewhat inconspicuous position. There was a portion of the broken cast-steel crank shaft of the Peninsular and Oriental Company's screw steamship "Jeddo," manufactured by Krupp, of Essen. It had been cut up into specimens and tested to ascertain the mechanical properties of the steel used. Besides these and a number of other specimens illustrative of the application of pulling, thrusting, bending, and twisting strains, Mr. Kirkaldy exhibited his patent indicator dial used with his testing machine for ascertaining the change in form of articles during experiment, extension and set under pulling stress, depression and set under thrusting stress, deflection and set under bending stress, distortion under shearing stress. He sent also four modifications of his patent micrometer, for ascertaining minute differences in measurement or dimensions. It is specially applicable for testing and other experimental purposes, and may also be used in various manufactures where great accuracy of measurement is desirable. The subject of strains reminds us of an ingenious method, devised by Mr. Airy, of ascertaining the tensile strains upon bars or rods by the musical note emitted by them when struck. A model of a bow-and-string girder illustrated the system, in which the members of the girder are represented by pieces of wire, which are weighted to a certain degree of tension, when they are struck to give the musical sound. A wire of similar length to the member is strained in a separate frame until it emits a corresponding note to that in the girder; the weight being taken, the strain is arrived at. When we have said that this method of taking strains is ingenious, we have summed up its merits.

Messrs. De Bergue and Sons exhibited a model illustrating an improved mode of transmitting the power of the locomotive engine to the wheels of the tender, converting them all into driving wheels; as also, where need be, the wheels of one or more of the carriages of a train, for the purpose of obtaining greater adhesion with a minimum weight on any of the wheels, so as to diminish the great wear and tear of tyres and rails, and facilitate more rapid starting and stopping without skidding. A coloured drawing illustrated the application of this system to a 4-wheel locomotive and 4-wheel tender, so as to constitute an engine with eight driving wheels, with short wheel base for quick curves. The dimensions and main particulars of this engine are as follows:—Length of fire-grate, 4ft. 9in.; width of ditto, 3ft.; grate surface, 14sq. ft.; length of tubes, 11ft.; interior diameter of tubes, 1¼in.; tube heating surface, 800sq. ft.; heating surface of firebox, 60sq. ft.; total ditto, 860sq. ft.; diameter of body of boiler, 4ft.; working pressure, 130lb.; thickness of plate of boiler, 7-16in.; diameter of cylinders, 16in.; length of stroke, 24in.; wheel base of engine, 9ft.; ditto, tender, 8ft.; diameter of wheels, 4ft. 6in.; number of coupled wheels, 8; weight of locomotive working, 23¼ tons; ditto of tender ditto, 19 tons; adhesion of locomotive (at one-sixth of weight), 3 tons 18cwt.; adhesion of tender, 3 tons 3cwt.; total adhesion in dry weather, about 7 tons; tractive force, at 65 per cent., 4 tons 3cwt. Adjoining Messrs. De Bergue's model was a novel arrangement for coupling the wheels of locomotives and tenders and locomotives to carriages by Mr. Livesay, and intended for mountain and other railways having steep gradients and sharp curves. The object of the inventor is to decrease the present excessive load on the driving wheels of locomotives by coupling the driving to the bogie or radial wheels, or to those of the tender, and when necessary to those of the next van or carriage, and thus to add considerably to the tractive power of the engine. The coupling consists of endless bands, which in practice are made of india-rubber and steel wire, and are perforated with a series of holes which are protected by steel bushes or eyelets. These bands work over cylinders on which are studs taking into the holes in the bands. The bands are from 12in. to 20in. wide, and from ⅜in. to ⅝in. thick, according to the power of the engine, and are said to be equal to a strain of from thirty to fifty tons, although in practice they will not be liable to more than five or six tons. Except in very rare instances it would not be found necessary to extend this coupling arrangement beyond the tender, first van, or carriage of a train. This amount of extra adhesion, says Mr. Livesay, would be fully equal to the cylinder power.

Mr. Dodds, of Rotherham, sent some samples of his steeled rails, which are offered as an alternative to those who complain of want of wear in iron rails and the expense of those of pure steel. Railway companies having recognized the value of steel rails, but having intimated that unless the price could be kept within a few shillings of the cost of iron, however valuable the rails, they would not adopt them, Mr. Dodds set to work to meet

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these views, and has taken out several patents for making a more durable rail at the smallest possible extra cost. His first patent was simply to convert the surface of rails into steel, by an arrangement of furnace and mixture of carbonaceous fuel, which acted more rapidly at a lower heat than the process used by steel makers for producing blister steel. But he never supposed that rails so treated would be made more tenacious, that inferior iron would be changed to a first-class quality, nor that unsound rails would have their imperfections remedied. However, he found that a hard and more durable surface was produced, but with the exception that no blisters were made, these surfaces had the imperfection of blister steel, viz., brittleness. Mr. Dodds's latest improvements not only include a process of converting, but a peculiar arrangement for rolling or hammering after conversion, whereby the surfaces are rendered more tenacious, and the body of the rails are improved in fibre. These rails are said to be superior to cast steel, for the reason that durability against wear and tear is as their degree of hardness. Cast steel is homogeneous, and if hardened would be hard all through, and therefore brittle—if kept soft enough to be tough, the wearing qualities are reduced. Steel-surfaced rails (made by this improved process) have not this disadvantage, for the surfaces can be hardened or tempered to any required hardness, and still retain the ductility of the iron body. These rails are also superior to steel-surfaced rails made by welding a steel top on an iron rail, for no mechanical combination can be made with certainty; the expansion and contraction of the materials differ, and the rolling of the trains has a constant tendency to separate the two, as experience has shown. By Mr. Dodds's method, however, there is no defined line between the iron and steel, and it is an impossibility to separate them, due regard being had to the quality of the iron used, as good steel can only be made from good iron. These rails are produced at a cost midway between steel and iron rails, and, therefore, offer special advantages in an economical point of view.

The use of locking gear in the working of switches and signals at station yards and junctions having recently been rendered compulsory by the regulations of the Board of Trade, it has become a serious necessity to railway companies, proposing to open new or to alter existing lines, to procure apparatus fulfilling the conditions as to safety and efficiency required by the Board, and at the same time not show a disproportionate outlay compared with other items of expenditure. To meet this point, we find in the "economical switch and signal locking levers" an arrangement which, whilst not attempting to rival the costly and complicated machinery suitable for crowded metropolitan junctions, will yet ensure a reliable and safe protection amply sufficient for any ordinary traffic. In this arrangement of locking gear, which is manufactured at the Viaduct Works, Crumlin, it is impossible to move the switch lever until the signal levers have been first put to danger, and locked there. After this is done the switch may be moved as required, allowing shunting to be carried on without interfering with the signals. Neither can the signal levers be moved until the switch lever is made right, and locked to the main line. This prevents the liability of any accident arising from a mistake in working the signals. Another apparatus of this class which was exhibited is Mr. Cashin's patent safety switch levers. They consist only of three parts—the standard, handle or lever proper, and balance weight. The crank and oscillating jaw are substituted for the ordinary connecting rod and bell-crank. There appears to be no risk of accident arising from frost, or the various sources of danger and obstruction to which switch boxes are liable; and the whole being in view above ground, can always be kept in order. They work parallel to the rails, and can be fixed to a piece of timber or sleeper in a few minutes. In connection with railways we also observed one of Mr. Mallet's patent elastic hollow buckled plate sleepers, which had been proved with ten tons dead load placed on the chair. The deflection is stated to have been only 0·033 of an inch, and no permanent set occurred. It is astonishing what these buckled plates will stand. We must not here pass by without allusion to Messrs. Saxley and Farmer's excellent system of railway signals, although we purpose referring to them specially on another occasion.

Mr. H. Ormerod contributed a working model of his patent safety link for preventing those fatal accidents which so often arise from overwinding. This apparatus was fully described and illustrated by us on April 17 last, so that we need not now refer to it further than to say that it is simple in construction, effectual and certain in action, and not liable to get deranged or out of order. Messrs. Lambert Brothers sent one of Foster's ingenious contracting taps, which is especially adapted for screwing work in which the tap has to be withdrawn. This tap has many advantages; it saves considerable time, and does not take away the sharpness of the thread, as in the present solid tap, it not being necessary to unscrew the tap out of the work, as it is released and withdrawn at full speed without reversing the machine, thus doing away with the necessity of constantly running oil on the tap to keep it cool when unscrewing itself. It also dispenses with the necessity for reversing the motion in the screwing machine—the cause of much wear and tear. The body of the tap being made of steel does not wear. The cutting threads being of small size steel, a better quality of metal is ensured, the tap is consequently very durable under heavy work. This is proved by experience in the screwing department of Messrs. Lambert's Tube Works at Walsall, when upwards of 4,000 1-inch wrought-iron tees, or 12,000 holes, have been screwed by one tap without renewing the cutters.

Messrs. Moreland and Son exhibited their improved method of constructing floors, which consists in fixing wrought-iron girders at given distances apart on the walls of buildings, and then placing between them on their lower flanges a number of wrought-iron bow-and-string lattice girders, and on the upper or curved surface of these laying corrugated iron throughout the floor. Concrete is then laid on the corrugated iron to the desired form and thickness, and sleepers, joists, and floorboards are then laid on the concrete in the ordinary manner. The ceiling joists are fixed on the lower part of the lattice girder, and are lathed and plastered in the usual way. This system of flooring is adaptable to all spans and positions required in ordinary buildings, particularly in large spans, and it is found to be more economical and much more rigid than floors constructed with rolled girders. Large spans may be constructed upon this principle without the intervention of main girders, as the wrought-iron girders are made of the greatest depth possible, being kept close to both floorboards and ceiling, thereby ensuring the greatest rigidity and strength with the least quantity of material. The air space which is included between the under side of the corrugated iron and the ceiling, being a non-conductor of sound and also of heat, renders the floor sound-proof and safer under the action of fire, either from above or below the flooring. The concrete being laid on the corrugated iron forms a natural arch, which is prevented from exercising any lateral thrust by reason of the bow-and-string lattice girders with the corrugated iron acting as permanent centering to the arch. This combination has been proved by a variety of tests to be the best and most economical disposition of the various materials composing the floor. Of the results of these tests—which include dead-weights and the impact of falling bodies—it will not be amiss here to say a few words. An arch was formed by laying a concrete of broken brick and gypsum on corrugated iron, No. 20 gauge, with 3in. flukes, supported by bow-and-string girders 8ft. long, 8in. deep in centre, and made of 1¾in. × ¼in. angles, 2in. × 3-16in. verticals, 1¼in. × ¼in. diagonals, and ½in. rivets, the whole resting between two wrought-iron girders 20ft. long, 16in. deep, 4in. × 4in. × ½in. angle iron, and tied together with tie rods 1⅜in. diameter, 1⅜in. ends. After standing twenty days, a cast-iron weight 12in. square on the face, 2ft. long, and 9in. square on the top end, and weighing 650lb., was raised 16ft. immediately over the centre of one of the bow-and-string girders, and allowed to fall on the concrete arch above it. On falling, the weight penetrated the concrete 4½in., and the elasticity of the bow-and-string girder caused it to rebound 10in. or 12in., and on falling again the lattice girder was further deflected. The corrugated iron after the impact was 1¼in. clear for 4ft. 3in. of the bow-and-string girder. The bow-and-string girder had the centre vertical bent and cracked, the diagonal broken, and two rivets securing the diagonal at top started. The application of dead-weight loads was also eminently satisfactory.

There remain but few things more to be noticed, amongst which comes Murray's brick-cutting table, which was exhibited by Mr. Middleton, of Southwark. These tables can be adapted to any steam brickmaking machines, and it is said that from 2,000 to 3,000 bricks can be made with each table per ten hours more than with any other cutting table at present in use. This is effected, not by increasing the speed of the stream of clay issuing from the die, but by avoiding stoppage and waste, as the clay is continually running, and not more than about one in twelve bricks need be thrown back. Twelve bricks are cut at a stroke, and the day's work, making the increased number of bricks, is done with less labour than is required for the smaller number of bricks with other cutting tables. The wires can be adjusted to cut bevel bricks to any angle as well as straight bricks, and the bricks cut are removed to the barrow without handling, which increases their value. No sand is used on the table, so that the wires and fustian are subject to very little wear. A common oil not exceeding 4d. per gallon in cost is used for lubricating, and a pint is found sufficient for 1,000 bricks. These tables have been used by Messrs. Kelk, Waring, and Lucas, the contractors for the Metropolitan Railway, with highly satisfactory results. Messrs. Forrester, of Liverpool, sent one of Gray's improved compressed air riveting machines, which have been in use for a lengthened period, and answer admirably for all ordinary classes of boiler, ship, girder, tank, or other riveting. The machine itself is quite portable, weighing only 28lb., and from the rapidity of its action it is stated that the recoil is scarcely felt by the man holding the machine to its work. The starting of the machine is effected in a simple manner, and is fully under the control of the man guiding the machine. The connection between it and the air compressing machine is by a flexible tube. An ordinary skilled labourer can do with it four rivets ¾in. diameter per minute, in straightforward work.

Mr. Edward Cottam, of Battersea, sent one of his "Interceptors," or patent effluvium traps, a section of which we give annexed. To prevent the entry of sewer-gas into the house, *a a* are hollows to form the water lute, *b b* two diaphragms, which form an intercepting chamber *c*, by means of which the foul air of the drain, forcing the lute, is caught and carried by a grating or pipe inserted in the lid *d* into the outer air. The same firm also sent a specimen of what they very properly term the "Humane" horse-shoe, by which the

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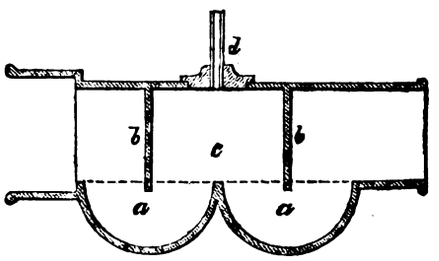
horse can endure hard work without pain, and by the use of which his feet are found to last sound during his natural life. As the weight of the horse is mainly sustained by the crust of the hoof, so this shoe is designed to arm



that crust, and to preserve, although caulked, the true level position of the foot. The level caulking prevents that straining and waste of muscular power consequent upon continual slipping and rocking of the foot. Burning on the shoe to fit it destroys the hoof, rendering it brittle; this common and pernicious practice is entirely avoided, as the "Humane" shoes are made true and level by machinery, and can be better fitted cold. With this shoe, and by the system of shoeing, the patentee, Mr. Goodenough, states that horses recover from diseases arising from bad shoeing, viz., contracted feet, corns, sand or quarter cracks, thrush, springing of the knees, shrinking of the shoulder, &c. The efficacy of this shoe has been thoroughly proved in America; in New York alone, we understand that over 80,000 shoes are made weekly.

TESTING THE RUNCORN GREAT BRIDGE.

THE enormous girder bridge erected by the London and North-Western Railway Company over the Mersey at Runcorn is now practically completed, and on Thursday week was subjected to the preliminary tests of stability. The object of this great work is to carry a line of railway over the Mersey at this point, by which the Company will shorten the route from London to Liverpool by fifteen miles or so. Messrs. Brassey and Ogilvie are the contractors for the line, whilst Messrs. Cochrane, Grove, and Co., have undertaken the Runcorn Bridge, the execution of which they have entrusted to Mr. J. P. Ashton. The bridge was designed by Mr. W. Baker, the engineer-in-chief of the North-Western Railway Company, Mr. S. B. Wells being the resident engineer. The bridge is upon the trellis girder principle, and is nearly 1,000ft. in length, supported upon stone piers 167ft. in height from foundation level, and which rise 75ft. above high-water mark. The three central spans are 305ft. each. At each end of this great girder are several arches which carry the railway over the remaining portion of the river. There are three of these arches on the Cheshire side, and five on the Lancashire side, each having a span of 60ft. These are succeeded on each side of the river by a long viaduct ending in an embankment, with a gradient of about 1 in 120, until the level of the line at Ditton and Aston respectively is reached. Altogether, independently of the girder bridge, there are 97 arches, 65 being on the Lancashire and 32 on the Cheshire side. The arches of the viaduct have a span of 40ft. The width of the bridge is 38ft. over all, and 25ft. between the girders; and there is a footpath 6ft. wide on each side of the bridge. For the purpose of testing the bridge in the severest manner, sixteen locomotive engines, each loaded to a weight of 15 tons, were sent from Crewe. Two engines were first sent over, then four, then six, afterwards eight, and finally the whole sixteen. Eight engines were then placed on each line of rails between two piers, besides which there were 90 tons of material in the footways, so that, including the girder itself, about 2,000 tons of dead weight was suspended between two points 300ft. apart. The two trains of engines were then run backwards and forwards at full speed without perceptibly affecting the steadiness and stability of the structure. The results, however, as registered by the gauges, were a deflection of barely an inch and a quarter, whilst the permanent set was only three-eighths of an inch. This result must be highly satisfactory to all engaged upon the work, as it far exceeds what was anticipated. The first stone of this bridge was laid on April 12, 1864, and the last rivet was driven on February 14 last. The estimated cost of the bridge was £250,000; but this, as a matter of course, has been somewhat exceeded. Some minor works on the line still remain for completion, but the whole is expected to be ready for traffic in the course of a few months.

ENGLISH AND FRENCH LENSES.

THE facts we mentioned a week or two ago, that the best lenses of the French opticians, although as good as the best English lenses, average less than half the price, and that the photographic journals have omitted to make known this truth to their readers, necessarily somewhat awoke the consciences of the latter journals. The "Illustrated Photographer," in a letter it publishes on our article, says:—"It is quite possible to get from a French optician a lens in all respects equal to one by the best of our English makers, and that at considerably less cost. But it is a 'toss up,' or, rather, ten to one against your getting really a good one. They turn them out as a bricker does his clay out of the moulds; they put them into flimsy brass mounts, and 'there you are' for the market. I should do injustice to Maugey, Lerebours, and Hermagis, of Paris, whose instruments I know, were I not to say that some of their best compound (portrait) lenses are quite up to the mark of our best English optician, Mr. Ross, and to that of Voightlander."

As this paragraph admits that particular French opticians do turn out lenses as good as the enormously high-priced ones sold sometimes in England, and at much less cost, so far its statements are authentic. But the statement that the French lenses of the best makers have bad brasswork is not true, for Darlot, whose lenses carried off the first prize against all-comers at the Paris International Exhibition, turns out brasswork mounts which the merest tyro can see at a glance are in most cases superior to the mounts of the best English lenses. Again, the percentage of bad lenses sold by the best Parisian opticians is not higher than the percentage of bad ones sold by the best English opticians. Lastly, the "Illustrated Photographer" says that Mr. Ross (the optician who advertises most in its pages) is the best lens maker in London. The "Photographic News" praises Mr. Dallmeyer (who advertises most in its pages) infinitely more than any other optician. Whence this discrepancy? And if both these journals think they are right on the point, why do they not test the lenses against each other, state the results in figures, not opinions, and then go into the question of price, as compared with French lenses.

The editor, or one of the editors, of the "British Journal of Photography," has an intelligent knowledge of the principles of construction of lenses, and his reply to our article is amusing. The facts being too strong, he cannot deny them directly, so he asks a string of questions, which he does not answer, and thus flings doubts over our statements by implication. He speaks of the difficulties of making lenses, which we do not deny, but these are as great in Paris as in London. He says:—"Photographic lenses are not made out of window glass, but out of discs of optical glass, which, even at the glass manufactory, and while as yet untouched by the optician, costs a much higher price than is usually imagined. A good lens must be free from flaws and imperfections: and as striæ in the glass is one of the imperfections most difficult to eliminate, it naturally follows that for pure glass a price must be exacted proportionate to the expense and difficulty encountered in its production." Now, nobody knows better than the writer of the foregoing that a halfpenny per pound extra price will buy window glass without striæ. He also knows that inferior optical glass which will not do for the telescope will do for photographic lenses, as, from some source or other, it is an advantage in the latter to have a little "diffusion of focus." A lens which produces a perfectly sharp image in one plane only is bad in photography. Moreover, we have seen a landscape lens made out of common plate window glass, which worked well in photography.

A more important subject than this to English photographers could not be chosen, for, unfortunately, information how to make cheap homely lenses, such as we published a few weeks ago, is never given in metropolitan photographic literature. A corrupt journal, directly under the thumb of an advertising tradesman, would be of course unable to speak the truth on these points, and we have no direct knowledge that any photographic journal of this kind is published in London. Nevertheless, silence on the fact of the enormous differences in the price of English and French lenses of the same quality is a marked feature of London photographic literature, and now that the serious omission has been publicly brought under the notice of the managers of these journals, we hope not one of them is so afraid of free discussion as to decline to quote the whole of the two articles we have written on the subject, without abbreviation or alteration. There is no doubt that the matter is so important to their readers that the space would not be wasted; moreover, the fact of making the quotations in full, will show that the editor so quoting is not afraid to have the back numbers of his periodical examined by his subscribers, to see whether those who advertise most largely have uniformly and systematically received most editorial praise of their goods.

Nobody would be better pleased than ourselves to see them adopt this plain and straightforward course, thereby enabling their readers to see, unabridged and unaltered, what we say on one side, and in separate articles what they say on the other. There are photographers in London who think one or other of the journals dare not stand this test, and will make any mortal excuse to escape from it; so as this suspicion may be most unjust to honourable journalists, those editors will, of course, be delighted to seize this fair method of ventilating a subject, which, although of great interest to their readers, they have hitherto chanced to overlook. The best lenses of the best French opticians are quite as good as the best lenses of the best English opticians, the only difference being that the former are about half the price of the latter. A French optician, with his fair-priced lenses, carried off the first prize against all-comers at the Paris Exhibition. Therefore, we think it would be a great protection to photographers if an establishment were started in London, which would test lenses for anybody at a moderate fee, and state the results in figures, so that lenses shall henceforth get a reputation on their own merits.

WORKS IN IRON.*

WE have of late observed the growing tendency of manufacturers and others desiring to place before the public the various

* "Works in Iron." By ANDREW HANDYSIDE and Co., Britannia Iron Works, Derby and London. E. and F. N. Spon, 48, Charing Cross. 1868.

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works in which they are specially engaged, to adopt a style of conveying information which almost brings their books within the scope of scientific literature. The latest production of this kind which has been brought under our notice, is that of Messrs. Handyside and Co., of the Britannia Works, Derby, who, no matter what commercial object may be their aim, really deserve credit for giving the public a vast amount of practical information on some of the most important points connected with ironwork. The Britannia Works were established in the early part of the present century as an iron foundry, and soon became noted for the superior quality of what are known as "Derby" castings. In time, these works came to turn out every description of wrought as well as cast iron work, including steam engines and machinery of various kinds. The volume now under notice is a remarkable production of its class, as, without specially professing to do so, it forms a useful record of a number of the most interesting public structures both at home and abroad. Besides this it enters upon the questions of the strength, quality, and application of various kinds of mixtures of iron in an eminently practical manner. Its professed object is to form a useful book of reference to all those at home or abroad who may be interested in engineering or other ironwork, and it succeeds admirably in accomplishing this object, inasmuch as it gives in a concise form a large amount of information which cannot fail to prove useful to engineers at home or abroad. And not only to engineers alone does it address itself, but, in fact, to all those who, away from home, cannot have access to the usual source of information. Its illustrations are in all cases those of works actually executed, and not merely cut-and-dried representations of what can be supplied. And, what is more, correct views of the various works are given by means of photography, the aid of which has been judiciously obtained.

Having indicated the aim and object of Messrs. Handyside's book, let us look into it and see how these have been carried out. It is divided into three main sections, treating of three distinct classes of work in all their detail and variety. In the first place, we have constructive ironwork, including roofs, bridges, and buildings. Next, we have steam engines, machinery, and foundry work of all kinds; and, thirdly, ornamental ironwork. Under the first head are some useful remarks upon the quality of iron, embodying the results of practical experiments and suggestions for aiding a proper selection of the material. Bridges and girders of various kinds are next noticed, numerous examples being given of structures upon the several principles now adopted in engineering practice which have been made and erected by Messrs. Handyside. And it is not merely a descriptive account which is presented to us; we have also much information about the forms of the several members of the girders and the iron suited for each purpose. Amongst the examples of bridges illustrated will be found one over the River Wye, at Hay, in Brecknockshire; another for the Queensland Railway, in Eastern Australia; a railway bridge at Whitney, Herefordshire; and another over the Avon, near Bath, all of which have been turned out at the Britannia Works. We specially notice Handyside's colonial bridge, which is admirably suited for new colonies and foreign countries, where transport is difficult, and skilled labour scarce and expensive. It is so designed that there are no pieces of excessive size or weight, and the mode of erection is simple and speedy, no riveting being required. Iron roofs are also amply considered, those of the Agricultural Hall, the Inns of Court Hotel, the Broad-street Terminus of the North London Railway, and the Amsterdam Station of the Dutch Rhenish Railway being conspicuous. The average weights and prices per square of 100ft. are given for various other constructions of roofing, of small as well as of large span. Following the roofs are particulars of iron buildings, in which Messrs. Handyside have had much experience both as regards plain and ornamental structures.

In the second division we have some useful hints with respect to steam engines and machinery in general. In this department Messrs. Handyside's specialty appears to be colliery winding engines, of which a pair have recently been erected by this firm at the Moira Colliery, Leicestershire. These engines, which are well illustrated, are horizontal and non-condensing, and are coupled to one crank shaft. The cylinders are 30in. in diameter, making a stroke of 5ft., and together exert a combined force equal to about 150-horse power. We shall not further describe this engine now, although disposed to do so, as we hope shortly to place full particulars and drawings of it before our readers. In the third division of the work, we have iron presented to us in another form—the ornamental—in which condition it is largely utilized for conservatories and such-like buildings. The most recent example executed at the Britannia Works is the winter garden in the new infirmary at Leeds, an elegant structure, and which was recently opened. An earlier, but more familiar, example is the splendid conservatory in the Royal Horticultural Gardens, at South Kensington, of which we have a fine photograph. This is one of the largest conservatories in the world, being 265ft. long, 96ft. wide, and 75ft. high in the central aisle. Besides these and many other more prominent examples of ornamental ironwork, we have a collection of smaller items, from fountains and vases down to pillar letter-boxes and railings. We have now said more than enough to show that we have no ordinary price list or illustrated catalogue here. Much time and money must have been expended in producing such a work. Brains, too, have not been wanting, and in this respect we believe we are right in ascribing to Mr. Ewing Matheson—the London representative of the firm—the conception and literary execution of the work. It reflects great credit on him, as do the structures it illustrates on the proprietors of the Britannia Works. The publishers, too, have done their part well, and the book is turned out in a highly creditable manner.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

AN IMPROVEMENT IN GALIBERT'S APPARATUS—ZIRCONIA IN THE OXYHYDROGEN FLAME—THE PASSAGE OF HYDROGEN THROUGH PLATINUM AND THE DISSOCIATION OF WATER—ARTIFICIAL SAFFRON—LUBRICATING OIL FROM COCKCHAFERS.

THE apparatus of M. Galibert, which allows the wearer to penetrate into poisonous atmospheres without danger, has been recently improved by the inventor. As our readers will remember, while a communication is kept up with the external atmosphere by means of a tube, the wearer of the hood is compelled to rebreathe the air expired from his lungs. Thus the air became overcharged with carbonic acid, and the hood could not be worn for any length of time. M. Galibert has now added a receiver into which he puts potash, by which the carbonic acid is absorbed, and the expired air is again made fit for respiration. This is a great improvement, and the apparatus is perfectly calculated to prevent those fatal accidents so frequently occurring in breweries, sewers, and old wells; and also to enable men to rescue the sufferers from coal mine explosions. M. Galibert's apparatus should be kept in readiness at all establishments where risks of the kind are possible.

The use of the oxyhydrogen flame for illuminating purposes is extending, so we may record the observation of M. Caron, that the maximum of light is only obtained when hydrogen is used in excess of the proportion necessary to form water. He has also made another observation more interesting than useful at present, and that is that a much more powerful light is obtained when zirconia is employed in place of magnesia. Zirconia is unfortunately rare and expensive to-day, but it may some day become cheap, and M. Caron's discovery may prove of value. In the mean time he suggests that it is not necessary to use a cylinder entirely of zirconia, but a foundation may be made of some other material, the outer part being composed of the rarer earth. Zirconia, he tells us, is completely unchangeable in the flame, and will last for ever.

Mr. Grove, as Dr. Odling recently mentioned at the Royal Institution, first showed that water may be decomposed by passing steam through a platinum tube intensely heated by the oxyhydrogen flame. M. Deville has recently shown that under such circumstances the hydrogen passes through the platinum while the oxygen is retained in the tube. M. Deville seems to have been repeating some of the experiments of Mr. Graham, with the view of supporting his own theory of dissociation.

What is artificial saffron? We must confess to ignorance on this point, but as the article is in actual use as a colouring material for vermicelli, macaroni, and possibly other things, we feel it our duty to inform our readers that it is a dangerously explosive substance. It is imported into France from Germany, and we read that a few weeks ago a workman was engaged in opening a tin of it when the contents exploded and burnt the man so severely that he died. We might suppose it to be some picric acid compound, but all these preparations we know are intensely bitter, and little likely to be used for colouring alimentary substances.

Everything in nature no doubt has its use; but we should never have supposed that cockchafers were intended to yield lubricating oil, which, we read, is now extracted from them in France, where they are this year unusually abundant. How the oil is extracted we are not told.

THE ROYAL HORTICULTURAL SOCIETY.

THE great flower show of the season was opened on Tuesday last, at the Royal Horticultural Gardens, South Kensington, and was attended by a very numerous and distinguished company. The display of azaleas, heaths, and pelargoniums was unusually fine, whilst the show of rhododendrons under the tent was magnificent. These plants are now at their best, and form a splendid and striking show. The following are the principal prizes awarded by the judges:—For nine greenhouse azaleas, distinct, Messrs. S. Glendinning and Son, nurserymen, Chiswick, £15; and Mr. S. Carson, gardener to Mr. W. R. G. Farmer, Nonsuch-park, Surrey, £10; for nine roses, distinct, Mr. W. Paul, Paul's Nurseries, Waltham-cross, £12; for nine show pelargoniums, distinct, Mr. J. Fraser, Lea Bridge-road Nursery, £10; for twelve exotic orchids (open), Mr. C. Renny, £15; for ten exotic orchids (nurserymen), Mr. B. S. Williams, £12: for twelve stove or greenhouse plants, Mr. B. Reid, £15, and Mr. J. May, £12; nine fine-foliaged stove or greenhouse plants, distinct, including variegated plants, Mr. S. Fairbairn, The Gardens, Sion House, Isleworth, £10; for twelve stove or greenhouse ferns, Mr. B. S. Williams, £10.

IMPROVED SLIDE RULE.

MR. JAMES NOBLES, an engineer, of Fitz-William-street, Sheffield, has greatly improved the engineers' slide rule by the introduction on it of gauge points for obtaining the weight of steel and wrought iron in square, round, octagon, and triangular bars, in inches, 8ths, 16ths; also in French lines and millimetres. On the back of the rule is a table of decimal multipliers, for obtaining the weight of steel in figures, in inches, 8ths, 16ths, 32nds, 64ths; also in French lines and millimetres in bars of the above sections. The engineer can with this rule obtain his weights without the trouble of calculating decimals. These, and other points of usefulness, render these rules—one of which is before us—a valuable acquisition to the engineer and mechanic, who owe Mr. Nobles thanks for helping to simplify the work of calculation.

DURING the past week thirty wrecks have been reported, making for the present year 955.

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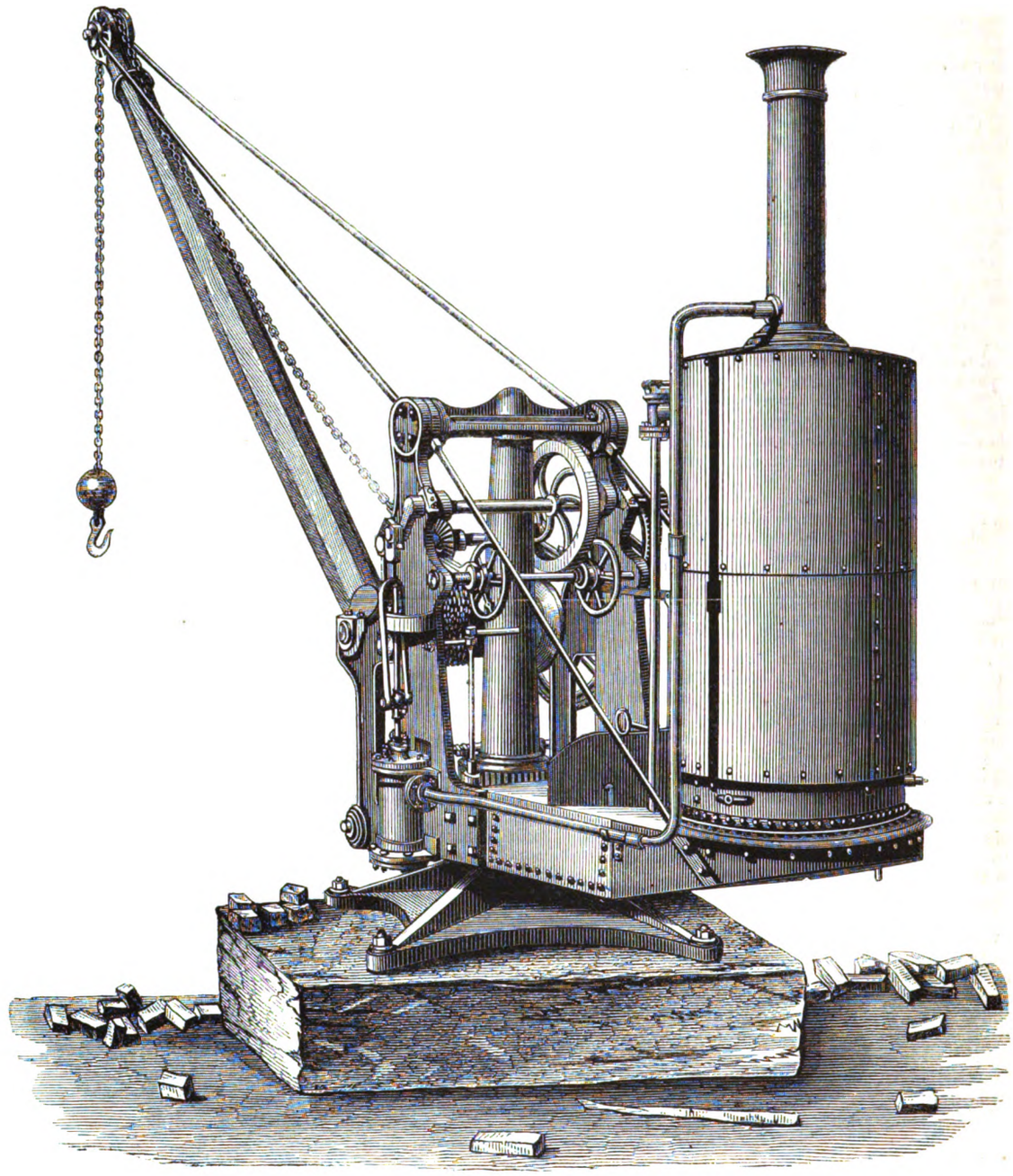
STEAM CRANE.

BY THE DALLAM FORGE COMPANY.



STEAM CRANE.

THE steam crane chosen for illustration above is one of several made by the Dallam Forge Company, Warrington. It is 15ft. high and 15ft. radius, and is hung upon a cast-iron central pillar firmly fixed on a massive sole plate, which is secured to a foundation by the usual holding-down bolts, and which has on it a turned race for the roller at the gib foot to travel upon. The crane can be swung completely round by means of a worm, carried by the crane waist, gearing into a worm wheel keyed on to the central pillar, the boiler and water tank, which is under the foot-plate, serving as a counterbalance to the load. The steam cylinder, of 5in. diameter, and with 10in. stroke, is fastened on to the cheek of the crane working the gearing for hoisting and swinging in either direction by means of conical clutches thrown in and out of gear by two hand-wheels working on a screwed bar, the brake for lowering being worked by the foot. The feed pump is worked from an eccentric keyed on to the crank shaft of the engine. With a working pressure of 50lb. the crane has discharged between 60 tons and 70 tons per hour in 20cwt. and 25cwt. lifts. The boiler is an ordinary vertical firebox boiler, the draught being accelerated by the exhaust steam passing into the chimney. It is fitted with steam and glass water gauges, safety valve, spring balance, man and mudholes, and blow-off cock. The crane is also fitted on a strong cast-iron carriage with four wheels for either road or rail.

IMPROVEMENTS IN FANS.

MR. C. SCHIELE, of Frankfort-on-Maine, whose name is well known in connection with turbines and similar apparatus, has recently made some important improvements in fans. In these fans the strain of the strap, axis, and the tremour caused by the revolving of the vanes, is confined to one casting—a pillar, which is fixed by its bottom plate securely to the foundation. The casing in which the vanes revolve, therefore, becomes a mere air-chamber, which is made of very light plate. This is so mounted on the bearing of the pillar that it can be turned round to direct the discharge-opening as may be desired, and then fixed by a set screw. There are only about four light plate-vanes, square, as of old, which, however, instead of throwing the air out against the outside casing, producing a terrible noise, or receiving checked air back between them, causing a great waste of power, have a concentric channel formed round them, in which the air thrown out by the vanes continues revolving, and is prevented from flying out by its centrifugal force. This ring is wider than the vanes, and so much air only escapes as is required at the time, and is propelled forward through the casing to its destination. This ring is at some distance round the vanes, but its sides are provided with flanges, which have an inside radius about equal to that of the vanes, thus ensuring the confinement of the revolving air until required. The suction opening is in the centre, at the front of the casing. Mr. Schiele promises us drawings and description of this apparatus, which we hope, in course of time, to place before our readers.

MANUFACTURE OF PRINTED TAPESTRY CARPETS.

IN the manufacture of printed tapestry carpets it is customary to use straight threads of warp in the back or body of the fabric, which are called "dead," for the purpose of filling up the interstices between the lines of the real or binding warp, and for supporting the pile warp. This dead warp is usually made of linen threads dressed smooth with size, and having generally three threads in each spac between the dents of the reed, the effect of using

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his smooth sized dead ward of threads being to make the carpet comparatively thin, hard, inelastic, and cold. We have before us, however, an invention which has been patented by Mr. William Wood, of Monkhill, near Pontefract, and by which the carpet is made thicker, softer, more elastic, and warm. It consists in making the dead warp wholly or partly of certain other materials in suitable forms and combinations.

In the first place, the dead warp is made of yarns composed wholly or partly of silk obtained from cuttings and rags of woven fabrics wholly or partly of silk, which are torn up, and either alone or combined with any other suitable fibres are formed by the usual or other convenient processes into yarns of suitable size and strength. In the next place, the dead warp is formed of yarns made wholly or partly of wool, hair, or such-like animal fibres, either new or obtained from cuttings and rags of woollen, union, or linsey fabrics and spun waste, and new or old carpeting. These also either alone or mixed with other fibres are formed by convenient processes into suitable yarns. In the formation and application of these improved yarns for dead warp Mr. Wood prefers to twist and size the yarns to such extent only as will enable them to be woven properly, that is, he preserves as much softness and elasticity as possible in the dead warp, and to enable this to be carried out with a minimum of twist or size, he sometimes "doubles" or intertwists the yarn of silk, wool, or animal fibre with a linen or other strong thread, so as by binding them to assist the weaving of soft or short fibred yarns, and coating the thread with cementing matter.

THE APPLICATION OF TOWN SEWAGE TO GENERAL FARM CROPS.*

By THOMAS CARGILL, C.E., B.A.

IN bringing before you this evening the subject of the present lecture it is unnecessary for me to enlarge upon the importance to which it has attained, the increasing interest which is attached to it, and the serious consideration and attention it claims at the hands of the whole community in general, and of the agriculturist in particular. Still less occasion is there to deduce arguments in favour of the utilization and application of sewage, either from the pages of Holy Writ or from the examples afforded by the Japanese, Hindoos, Chinese, or similar semi-civilized nations. From whatever point of view the subject may be regarded, whether sanitary or otherwise, the utility of it has been acknowledged from the earliest times, and the absolute necessity of it has now become universally apparent. To the question, "What is to be done with our sewage?" there is but one answer, "Apply it to the land," but to the question, "How to apply it?" or, rather, "How to apply it in the most economical and remunerative manner?" the answer is not so simple, owing to the fact that it has not received that thorough investigation which it demands, and which must be eventually accorded to it. The reason of the want of information generally felt with respect to the application of sewage to land, and, consequently, of the unwillingness of parties to embark in projects of this nature, is due to many causes. Of these the principal, undoubtedly, is that sewage has never hitherto been regarded by us in its proper light. It has always been considered as a nuisance, as a thing to be got rid of somehow and somewhere at any price, and men continued to shun and avoid the evil, instead of grappling with it, until it assumed a character so alarming and proportions so gigantic that at last self-defence urged them to adopt measures calculated to mitigate what was fast becoming a national scourge. Even at the present time this is the view of sewage entertained, most unfortunately, by the majority of local boards and corporate authorities, who, as a rule, have accomplished little or nothing regarding the disposal of their town sewage. At the same time, it is idle to imagine that we shall ever fully appreciate the true value of sewage or benefit by the advantages within our reach, until we esteem them properly, and regard as an invaluable blessing what has previously been looked upon almost as a curse.

Town sewage, in the general acceptation of the term, and in which sense it is here employed, is composed of the numerous and various elements constituting the contents of sewers, including the liquid and solid excrements of human beings and animals, the waste water and refuse from dwellings and manufactories, and the ordinary drainage of the streets. In alluding hereafter to the application of sewage, it will be supposed to be taken direct from the sewers and applied to the land without undergoing any previous process of disinfection or deodorization. I the more particularly call attention to this statement, as I consider it essential to the real economy and ultimately remunerative character of the system adopted. Not a single one of the many processes undertaken with reference to modifying the condition of sewage has been attended with even a partial success, and there is not the slightest doubt but that it must be taken pure from the sewers to impart the greatest benefit to crops. At Tottenham, Leicester, Birmingham, and Manchester various disinfecting and deodorizing schemes have been tried, but which have all resulted in complete failure. At one place 4s. per ton was barely obtained for that which was expected to realize £4; while at Birmingham scarcely 6d. per ton could be got for the solid residue left after deodorization and evaporation. Similar results attended the first operations at Croydon, where a most expensive and elaborate system of filtration was carried on for a time, in order to prevent the pollution of the River Wandle. It must not, however, be understood that in some instances, as at Norwood, subsidence tanks can be altogether dispensed with. They are rendered necessary whenever the sewage is conveyed over a short distance in pipes laid at sharp gradients, the flow in that case being too rapid to allow of the deposit of the heavier particles. As an example of an opposite character, we may take the Lodge Farm, at Barking, where subsidence tanks are not required, the sewage being conveyed for several miles in the Metropolitan main sewers. During its journey it not only deposits many of its heavier constituents, but some of them become dissolved and churned up in the general mass of fluid. At the occurrence of a considerable rainfall the sewage at Barking always comes over muddier and stronger than at other times, plainly showing that the violent rush of water carries along with it in suspension the heavier particles deposited upon the bottom and sides of the sewers during the ordinary flow.

Having defined the meaning of the term "town sewage," the next step is to ascertain its exact composition and the chemical constituents it possesses. These will vary with the habits of different populations accordingly as wealth or poverty predominate; with the character of the refuse, the rate of the water supply per head, the nature of the soil, the rainfall, and the materials of which the roads and streets are formed. Among the valuable constituents of town sewage the principal are, firstly, nitrogen, which exists partly in the form of ammonia and partly as organic matter; secondly, potash; thirdly, phosphoric acid and phosphates; fourthly, organic matter, which is found in two conditions, one soluble and the other insoluble, the latter remaining in a state of mechanical suspension. In one gallon of average sewage the proportions of the above ingredients are, in grains—nitrogen, 6·7; phosphoric acid, 1·8; potash, 1·1; and organic matter, 30. The total quantity of solid matter in one gallon varies considerably. Taking an average of numerous analyses I have found it to be 131·88 grains; but the only reliable method of ascertaining the composition of any particular specimen of sewage, or, in fact, of any manure, is to have it specially analyzed, which can now be done by competent chemists at a very moderate charge. Notwithstanding that the composition of sewage is dependent upon so many fortuitous circumstances, yet it may be accepted with perfect safety that there is no description of town sewage that cannot be profitably applied to land so far as the land itself is concerned. This has been satisfactorily ascertained in the case of the Manchester sewage, which is nearly as black as ink in colour. The question of the application of sewage proving profitable in a pecuniary sense depends altogether upon the proportion which the necessary outlay and working expenses bear to the result obtained. A capital that would insure a good return upon works laid out to sewage 500 acres would be totally unremunerative if expended upon 80 or 90 only. As sewage contains a sufficient amount of ingredients to render it a valuable fertilizer for any crop its commercial value is an item of great importance. Without entering into the details of the facts and experiments undertaken at different times to determine the exact commercial or market value of town sewage, it will be sufficient to state that the average of ten different estimates made by the first authorities makes it equal to 1·48d., or a fraction less than a 1½d. per ton, which for all practical purposes may be safely quoted as its value. It must be borne in mind that this represents the value of the fertilizing constituents in town sewage compared with guano, which is assumed as the standard, and which has been taken in the above estimate to be worth £12 per ton. Experiments have proved beyond a doubt that town sewage could be profitably applied by the farmer if it were worth only ½d. per ton, instead of three times that amount. Another method of estimating the value of sewage, which is a more convenient one for calculation, is to rate it at so much a head of the population. The sewage commissioners arrived at the conclusion that the standard value was fairly represented at 8s. 4d. per head, and there is no doubt but this might be correctly assumed as the basis for calculating the returns likely to be realized by the application of town sewage to agricultural purposes. The highest value at which it had been estimated at per head is 16s. and the lowest 6s.

As it is from the example of the past that we regulate the present and provide for the future, I cannot do better than briefly to direct your attention to what has been already accomplished by the application of sewage to general farm crops. Edinburgh, by reason of the length of time during which sewage irrigation has been carried on there, has a prescriptive right to priority, more particularly as the results obtained, in comparison with those at other places, present the greatest pecuniary value. A large tract of land, consisting of almost pure sea sand, hardly worth 2s. 6d. an acre, has been converted, by the application of town sewage in large quantities, into fertile fields worth £40 per acre. Five crops of grass are cut annually, averaging forty-seven tons to the acre, and selling for a price so high as £40 occasionally, but yielding a fair average of £27. At South Norwood the greatest crop of Italian rye grass ever obtained was sixty tons to the acre, and last year the average was fifty tons. Croydon is always quoted, as it justly deserves to be, as a most successful instance of sewage irrigation, although, at the same time, it possesses many advantages with respect to site and the natural levels of the ground not always to be met with in other districts. The average number of cuttings is four, and the produce of meadow grass is equal to about thirty tons per acre, which sells for £25. The rye grass yields thirty-five tons to the acre, and sells for £30. These returns, heavy as they are, have been surpassed by those realized at Lodge Farm, Barking, where the heaviest crop obtained in one year from one acre of rye grass was sixty-one tons. The greatest number of cuttings, I was informed by the manager, was eight, and the average six. As an example of the extraordinary rapidity of the growth of the plant, it may be mentioned that a height of 30in. was grown in as many days. The grass is sold on the ground at the rate of £1 per ton. In the neighbourhood of Chelmsford, where the quantity of sewage is very limited, and the land much subject to flooding, six cuttings of rye grass were obtained per acre, weighing nearly fifty tons. The sewage works at Bury have been scarcely a year in operation, but ten and a-half tons of rye grass was the yield per acre of the first crop cut. The Edinburgh meadows, which have been irrigated with sewage, in one way or another, for a couple of centuries, are a proof that the continuous application of it to land is not injurious to its productive powers, more especially when the deposit accumulated during the whole of that period has not amounted to more than half an inch in thickness. There is an enormous waste incurred in the application of the sewage at Edinburgh, chiefly owing to the fact that there is a superabundant supply and nothing to pay for it. Instead of being injured and deteriorated land improves in its productive qualities by successive annual treatment with sewage. This has been proved by the results obtained both at Barking and Worthing. The crop of rye grass, cut at the latter place during the first year of the application of sewage, yielded barely twenty tons to the acre, while those of last year produced nearly fifty tons. These facts should be borne in mind by the farmer, and while, on the one hand, they should warn him not to anticipate too large a return for the first year or two, they should, on the other hand, prevent him from being discouraged or disappointed, and so deterred from giving the application of sewage a fair trial.

(To be continued.)

* Paper read before a meeting of the Farmers' Club at Maidstone May 28.

THE number of Cornish pumping-engines reported for April is twenty-two. They have consumed 1,493 tons of coals, and lifted 114 million tons of water 10fms. high. The average duty of the whole is, therefore, 51,700,000lb. lifted 1ft. high, by the consumption of 112lb. of coal.

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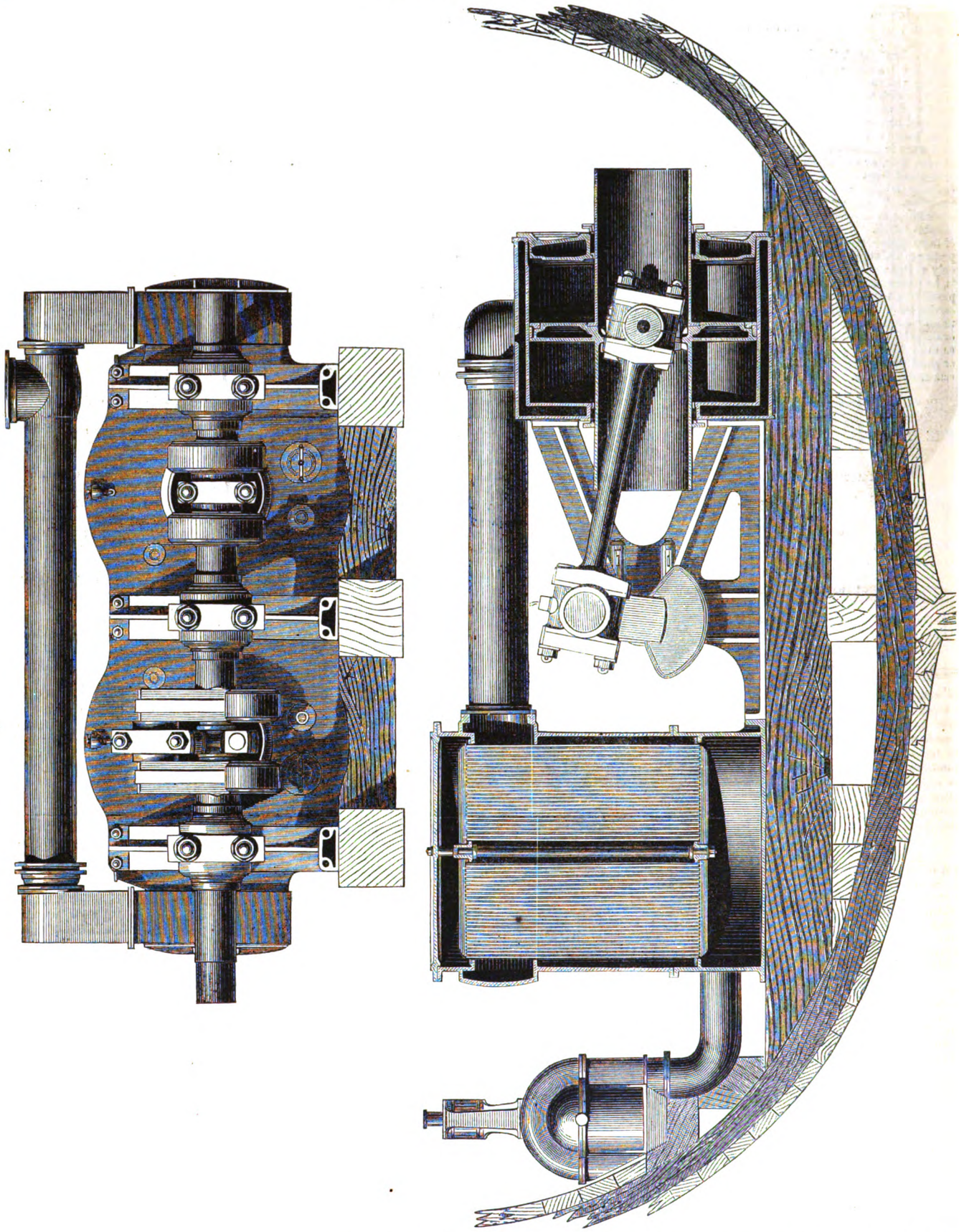
ENGINES OF H.M. SLOOP OF WAR "SAPPHO."

BY MESSRS. PENN AND SONS.



ENGINES OF H.M. SLOOP OF WAR "SAPPHO."

THE "Sappho," as our readers are aware, is a wooden unarmoured ship built from the designs of the Chief Constructor of the Navy. She is 212ft. long, 36ft. beam, and 1268 tons burden. The engines, which we illustrate above, are of 350-horse power nominal, and are intended to work up to about 2000-horse power indicated, when steam is cut off at one-third of the stroke. The principal dimensions are as follows:—Diameter of cylinder, 70in.; ditto of trunk, 30in.; effective area of piston, 3142·04sq. in.; length of stroke, 3ft.; diameter of air pumps, 17½in.; length of stroke, 3ft.—that of the main pistons; diameter of feed pumps, 4in.; number of tubes in surface condensers, 4776; diameter outside, 3¾in.; length, 6ft.; position vertical; shape of condenser, cylindrical; tube surface in condenser 5626sq. ft.; the tube joints are made with compressed wood ferrules. Heating surface, in boilers, 5718sq. ft. The "Sappho" has four boilers and sixteen furnaces. The grates 6ft. by 3ft., giving 288ft. of area. The boilers have in all 1120 tubes, 3in. diameter and 6ft. 6in. long. The boilers are fitted with superheaters, the tubes in which are 5in. diameter, 2ft. 3in. long, and 324 in number, giving a collective area of 954sq. ft. The screw will be 15ft. in diameter.

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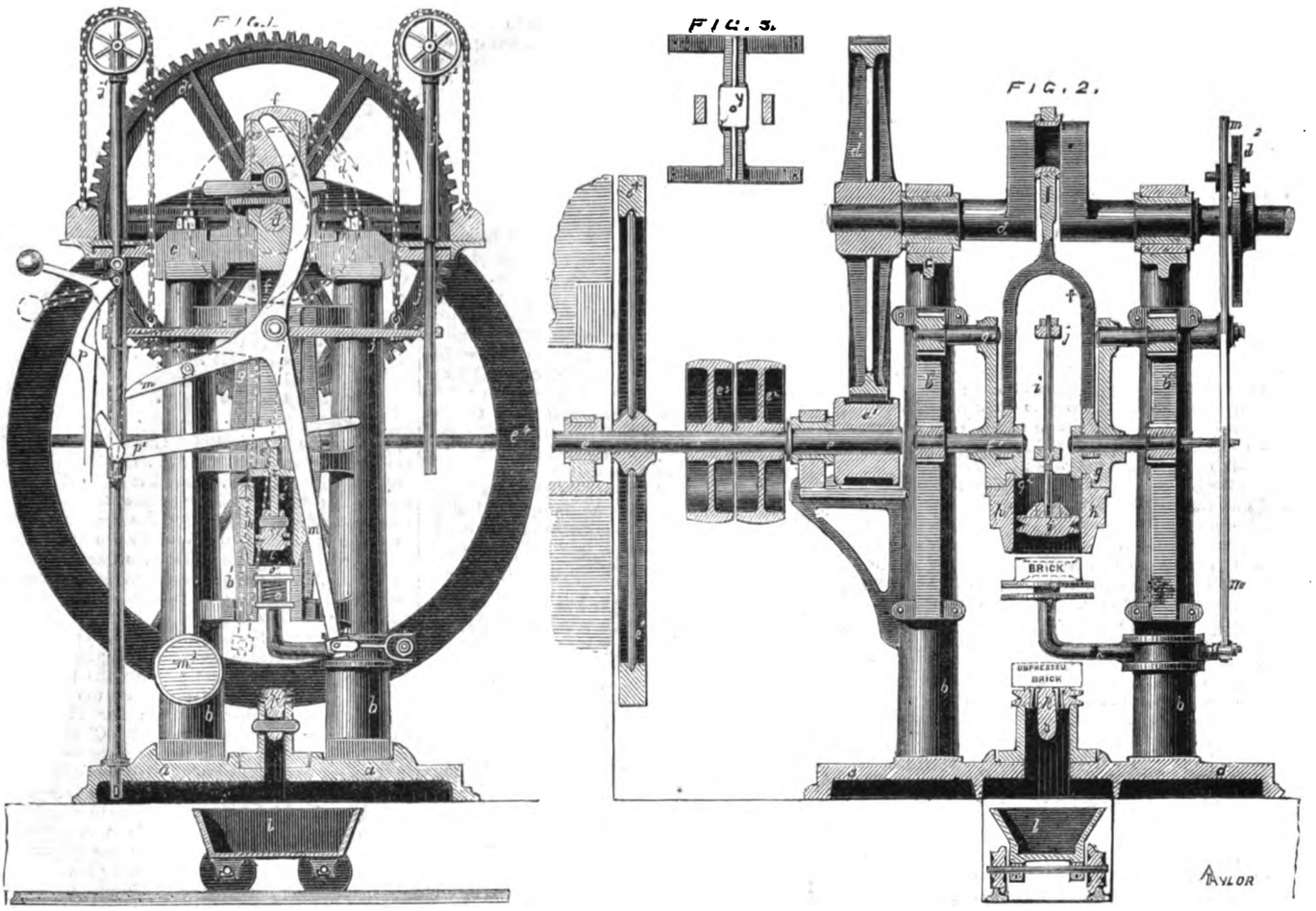
IMPROVED BRICKMOULDING MACHINE.

BY MR. S. JOHNSON.



The water is circulated through the condensers by a pair of centrifugal pumps, 22in. diameter, driven by separate engines. These pumps can be made to draw from the bilge when necessary. The cut-off is effected by Mr. Penn's well-known separate cut-off worked by a third eccentric. The main valves are worked by the usual link motion, the link being suspended by the middle. The proportions of these engines are excessively light, the whole weight being but 74 tons.

BRICKMOULDING MACHINE.

MR. S. JOHNSON, of Crook, near Darlington, has recently patented the brickmoulding machine shown in the accompanying engraving. It is a combined machine for the several purposes of moulding, perforating, and pressing bricks, and for removing them when pressed from the machine. In our engraving, fig. 1 is an elevation partly in section of this machine, fig. 2 being a sectional side view. It consists of a cast-iron bed-plate *a* on which are erected the four columns *b b* supporting a cast-iron framing *c* upon which are fixed the bearings of the crank shaft *d*. To one end of the crank shaft is keyed the spur wheel d^1 which is driven by the pinion e^1 fixed on the driving shaft *e*, which is provided with a fast and loose pulley e^2 and e^3 and with a fly-wheel e^4. The space between two of the arms of the spur wheel d^1 is provided with a weight to counterbalance the crank and moulding box. To the crank shaft *d* is jointed the upper end of the connecting rod *f*, the lower end of which is forked and jointed to the studs f^1, passing through the yoke or frame *g* to which the moulding box *h* is fixed. To the upper ends of the yoke *g* are fixed the studs g^1, and all the studs f^1 and g^1 are provided with blocks which work up and down in slides b^1 supported by the columns *b*.

Within the moulding box *h* is the top piston *i* which is moved up and down by the moulding box in the following manner:—To the piston *i* is fixed the piston rod i^1 fixed above to the crosshead *j* which is guided by the pillars j^1 fixed in the framing *c*; the upper ends of the pillars j^1 support the pulleys j^2, around which pass chains, one end of each of which is fixed to the crosshead *j*, and to the other end is fixed a weight to counterbalance the piston *i*. Immediately underneath the top piston *i* and moulding box *h* is the iron block or lower piston *k*, having one or more holes through it to allow the surplus clay or other substance to escape into the carriage *l* which runs on rails placed in a channel under the bedplate *a*.

The mechanism for removing the finished bricks consists of the following parts:—*m* is a three-armed lever mounted on a stud fixed to a bracket connecting two of the columns *b*; the curved upper arm of this lever is acted upon by a cranked pin projecting from the disc d^2 fixed on the crank shaft *d*, and the lower arm of the lever *m* is connected by means of a universal joint to the arm *n*, which swivels on one of columns *b*. To the arm *n* is fixed the pallet rest *o*, on which a loose pallet o^1 is placed; the finished brick is deposited on the pallet o^1. Between the pallet o^1 and the plate of the arm *n* is a spiral or other spring to allow the pallet to yield when the brick is delivered from the mould. To the horizontal arm of the lever *m* is suspended the weight m^1, the object of which is to bring the pallet o^1 back after the brick has been removed. This arm is held up by the catch *p* which is liberated when required by a prolongation of one of the studs f^1 acting on the lever p^1. The dotted lines in fig. 1 represent the position of the catch *p* and lever *m* when the pallet o^1 is held to one side.

The mode of operation is as follows:—The compressed brick is now supposed to have been deposited on the pallet rest *o* or on a loose pallet placed thereon, and the stud in the disc d^2 is going to act on the lever *m* to move the pallet and the brick on it to one side, while the pallet is moving to one side a piece of clay or other material of suitable stiffness and size, or a hand-made or impressed brick, is placed upon the block *k*, and the moulding box *h* and piston *i* are brought down upon it, the pressure being given by the crank *d*, and the final compression by the crank turning over its lower centre. The excess of clay escapes through the holes in the block *k* or through holes in the piston *i*, and the usual recesses in the upper and lower beds of the brick are produced by projections on the piston *i* and block *k*. Any device or ornament may be produced in the same manner, and if perforations are required in the bricks or other articles the perforators are attached to the piston or the block. When the compression is being given to the brick, the piston *i* is pressed down by the shoulders g^2 of the yoke *g*, and when the moulding box is rising the counterweights attached to the chains passing over the pulleys j^2 prevent the brick from at once being forced out of the moulding box by the weight of the piston *i*, but when the moulding box has risen to a height convenient for the brick being received on to the pallet, then the brick is thrust out by means of the piston *i* being prevented rising further by the crossbar *x* on the piston rod, which at a convenient height comes against the under side of the crossbridge *y*, shown detached in fig. 3, fixed to the columns *b b*, and forces the brick out of the moulding box while ascending, the moulding box being thus drawn away from the brick until the brick is fully delivered out.

As soon as the moulding box has arrived near the top the stud f^1 raises the long arm of the lever p^1, the short arm of which then forces back the catch *p* and liberates the arm of the lever *m*, which instantly drops and brings the pallet o^1 under the moulding box *h* to receive the brick, as shown in fig. 2. The moulding box *h* is made as deep as is practically convenient in order that the ends and sides of the brick may be smoothed and perfected after compression as it is being thrust out or as the moulding box is being drawn away from it. In some cases it is preferable to leave the compressed brick or other article on the lower piston block *k*, and to remove it by hand or otherwise. This may be accomplished by dispensing with the counterweights connected to the upper piston *i*, or by other means as practice may dictate, and according to the stiffness of the clay or other substance under operation. We may add that this machine is in use at the works of Messrs. Pease and Co., of Crook, where it is giving every satisfaction.

THE METRIC SYSTEM BILL.

AT a meeting of the Council of the British Branch of the International Decimal Association, Earl Fortesque, President, in the chair, the result of the recent discussions on the Weights and Measures (Metric System) Bill, brought in by Mr. Ewart, Mr. Bazley, Mr. Baines, Mr. J. B. Smith, and Mr. Graves, was reported as quite in accordance with former decisions of the House. The second reading of the Compulsory Bill was carried in 1863 by a majority of 110 to 75. majority, 35; the second reading of the Permissive Bill in 1864 was carried by 90 to 52, majority 38; and the second reading of the Compulsory Bill in 1864 was carried by 217 to 65, majority 152. Whereupon, on the motion of Sir J. Bowring, seconded by Mr. Yates, it was resolved as follows:—The Council have seen with great satisfaction the affirmation of the principle of the introduction of the metric system in this country by the passing of Mr. Ewart's bill by so large a majority of the House of Commons."

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THE IMPROVEMENT OF THE PATENT OFFICE.

A DEPUTATION, composed of the following gentlemen, waited upon the Right Hon. B. Disraeli, on Thursday, the 21st ult., in reference to the carrying out of improvements at the Patent Office:—Mr. Dillwyn, M.P.; Mr. Laird, M.P.; Mr. Horsfall, M.P.; the Hon. A. F. Kinnaird, M.P.; Mr. Graves, M.P.; Mr. Gregory, President of the Institution of Civil Engineers; Sir C. Fox, member of the Institution of Civil Engineers; Mr. E. Woods, member of the Institution of Civil Engineers; Mr. Siemens, F.R.S., member of the Institution of Civil Engineers, and member of council of the Institution of Mechanical Engineers; Mr. Heywood, late M.P. for Manchester; Mr. Mallet, F.R.S., member of the Institution of Civil Engineers; Mr. E. A. Cowper, member of council Institution of Mechanical Engineers, and member of Institution of Civil Engineers; and Mr. C. E. Amos, member of Institutions of Mechanical and Civil Engineers.

Mr. Dillwyn, M.P., introduced the deputation, and observed that their object was to bring before the Government a knowledge of the great inconvenience and expense, both in time and money, necessarily incurred by those who wished to take out patents, and by the public in general, who wished to ascertain what was new and what was old in the history of invention. The loss of time and uncertainty arose in great measure from the want of proper subject-matter indices, containing very short abstracts, to act as keys to the subject of the patents, no complete examination of the specifications ever having been made for the purpose. It was, therefore, impossible to ascertain with any certainty whether an invention was new or old. It frequently happened that when it was of importance to know whether a given invention was new or old, as much as £50 or £60, or more, had to be expended in order to make a search at the Patent Office, as numbers of specifications were not under their proper headings. This and other defects at the Patent Office had been so strongly felt by engineers and others that they had taken the matter up on the part of the public, feeling that great injury was done, by the want of a full and perfect knowledge of numerous highly useful inventions and processes, described in the specifications, both foreign and English. They had, therefore, requested him to act in the matter, he having been chairman of a select committee of the House of Commons appointed to consider the arrangements of the Patent Office, some years ago. The deputation had already laid the case before Lord Romilly (the only permanent Commissioner of Patents), who admitted the justice of the claims, and after consultation with the Lord Chancellor (Lord Cairns), their lordships admitted that something was required to be done, and promptly, and signified their willingness to recommend the appointment of three additional Commissioners of Patents, to be chosen from practically scientific institutions, one gentleman to be a mechanical engineer, one a chemist, and one to represent science generally. These appointments would involve some expense, though the greatest expense would be incurred in securing proper and sufficient subject-matter indices of English and foreign inventions, printing catalogues of the excellent scientific and technical library and of foreign scientific books and periodicals, &c., collected with great labour by Mr. Bennet Woodcroft, the very painstaking clerk to the Commissioners. Lord Cairns and Lord Romilly had requested the deputation to wait upon him (the Right Hon. B. Disraeli), inasmuch as some expense would be incurred; it was considered that inventors had some claims, as they did not ask for anything out of the public purse, but simply for some portion of the gross sum of £120,000 a-year (now paid in fees and stamps), to be spent in perfecting the office. The expenses of the Patent Office were about £50,000 a year, leaving a balance of about £70,000 in favour of the Exchequer; and viewing the large annual expenditure for art and science, School of Mines, naval architecture, meteorology, South Kensington Museum, &c., it was thought that the persons who paid such a large annual sum into the Exchequer had some claims for the Patent Office to be made thoroughly useful to the public, and as the Lord Chancellor and Lord Romilly recommended the appointment of the three new practical Commissioners of Patents, the deputation trusted that the First Lord of the Treasury would sanction such expenditure as might be necessary to give the public the full benefit of the 60,000 inventions stored at the Patent Office. He begged to hand in a copy of the Act and various other documents relating to the subject. Other honourable members would have attended, but were engaged on committees at the House. He would call on Mr. Gregory to give any further information.

Mr. Gregory confirmed the statement already made, and would add that if anything it was rather against the interests of civil engineers to promote such improvements as had been named, but trusted Her Majesty's Government would be disposed to carry them out on public grounds. No doubt the theory was that the Patent Office should pay a certain amount to revenue and the expense of making inventions patent, or open to the public, so that a person could easily ascertain what was new and what was old, or had been published before in some way; this was not now done. There was an accumulation from the profits of the Patent Office of £340,000 over and above that intended as revenue, and there was an annual surplus of £54,000, exclusive of that called revenue. Now, the deputation humbly submitted that a sum of £30,000 might be appropriated out of the accumulation of £340,000 in order to properly examine, abstract, and index the 60,000 specifications which are in arrear, and that a further sum of £10,000 a-year might be appropriated for a proper staff in the Patent Office and to accomplish all that is necessary, still having the very large sum of £44,000 per annum beyond the profits called revenue.

Sir Charles Fox observed that he quite agreed with the last two speakers; the difficulties in the way of ascertaining whether an invention had or had not been patented were at present insurmountable without proper indices, and he thought it most important that such a state of things should be put an end to.

Mr. Horsfall, M.P., said that whatever difference of opinion there might be about the Patent Laws, all agreed in this, that the Patent Office ought to be carried on efficiently.

The Right Hon. B. Disraeli observed that the subject was one of the very greatest importance, and at one time he had taken considerable interest in it; he had hoped that the committee of the House of Commons would have brought about a solution of many difficulties connected with the whole system. Unfortunately, that had not been the case. It was a matter, no doubt, involved in many difficulties, but he thought there could be no doubt (and he had never had any doubt) of the expediency of good indices. Whenever a good system of indices was followed out, no doubt, as far as it went, it was a safe principle, and although persons might, even with good indices, lose a good deal of time, yet the chances were immensely in their favour. The representation of such a deputation as that before him, consisting of men of eminence and experience, would have due weight with the Government and they might rely upon the Government taking the matter into their consideration.

ON CERTAIN POINTS IN THE MANUFACTURE OF MALLEABLE IRON, WITH SPECIAL REFERENCE TO THE RICHARDSON PROCESS.

By Mr. St. John Vincent Day, C.E.

(Concluded from page 416).

I MAY call attention to one analysis of Scotch black-band ironstone, which we may safely take as a very fair mean representative of the productions of this country—it is from Gartsherrie, and my authority for it is a report made to the Prussian Government, by M. A. Erbeich. In the raw state it gives phosphoric acid (Po^5) 0·90, which corresponds to rather above 0·5 per cent. of phosphorus in the pig iron, but we may with safety take it at 0·5 per cent. for the sake of avoiding error in excess. Some samples of Scotch pig iron give sulphur and phosphorus in other proportions: for instance, some No. 3 grey coke iron from the Calder Ironworks contained sulphur 0·35 and phosphorus 0·39, and another specimen from Clyde contained sulphur 0·40 and phosphorus 1·30; the former of these is probably a fair mean representative of the quantities of sulphur and phosphorus combined in irons from the Scotch coal measures, whilst the latter is no doubt an extreme; taking, however, the mean of these three, we get—

Sulphur	0·375
Phosphorus	0·73

From the appended tables we have the values of British pig irons in regard to phosphorus represented in the following scale of ascending values of the quantity of that element by their mean of means:—

	Phosphorus per cent.
Hæmatites (various)	0·144
South Wales	0·473
Staffordshire (South)	0·48
Yorkshire	0·54
Scotland	0·73
Derbyshire	0·865
Staffordshire (North)	1·07
Northamptonshire	1·143
Cleveland	1·32

On the other hand, taking the mean of means of sulphur, we get the following order of ascending values in respect of the quantity of this element contained in the ores of different localities of Great Britain:—

	Sulphur per cent.
Cleveland	0·035
North Staffordshire	0·04
Derbyshire	0·0447
Yorkshire	0·052
Whitehaven (Ulverstone)	0·056
South Staffordshire	0·0614
South Wales	0·098
Northamptonshire	0·267
Scotland	0·283

Now, since the effect of combined sulphur is to prolong the time of melting, and phosphorus, on the other hand, diminishes that period, comparisons like those we have made are extremely useful in indicating the other chemical conditions in addition to those produced by the presence of carbon and silicon, that affect the duration of the period of melting of pig irons made in different localities. I am now of course speaking independently of the construction of the furnace, for this modifies the time of melting to a considerable extent, a high bridge and great depth of hearth tending to drive off and prevent the tips of the reverberated flame from attacking the charge so easily as in a furnace with a low bridge and shallow hearth. In the case of the Cleveland ore, we see at a glance that in the phosphorus series it is the very last, whilst singularly enough in the sulphur series it takes the first place; this theory shows it should be a very fast melting pig iron. In the case of North Staffordshire it is second in the sulphur series and seventh in the phosphorus series, the presence of sulphur being low and that of phosphorus very high, it should be a very fast melting iron. In the case of Derbyshire the phosphorus is much lower than in the preceding, and the sulphur but very slightly increased, it therefore should take a little longer in melting than the North Staffordshire pigs. In the case of Yorkshire the sulphur is increased and the phosphorus diminished, the time of melting should be longer still.

By making comparisons like the foregoing we obtain the period of melting of British pig irons in terms of the combined sulphur and phosphorus in the following order:—

Cleveland,
North Staffordshire,
Derbyshire,
Yorkshire,
Northamptonshire,
Whitehaven, Ulverstone (Hæmatite),
South Staffordshire,
South Wales,
Scotland.

Here we see the order is nearly the same as in the sulphur series, the exception being in the case of Northamptonshire pig, where the percentage of phosphorus is so very high that it predominates over the sulphur, and, therefore, materially shortens the period of melting. If these conclusions which I have deduced are compared with practical results they will, I believe, be found to very fairly coincide. In the case of Scottish irons these should take longer to melt than any others present in this country, and from the number of trials at different works that have been made on this point such deduction will, I believe, strictly correspond with the practical results.

We have now to consider the extent to which phosphorus and sulphur are removed in the ordinary process of puddling. On this point I have not had time to prepare tables, as in the case of pig iron, but it is my intention to do so on the earliest opportunity, as their value is evident enough to any one whose pursuits are directed towards improving the metallurgy of iron and steel. On the present occasion, then, I shall, to shorten the time I am occupying, merely bring forward analyses from the very best makes of malleable iron I have met with, some of these being taken from Dr. Percy's excellent work on "Iron

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and Steel." An armour plate made at Lowmoor was found to contain 0·104 per cent. of sulphur, and 0·106 per cent. of phosphorus; now, as we have before seen, the mean values for Yorkshire pig iron are—

Sulphur	0·052
Phosphorus	0·549

in which case, either in the puddling or re-heating furnace, but most probably in the former, the sulphur is doubled, but the phosphorus diminished by the very great amount of ·433 per cent. This, however, being an armour plate, is a special case, and it is highly probable that a portion of better pig iron was mixed with the Yorkshire pigs ordinarily used at Lowmoor. The sulphur is considerably increased; it may possibly have been added from the fuel. In several other specimens of armour plates we find sulphur existing in the following percentages:—

Sulphur, 0·058, 0·121, 0·190, 0·118, ·058, 0·104.

And phosphorus in the following:—

Phosphorus, 0·030, 0·173, 0·020, 0·228, 0·089, 0·106.

In regard to the sulphur, it is higher in the examined plates than in all the different qualities of British pig iron except two, namely, Northamptonshire and Scotch, and since it is not in the least likely that either of these pigs were used in producing the plates, we may infer that sulphur has been added to the iron during its conversion and working into the malleable state, whilst the phosphorus is eliminated in every case to a very large extent, bringing its percentage considerably lower than in any known analysis of British pig iron. Comparing again malleable iron of South Staffordshire with the pig we have for the former:—

Sulphur	0·165
Phosphorus	0·140

Here also the sulphur is increased and the phosphorus diminished to a very considerable extent, and the same result obtains generally with any other comparisons that we may make. We are, therefore, led to infer that during the conversion of pig into malleable iron, sulphur is added to the iron from the fuel whilst the phosphorus is eliminated in a very large ratio. Of course, in considering the increase that takes place, we must bear in mind that the percentage in malleable iron is greater in proportion to the absolute amount of iron itself present than obtains in the pig iron, for the reason that in the latter case the carbon and silicon are present, whereas in the former they are nearly eliminated.

Comparing the foregoing results with analyses of iron made by the Richardson process, the superior eliminating power of that process is forcibly striking. In the analyzed samples of the iron made at the Glasgow Ironworks by that process, as I have before stated for the experiments, common Scotch pigs were used, and yet from that material we have obtained finished bar iron purer than anything that has ever heretofore been manufactured from British ores, and that, too, from pig irons which contain the highest percentage of sulphur, and rather above a medium of phosphorus; indeed, the removal of these two elements is so nearly complete, that, practically, they are not found. There can be no doubt remaining that the Richardson process has effected what has never before been done in Great Britain; by it we are enabled to produce a better and purer iron from the commonest pigs than we can yet depend on obtaining continuously by the common process of puddling from the best pigs. We can save a third of the time hitherto occupied in puddling, get a higher yield, save fuel, and, therefore, cheapen the production of malleable iron.

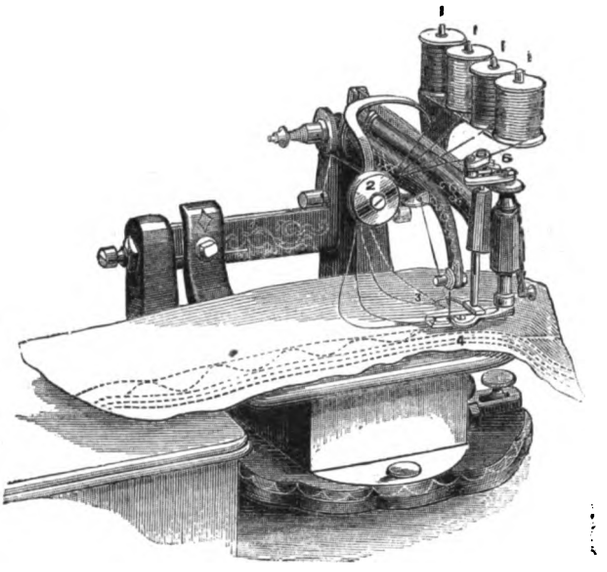
For the last two or three months there have been several furnaces making iron by this process at Parkhead; I have a large number of the returns as to the time of puddling a charge, besides a large number of results which I have noted myself from watching the conduct of the process on several occasions; these, however, I have not had sufficient time to tabulate, but I may state that the time from the moment of charging to taking out the balls varies from 1hr. 15min. to 1hr. 30min., whilst in another experiment that we made, having previously "fettled" the furnace very heavily all round, both the bridge, sides, and flue, the heat was out in 1hr. 20min.; this, without the fettling, would correspond to about 1hr. 10min., a remarkably short time, when we remember that at this forge, where very grey pig iron is principally used, the amount of time usually occupied for puddling by the old method is 1hr. 45min., and very often 2hr. The period of melting in the case of such pig iron is very high; I have on several occasions noted it, and find it to vary between 35min. and 50min.; this is doubtless due in a great measure to the high percentage of combined sulphur, and very probably to some extent depending upon the large proportion of silicon contained in it, as well as the hæmatite, a small portion of which enters into the mixture. Out of the hundreds of bars that have now been made in this manner at Parkhead, from the "common mixtures," too, it is particularly important to remark that not a single bad bar has been met with. The iron works better under the shingling hammer as well as the rolls. In the puddled bars after they have passed through the mill and are cooled, their appearance externally is frequently as smooth and even as good finished merchant bars, whilst the fracture shows the perfect regularity of the metal. With puddled bars of the same mixtures made in the ordinary manner, when cold and worked to the same extent they are much more full of flaws and fissures, gaping wide open at the surface, and the fractures always show much want of uniformity, while the microscope usually reveals the presence of a great deal of graphitic carbon. Puddled bars from the common mixtures will not usually bend through a greater angle than 40deg., without cracking right across; some of them break off quite cold-short before having reached that angle, whilst the best bars of such mixtures rarely if ever bend 45deg., and usually break in half before reaching that extent of flexure; but with bars made by the "Richardson process," out of precisely the same materials, I have seen them, I may with certainty say, on most occasions bend completely round to 90deg. without breaking, frequently without showing a surface crack, and some specimens that have been tried were doubled up without effecting a complete fracture. Altogether, the advantages of working by this process are so great as to require no further comment from me.

Since writing the foregoing it has occurred to me that I should mention the now well-ascertained fact that in the puddling furnace some of the phosphorus passes from the charge into the cinder, but by no means the whole of it. This circumstance led Dr. Percy to propound his theory that still more of that element existing in the charge as phosphide of iron, was liquated or sweated out after the metal was balled. If there be any truth in this supposition, it appears to be confirmed by the results of the mode of working to which I have now called your attention. The balling process is of longer duration, as I have already explained; therefore, greater time is afforded for this supposed liquation of the phosphide. I merely throw this out as a hint; it is rather soon yet to attempt to form a conclusive theory. That phosphorus is not got rid of by oxidation in combination with iron is certain, or it would unquestionably be eliminated in the Bessemer converter, every means hitherto tried having utterly failed to remove it.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending May 30, was 2,268; total number since the opening of the museum, free daily (May 12, 1858), 1,302,811.

THE BELGRAVIA SEWING MACHINE.

BY MR. J. MABSON.



THE ADJUSTABLE BELGRAVIA SEWING MACHINE.

AS promised last week, we now proceed to give further particulars of the sewing machine exhibited at the conversazione of the Institution of Civil Engineers, by Mr. Mabson, of 20, High Holborn. This apparatus has been made very perfect by Mr. Mabson, who has very properly named it the "Adjustable," inasmuch as it can be adjusted to make any known stitch. It makes the Wheeler and Wilson lock-stitch, the Wilcox and Gibbs stitch, the Grover and Baker stitch, the pearl stitch, the cable stitch, and, finally, the embroidery stitch on the right or upper side of the cloth. The arrangement by which this latter stitch is made forms the subject of the annexed engraving. It is the embroiderer, and consists of a simple apparatus made to open and close in a similar manner to a pair of callipers. The fixed arm of the machine has a bracketed plate for carrying the required number of reels of cord 1 1, of various colours. The cords are led over a roller 2, down through eyes on the ends 3 4 of the calliper-like apparatus. This apparatus opens by means of a vertical rod actuated by the working parts of the machine, and is closed by an india-rubber band. The forks of the apparatus, which are curved, are made to cross every alternate movement, by which means the embroidery cords are made to cross and recross each other, each crossing being secured by the needle thread. By the arrangement of the colours and thicknesses of the cords, every variety of pattern and design may be worked. This is perhaps the most important of Mr. Mabson's improvements, and renders the sewing machine a complete apparatus. It performs the work on the upper surface of the material, and in sight of the operator, thus overcoming a hitherto insuperable difficulty.

SURVEYS OF JERUSALEM AND SINAI.

COLONEL SIR HENRY JAMES, Director-General of the Ordnance Survey, reports that the expense incurred by publishing the survey of Jerusalem will soon be more than covered by the profits arising from the sale of copies. The demand, especially for the photographs, has been so great that it has been difficult to meet it during the winter months, when very few photographs can be taken. The survey of Jerusalem having given so much satisfaction to the public, the Rev. Pierce Butler, of Ulcombe Rectory, Kent, proposed that a survey of Mount Sinai and of a considerable portion, if not the whole peninsula, of Sinai should be made under the direction of Sir H. James, with a view to identify the route taken by the Israelites, and the places mentioned in the Bible. Mr. Butler had obtained the sanction of the Secretary of State for War to the undertaking, and had issued circulars which brought subscriptions from several noblemen and gentlemen desirous of seeing this survey made, and he had paid for his passage to Alexandria, with the intention of proceeding to Cairo and Suez for the purpose of making prelimi-

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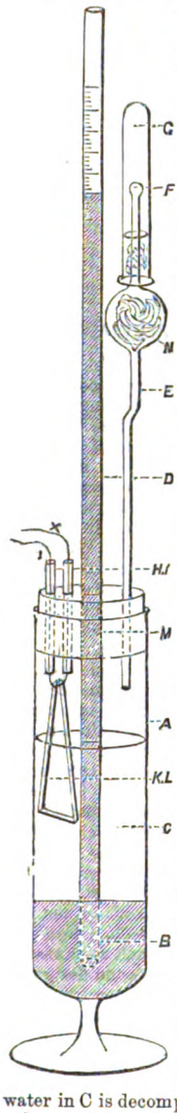
nary arrangements for the expedition, when he was suddenly taken ill and died in February, on the very day he was to have left England. He was a man well qualified for the task he was about to undertake.

A NEW FORM OF VOLTAMETER AND VOLTASTAT.

BY DR. F. GUTHRIE, F.R.S.E.

THE apparatus illustrated in the accompanying engraving was exhibited by Dr. Guthrie, at the recent conversazione of the Institution of Civil Engineers. This instrument may be advantageously used when a galvanic current of great constancy is required for a considerable time. When interposed in a circuit it allows a certain quantity of the current to pass, and it measures the amount which passes. Its construction and use are the following:



—A is a wide test-tube on a foot. B is mercury. C is dilute sulphuric acid. D is a long tube, open at both ends, passing through the cork M, and dipping under the mercury. E is a tube passing through the cork, and open below; it carries a bulb N, containing fragments of linen. The upper end is closed, with the exception of a microscopic opening F. H and I are the electrode wires, protected by glass tubes where they pass through the cork. K and L are platinum electrodes, in the shape of narrow strips of foil converging towards the top, and kept apart at top and bottom by strips of glass fused on to the platinum. G is a little test-tube, which serves to protect the end of the tube E from dust. It is separated from E by fragments of linen.

The only point requiring particular attention is the formation of the capillary opening F. This opening is best made by blowing a little bulb at the end of the tube, bursting a little hole in this before the blowpipe, and allowing the whole to collapse while the air is continually injected. Several such tubes should be prepared. It is not difficult in this way to get an opening in D so extremely small as not to allow the mercury, when at the top of D, to fall in less than ten minutes or a quarter of an hour. The cork and top of the tube C are made perfectly air-tight by sealing-wax. On connecting H and I with the poles of a battery, the water in C is decomposed; the detonating gas can only escape by the opening F. The hindrance it meets with on account of the small size of F causes it to force the mercury up D. The effect of the rise of the mercury in D is twofold; it forces more gas through F, at the same time that it lays bare a part of the electrodes, leaving the active portions of them further apart. The quantity of gas produced is accordingly diminished. In other words, an increase in the strength of the current produces effects which diminish the strength of the current. The instrument is a regulator, which may be compared with the governor of a steam engine.

It is found that the mercury rises to a certain height in D, and remains nearly at that height for many hours. Since a certain height of the mercury in D corresponds to a certain pressure in the interior, and since the latter corresponds to a certain rate of delivery through F, it follows that the quantity of electricity passing through the instrument is directly measured by the height of the mercury. The actual relation between the height of the mercury and the electricity which passes may, of course, be measured either by interposing a galvanometer or actually measuring the quantity of gas evolved by fitting a gas-delivery tube over F, &c. Nevertheless, an exceeding gradual depression in D must occur even with a perfectly constant current, on account of the removal of a portion of the liquid C by electrolysis. For many purposes this is negligible, namely, when the instrument is used as voltastat. It is clear that, as a certain height in D corresponds to a certain activity, the amount of water lost from C in a given time is measured by the height in D. Hence, on knowing the relative diameters of D and A, and knowing the amount of water decomposed in a given time, a simple calculation serves to make the minute correction.

FRENCH IMPORTS.

DURING the first two months of the present year there were imported from the United Kingdom to France 2,775,925 kilogrammes of coal, 4,873 of coke, 10,220,817 of coal tar, 1,232,834 of coffee, and 33,000 of wheat. Cotton was imported from this country amounting in value to 17,494,768f., cutlery to 27,373f., fine stoneware to 66,884f., and fine porcelain to 26,744f. Steam engines, fixed and marine, to 900f., agricultural machines to 625,727f., and machine tools, &c., to 191,718f. There were also imported 28,668 kilogrammes of tools of pure steel, 3,247,618 of pig iron, and 25,141 of iron bars of all kinds; 8,239,621 kilogrammes of iron ore being imported from Belgium, and 12,421,632 from Algeria. Of cast-iron, 53,541 kilogrammes were sent from the United Kingdom, and 106,736 from Belgium. The total imports of copper were 1,247,021 kilogrammes; of lead, 980,568; of tin wares, 5,870; and of zinc, first fusion, 4,188,640 kilogrammes; all these metals being imported from the United Kingdom, Holland, Belgium, and Spain. Of raw silk 415,400 kilogrammes were imported, of thrown silk 154,600, of waste silk 376,500, and of silk thread 69,900 kilogrammes, most of these articles being sent from the United Kingdom. Of textile manufactures, there were imported from the United Kingdom 102,622 kilogrammes of calicoes, cambrics, and muslins, bleached and unbleached; 37,043 of cords, moleskins, &c.; plain net to the value of 174,647f.; plain unbleached linen, 24,592 kilogrammes; carpets amounting in value to 104,794f., cloths to 1,127,461f., mixed stuffs to 5,532,729f., alpaca, vigona, &c., to 332,569f., and tissues of cashmere manufactured by hand in countries out of Europe to 608,446f.

Legal Intelligence.

VICE-CHANCELLOR'S COURT.

June 2.

(Before Vice-Chancellor GIFFARD.)

THE ATTORNEY GENERAL *v.* LEONARD EDMUNDS.

JUDGMENT.

THE arguing of this case was resumed on Tuesday last, by Mr. Digby Seymour, Q.C., and Mr. J. N. Higgins, on behalf of Mr. Edmunds, and the Attorney-General on the part of the Crown. The case has been reported at such length in all the daily papers, that we need do no more than append the substance of the Vice-Chancellor's judgment. His Honour observed that he was happy to say the arguments and the evidence adduced on behalf of Mr. Edmunds had been successful in clearing his character from all imputation. They had satisfied him that the defendant's liability, whatever it might be, was a liability arising from mistake, and mistake under circumstances of very considerable difficulty, brought about in some respects because he could not obtain the audits which he asked for (his Honour thought) in 1834, and subsequently in 1852 or 1853, and brought about also by what was a most unfortunate Act of Parliament, which was passed with reference to a given state of circumstances, when, in point of fact, those circumstances changed very materially afterwards. Having made that preface, his Honour said he might add that it was not without regret that he had come to the conclusion that in other respects the arguments which had been adduced on behalf of the defendant were not successful. He did not doubt that the Court had jurisdiction in a case of this nature to decree accounts, and he must hold that the Crown was entitled to a decree for account. After reading the provisions of the Act of Parliament, which fixed the salaries of various offices, including that of clerk of patents, and provided that the salaries should be taken "in full satisfaction for the duties of the said offices, and of all expenses incident to the performance thereof," and that all fees and emoluments received in the said offices should be accounted for and paid, his Honour said that he much regretted that the words of the Act left him no alternative but to decide that the deductions claimed to be allowed by Mr. Edmunds could not be made. It appeared to him to be a case of great hardship on the defendant, but this was the letter of the Act. The salary was to cover all expenses. He must, therefore, decree the accounts sought by the information, viz., accounts of the fees and moneys received by the defendant in his said offices, but directing that all just allowances should be made, and all settled accounts be left undisturbed. Further, he must declare that the defendant must account for all profits made by moneys originating from, or emanating, originally or otherwise, from moneys drawn from the Patent Office, and declare that the defendant was not entitled to make the deduction of 12s. 10d. for parchment and engrossing. His Honour said it was with regret he found himself compelled by the terms of the Act of Parliament to make that last declaration. He repeated, as he had said at the outset, that he thought the defendant's evidence had removed any imputation that could be justly or fairly cast upon his character; and, having regard to all the circumstances, the very difficult position in which he was placed, and the fact of an audit being refused, he should certainly not make Mr. Edmunds pay any costs of the hearing of this cause.

Correspondence.

THE PRESENT CONDITION AND FUTURE PROSPECTS OF MACHINE MANUFACTURE IN RUSSIA.

TO THE EDITOR OF THE "MECHANICS' AAMGZNE."

SIR,—I beg to thank you for inserting my first letter on the above subject in your impression of April 9. In resuming the question, permit me first to correct a small typographical error, which, I fear, has been caused by my indistinctly forming some letters. The town from which I write is "Kharkoff," sometimes spelt Charkoff, and the railways to which I referred are the Koursk-Kharkoff and the Kharkoff-Taganrog.

In attempting to lay before your readers more fully some proofs of the feasibility of my scheme, it will be necessary to direct attention to two things—first, the work to be done; and, second, the place, that is, the part of the country most suitable for carrying on that work. Before beginning, however, to discuss either of those points, I wish to make a few remarks upon another subject so intimately connected with the main proposition that the same line of argument may serve in illustration of either or both of them. There may be some who think that it is not quite patriotic in me to propose a scheme whereby British capitalists and engineers would be required to emigrate to a foreign country for the purpose of carrying on manufactures. But there can be few who will be disposed to find fault with me, if I can point out some means of increasing the demand for English manufactures here. What I have to say on that point is this, that there is no branch of English manufacturing industry so badly represented in the south of Russia as that of machine making. I do not mean in quality of workmanship, but in what, for a commercial country like England, might be thought much easier to attain perfection in Plainly and simply, then, I think I may safely assert that in the whole south of Russia, between Moscow and Odessa on the one hand, and between Warsaw and Astrachan on the other, there is not one practical engineer engaged in the sale of English machinery, and few of any sort accredited direct from English firms as agents.

If these lines should happen to meet the eye of a gentleman connected with one of the—in this part of the world—best known English engineering firms, he will fully bear me out in my assertion. He travelled through the greater part of Russia, some years ago, purposely to gain information on this point, and will, most likely, recollect the conclusion he arrived at, and the strong expressions he used in a conversation with me on the subject in this town. The German manufacturers are not so careless in this respect, and the result is that they carry off many good orders which customers would willingly give to English houses. English machinery, so far as it is known here, bears a very good name, and users would, under most circumstances, willingly employ it. But in a country like this a customer requires something more than the mere act of selling him a machine. He requires advice in preparing for its reception and fixing, and in most cases assistance in adopting it to his purpose, as there are few here who enter into any line of business requiring machinery who have had any special education or practice in the adaptation of machinery to it. I could give

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many instances of the difficulty of getting at English machinery, but let two suffice; and these two will bear upon an important branch of my subject, namely, the supply of machinery for sugar making and refining, and which I intend to speak more fully when I come to discuss the place suitable for a centre of operation. One gentleman, the owner of two and part owner of three other raw sugar manufactories, wishes this year to build a refinery, and as he has at work a small English-made steam engine, with which he is very well satisfied, he expressed the wish to me to have all machinery for the new refinery from England. As there is no agency here for the sale of such machinery, I proposed to accompany him to England to purchase or order the machinery. He would have consented, but as his time is much occupied and he never was out of the country before, while at the same time some parties having suitable machinery on sale from German houses got scent of the order, he was induced to conclude a bargain with them.

The other instance is that of a landowner, who wishes to build a raw sugar factory, and having travelled in former days in England, he was not afraid of going again to purchase machinery. But here came another difficulty in the way; he, although known here for a safe man, could not expect to get credit from strangers, and he has not the ready cash to pay for all the machinery at once; so the affair ended in a Warsaw house taking the order, agreeing to furnish plans and superintend the erection of the buildings, then to fix the machinery, and after working it the first year receive the remainder of the contract sum out of the first proceeds, and at last give up the keys of a complete manufactory. The most vexing part of the whole affair is this: that both these gentlemen were firmly convinced that English engineers could make and erect steam engines, hydraulic presses, vacuum pans, &c., quite as well as German, French, or Polish makers; the great difference is that these are here almost on the spot, while those are difficult to get at with orders.

These considerations induce me to lay another proposition before you, a proposition also like my former one, not got up on the spur of the moment, but, as well as it, long thought of, and only kept in abeyance until the time should come for bringing it to light. The users and would-be users of machinery say the hour is come, now we only want the men. I would, therefore, propose, secondly, that a number of English engineering firms, having different specialities, should lay their heads together and establish an agency and depôt of machinery here, with practical men to conduct it in all its branches. By practical men I mean not mere salesmen, but men who are practical engineers, and who could, whenever required, undertake the erecting of the machinery they sell. It might be thought that the language would cause a difficulty, but anyone speaking German or French will get on just as well with customers as if he spoke Russian; whilst a man who wishes to learn can, in the course of eighteen months, or, at the most, two years, pick up enough Russian to enable him to give directions to workmen. In making this second proposition I have by no means lost sight of my first—on the contrary, they can work together; and I consider that an agency of this sort would form a very good basis for the operations of the proposed factory, the more so as I think I can prove that the place most adapted for the one, is also the very part of the country most suitable for the other.

I had got so far with my letter, and meant to have gone on to speak of the work to be done, but by a strange coincidence I have just received the last number of the Transactions of the Russian Technical Society, containing, from native sources, a confirmation of my views on the subject, chiefly treated of in this letter. This society, yet in its youth, unlike English societies of a similar nature, is composed of both civil, military, and mechanical engineers, together with architects, chemists, &c., only holding their meetings in separate sections, but in reality forming one body. Its members, ever since its formation, have devoted a good deal of time to inquiring into the difficulties met with by makers and users of machinery in Russia, with a view to assist in their removal. The Riga branch of this society, among a series of resolutions connected with the proposed protective duty on machinery, passed the following one, with a translation of which I cannot do better than close my present letter.

Fourth resolution:—"That it is advisable to co-operate for the organization of associations, having for their aim the furnishing of machinery, especially that for manufactures connected with agriculture, in which the purchase of machines, whether in this country or from abroad, shall be under the superintendence of efficient mechanical engineers, paid by the society." The reasons given for this are:—"That under the present system of acquiring machinery, the purchaser, more especially if he is a landowner, seldom appears to either the home or the foreign machine manufacturer personally or as a regular customer. By such casual purchases he has less chance of being suited by the seller than if he acquired the machinery from a large society or company, the operations of which would be more extended than that of single manufacturers acting separately. A purchaser unacquainted with machine making often deceives himself, both in the choice of a machine and in that of the maker. An association, on the contrary, with a well-informed and well-paid engineer in its midst, presents a guarantee not only to the purchaser for the quality and adaptability of the supplied machinery, but also contributes to the success of the honest manufacturer, securing him a regular sale for his goods. By means of such an association, machine makers would be better able to adapt their machines to special operations. It would also cause those manufacturers, whose machines may be by some cause or another found unfit for the work required, either to improve them or lose orders."

If the passing of such a resolution as this is found to be called for in the neighbourhood of Riga, and is echoed by practical men in St. Petersburg, what must be the condition of affairs in the interior? Simply this: that the purchaser is at the mercy of the seller, who, being himself ignorant of the practical working of the machines he sells, has for his object to get rid of his customer as easily as he can, providing he can induce him to buy something. In the case of the machine not being suitable for the wants of the customer, the name of the manufacturer generally suffers, and the demand for his machine decreases. With your permission, I will in my next endeavour to give some idea of the work to be done, and the place suitable for doing it—a branch of the subject from which I have been led away for the present, owing to my anxiety to confirm my opinions by quoting those of others.—I am, Sir, yours, &c.,

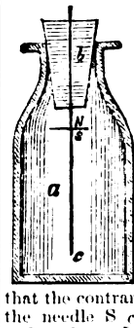
ALEXANDER CAMERON, Mem. R.T.S.

Kharkoff, May 6.

[Our manufacturing engineers ought to feel themselves indebted to Mr. Cameron for pointing out for them a course of action in these dull inactive times. We thank our correspondent, and look forward to the continuation of the subject.—ED. M.M.]

MAGNETIC PHENOMENA.

SIR,—Herewith I send you a rough sketch of the vertical section of an instrument I used in making experiments on magnetism. *a* is a common glass bottle, *b* a cork; through the cork is passed a common needle, the point downwards. This point is magnetized by the north pole of a common horse-shoe magnet. Another needle, of which the point is magnetized by the south pole of the magnet, is hung to it. Now, I should like to know the explanation of two different phenomena observed by me—first, in presenting the north pole of the magnet to the hanging needle at *c*, I found that the needle was attracted, while the contrary took place on presenting the south pole. I would suppose that the contrary ought to have taken place. Second, the needle S *c* is in continual irregular oscillation, and, as far as I can observe, the direction is from east to west, the eyepiece at *c* describing an ellipse. I hope you will find this curious enough to give it a line in your valuable paper, especially as the experiment is easy to be made. To observe the irregular oscillations of the needle, I put the bottle on the chimney-piece, being of marble, after having cleared it of everything that could attract in any way.—I am, Sir, yours, &c.,



A DE B.

Delft, May 31.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—F. A. P.—J. B.—R. D.—E. B. W.—G. W. H.—J. P. A.—E. P.—F. O.—C. B.—W. H. R.—W. E.—L. S.—J. M.—E. J. B.—J. T.—R. F. F.—R. H. T.—S. K. M.—P. D.—Messrs. S. and F.—S. J.—B. S.—T. W. T.—J. K.—G. J. G.—Messrs. W. and C.—J. M.—C. R.—Messrs. E. and H. O.—R. H.—J. E. C.—S. G.—H. H. T.—R. F.—A. de B.—S. O.—W. D.—M. G.—G. S. J.—J. F.—Messrs. D. and B.

Meetings for the Week.

TUES.—Royal Institution.—Dr. M. Foster on "The Development of Animals," at 3 p.m.

THURS. — Royal Institution.—Sir J. Lubbock on "Savages," at 3 p.m.

FRI.—Royal Institution.—Professor Frankland on "The Source of Light in Luminous Flames," at 8 p.m.

SAT.—Royal Institution.—Sir J. Lubbock on "Savages," at 3 p.m.

Naval, Military, and Gunnery Items.

THE transformation of the artillery in Spain is now terminated, the army of that country now possessing 130 steel breech-loading guns.

THE annual general meeting of the National Artillery Association will be held on Monday, June 8, at two o'clock p.m., at the new rooms of the National Artillery Association, No. 12, Charing-cross.

THE Prince of Wales has consented to dine with the corporation of the Trinity House on Trinity Monday next. Prior to the banquet there will be Divine service in the church of St. Olave, Hart-street, at which the brethren will attend.

THE floating shears in Chatham Dockyard, lent by the Admiralty to Messrs. Maudslay and Co., having been employed in masting and raising the heavy machinery on board the Prussian ironclad frigate "Konig Wilhelm," in the Victoria Docks, have been towed back to Chatham, for the purpose of lifting the large iron masts into the armourclad turret ship "Monarch," 6, 5,100 tons, fitting for commission.

A RECENT Gazette contains a notice informing the officers, seamen, marines, and others interested, that the distribution of the tonnage bounty, &c., arising from the capture of a slave dhow, name unknown, by Her Majesty's ship "Highflyer," on the July 28, 1866, will commence on Wednesday, the 10th proximo. Shares: Captain, £41 15s. 2d.; second class, £7 14s. 3d.; third, £6 3s. 4d.; fourth, £3 19s. 5d.; fifth, £2 4s. 2d.; sixth, £1 19s. 9d.; seventh, £1 6s. 7d.; eighth, 13s. 2d.; ninth, 8s. 9d.

MUCH inconvenience having been occasioned by the employment of regimental officers for an undue period on the personal staff of general officers, and of governors of the colonies, it has been decided to restrict the term of service in such capacity to five years in the former and six years in the latter case. When an officer has completed such period, he will be required to rejoin his regiment, and to do duty with it two years before he can be again similarly employed, unless he is willing to exchange to temporary half-pay.

AN order has been received at the Royal Engineer establishment, Chatham, directing volunteering from the companies of Royal Engineers at head-quarters for men to be employed with the corps now being formed to be attached to the Department of Public Works in India. The non-commissioned officers and Sappers who have already volunteered are undergoing a special course of instruction in military engineering, levelling, surveying, and road-making, at the Royal Engineer establishment, to prepare them for employment on the public works in India.

THE wretched, but happily abortive, attempt upon the life of the Duke of Edinburgh has met with universal denunciation, whilst his escape and recovery are the subject of general congratulation. They form the theme of a spirited song, "God Bless Our Sailor Prince," by Mr. J. E. Carpenter, which has been set to music by Mr. Stephen Glover. Messrs. Cocks, the publishers of this song, have sent us a copy of the words, which will form an interesting addition to our national songs.

Miscellanea.

THE pearl fishery grounds recently discovered at Western Australia extend along the coast for 1,000 miles. Upwards of sixty tons of pearl oysters were fished up in December last, and sold for £100 per ton.

IN the recent presentation of the various prizes of the Academy of Sciences, a touching incident

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occurred: M. Bour received a gold medal in honour of the analytical labours of his son, who was snatched from science at an early age.

BY the death of the late Dr. J. Davy, the service of plate presented to Sir Humphry Davy, in 1817, by several coal mine proprietors, for the discovery of his celebrated safety-lamp, reverts to the Royal Society. The value of the plate is £2,500,

THE Allentown rolling mill is one of the largest establishments of the kind in Pennsylvania. It is for the production of railroad iron exclusively, and turns out 400 tons of rails per week. The daily work is 260 rails, 30ft. long, and weighing 561b. to the yard, or 5601b. each.

PAPERS by Clements R. Markham, Esq., on "The Topography of Abyssinia," and by Dr. G. Neumayer on "The Scientific Exploration of Central Australia," will be read on Monday next, at the meeting of the Royal Geographical Society. Sir R. Murchison will take the chair.

NEAR Cologne, in the circle of Sieg, a tremendous hailstorm, accompanied by a waterspout, a few days back, devastated the territories of about twenty villages. The wind, which was extremely violent, tore up oaks of more than 100 years old, and blew down several dwelling-houses.

IT has been calculated by Professor Breithaupt that during the 640 years the Freiberg mines had been worked, dating down to 1825, the mines of Freiberg produced not less than 82,000 cwt. of silver, and that the amount yielded in 1850 alone was not less than 800,000 thalers.

A SHARP shock of earthquake was experienced in Guatamala on April 8. The shocks were repeated for days in succession, but no damage was done to the buildings. The imports and exports of the three ports of Salvador have been much greater than any previous year.

THE visitors to the South Kensington Museum during the week ending May 30, 1868, were on Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., 7,787; on Wednesday, Thursday, and Friday (admission, 6d.), from 10 a.m. till 6 p.m., 1,778. National Portrait Exhibition, by payment, 2,423; total, 11,988. Average of corresponding week in former years, 12,765. Total from the opening of the museum, 7,409,957.

AT the general monthly meeting of the Royal Institution of Great Britain, held on Monday last, W. Pole, Esq., F.R.S., in the chair, Mr. Alfred Morrison and Rev. J. George Wrench were elected members of the Royal Institution. The special thanks of the members were returned to Sir Henry Holland, Bart., the President, for his tenth annual donation of £40 to the fund for the promotion of experimental researches.

IN France the greatest distance over which a telegraphic message can be transmitted is about 600 miles; in Prussia, about 500; in Belgium, about 160; and in Switzerland, about 200 miles. The charge for a message of 20 words over the greatest distance in France is 1s. 8d.; in Prussia, 1s. 6d.; in Belgium, 5d.; and in Switzerland, 5d. In Great Britian 2s. is charged for the transmission of a messuage over 500 or 600 miles, and 1s. 6d. for any message sent 160 or 200 miles.

UNDER the superintendence of Mr. Lee, architec to the Earl of Dudley, the rebuilding of Her Ma-t jesty's Theatre has just been commenced, Messrs. Trollope and Sons being the contractors. By the terms of their contract the building is to be finished in forty weeks from the present time, under a penalty of £1,000 for every week beyond that time. It is intended that the accommodation shall be much increased in the new building, the last one holding not more than 1,700 persons.

IT is said that measures are being taken for the holding of industrial, artistic, and agricultural exhibitions at Lyons next year, to open in May, and close in August. The three exhibitions will be separate from each other; the first to be held on the new Cours Napoleon, the second in the Museum or Palais des Arts, and the third in the park of the Fete d'Or. A great festival of the orpheonists and of the musicians of the Rhone and the neighbouring departments is proposed to be held at the same time.

WE had occasion last week to rebuke the "Daily Telegraph" for having stolen some of our thunder, in the matter of silver coinage; it has now pilfered some of our lightning anent electricity. It has had the coolness to abstract from our "Notes" of last week the item on the application of electro-magnetism to ladies' ornaments, and, with a word altered here and there, to parade it as its own in leader type. But this is the old practice of the "Gaily Bellowgraph" (as the "Standard" dubs it), and we are sorry to see it so confirmed in its sinful ways.

A CENSUS of Queensland was taken on March 2. The returns are not yet fully made up, but the population is over 100,000; it was only 30,000 on April 7, 1861. The population of Brisbane, the municipality, is stated to be 15,032; Ipswich, 5,026; Rockhampton about 200 more; Maryborough not quite 3,000. The population of the province of Otago, New Zealand, is returned as 48,480, according to the census of 1867—29.819 males, 18,661 females; 12,405 at the goldfields, 36,075 in the rest of the province. The population of Dunedin city and harbour is returned as 12,776.

THE congregation of the ancient church of Wharram Percy, Yorkshire, have been somewhat surprised to find a breed of foxes in possession. An air drain for ventilation from the outside has been used as an "earth," and by this means access has been gained to the pulpit, beneath which an old fox and her litter of fine cubs are, except when unearthed during Divine service, comfortably domiciled. The novelty has been communicated to Morgan, Lord Middleton's huntsman, who declares that during his forty years' experience he never before heard of such a circumstance, and never met with a finer brood of foxes.

THE inspectors of factories, in their report just published, point to the fact that the extension of the factory system is the nearest approach to a compulsory system of education, and believe that the Factory Acts Extension Act, 1867, and the Workshops Regulation Act, 1867, will eventually be accepted as a national code. The number of accidents from machinery reported to the inspectors during the half year was 2,201; of those arising from other causes, 2,394; there were 292 informations for breaches of the Factory Act, and 213 convictions. The total of the fines inflicted was £317 5s., and the costs £146 4s. 6d.

THE full numerical list and index of the papers laid before the house of Commons and printed in (or belonging to) the Session of 1867 has been issued. The whole number of papers was 1,121. The public Bills of the Session, with the amendments and reprints, fill 6 volumes; reports from committees, 8 volumes; reports from commissioners, 24 volumes; miscellaneous accounts, returns, and papers, 38 volumes; making in all 76 volumes. In the Session of 1867 the House of Commons sat on 128 days, for 1,043 hours in all, 112 of them after midnight; the average time of sitting being as much as eight hours and nine minutes. The House received 12,744 public petitions, with 1,145,216 signatures; divided 164 times; passed 146 public general Acts, and 222 private Acts.

THE New Museum of the Fine Arts Applied to Industry, established in the Strogonow School of Design of Moscow, was inaugurated in April last. The general plan of the Museum was drawn up by M. Boutowsky, on the basis of a plan drawn up for the Lyons Chamber of Commerce by M. Natalis Rondeau, which has been very generally approved. The museum is divided into three sections:—Fine Arts, Industry, and History; and it includes—Collections of Flowers and Plants remarkable for beauty of form or colour, collections of Animals, Birds, and Insects; a cabinet of Drawings and Prints; a special Library of Illustrated Works relating to the Fine Arts; Decorations, Ornaments and Architecture; and an atelier and workshop for the use of the pupils of the school and of the public.

ADVICES from the Sandwich Islands report the occurrence of one of the most terrific volcanic eruptions, accompanied by earthquakes, probably ever recorded. It occurred in Hawaii, in the district of Kona, and the volcano is called Mauna Loa. The earthquakes at times were so violent that no one could stand up; immense precipices were levelled to the earth, and a tidal wave from the sea swept over the tops of the tall cocoa-nut trees. Five villages suffered from the visitation, 80 persons being known to have been killed. The mountain while in eruptirn vomited forth deep streams of lava, which pushed far out into the sea, driving the waters back and agitating them as by a storm. A huge island was thus thrown up, and the streams of smoke issuing from the crater of the volcano enveloped the surrounding country in partial darkness.

THE mean temperature of the air of the Royal Observatory, Greenwich, in the three winter months, December, 1867, to February, 1868, was 39·2deg., being 0·1 higher than the average of the preceding 27 years. The absence of severe cold last winter is shown by the fact that in the summary of returns given by Mr. Glaisher from more than fifty stations in various parts of England no lower temperature is recorded than 14·4deg., which was marked at Lampeter, Cardiganshire, in January last. In the winter of 1866-67 the thermometer both at Lampeter and at Norton-in-Hales, Salop, was as low as zero in January. To find a winter in which the thermometer went no lower than in that just ended we must go back to the winter of 1862-63, which was one of the warmest ever known, the mean temperature at Greenwich of the three winter months being 42·5deg., and the lowest temperature in Mr. Glaisher's list 16·2deg.

DURING the month of January in the current year there were imported to the United States iron amounting in value to 1,299,627 dollars, which consisted of 7,165 tons of pig and 11,841 of bar iron, 57,138 tons of railroad bars or rails, 574,5691b. of anchors, cables, and chains, 2,073,9491b. of sheet and 737,6661b. of hoop iron. The imports also included 4,564,5601b. of lead, 1,926,0201b. of rags, 63,015,1031b. of salt, 66,5931b. of raw silk, 25,523,6671b. of brown sugar, and 1,148,6051b. of molasses, 707,4491b. of tea, wines, spirits, and cordials, amounting in value to 301,031 dollars, 1,038,0411b. of raw and fleece wool, 224,677yds. of carpet, and 4,353,479yds. of dress goods. The imports of bullion and specie, consisting of gold bullion amounting in value to 9,314 dollars, silver bullion to 4,930 dollars, gold coin 512,947, and silver coin to 175,046 dollars.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3245, 3264, 3289
BUILDINGS AND BUILDING MATERIALS—3234
CHEMISTRY AND PHOTOGRAPHY—3232, 3295
CULTIVATION OF THE SOIL, including agricultural implements and machines—None.
ELECTRICAL APPARATUS—None
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3236, 3242, 3249, 3266, 3267, 3278, 3276, 3290, 3292
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—3275, 3307
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—3255, 3272, 3278, 3296, 3298
GENERAL MACHINERY—3228, 3230, 3237, 3246, 3254, 3257, 3260, 3263, 3265, 3268, 3277
LIGHTING, HEATING, AND VENTILATING—None.
METALS, including apparatus for their manufacture—3243, 3282, 3288
MISCELLANEOUS—3229, 3233, 3235, 3238, 3239, 3240, 3244, 3250, 3251, 3252, 3253, 3259, 3262, 3269, 3270, 3271, 3281, 3283, 3285, 3286, 3297, 3300, 3305, 3306
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3258, 3271, 3274, 3284, 3291, 3294
SHIPS AND BOATS, including their fittings—3231, 3247, 3302
STEAM ENGINES—3279. 3280, 3293, 3299, 3304
WARFARE—3241, 3256, 3278, 3301

3229 A. M. CLARK. *Improvements in apparatus for applying bronze and other powders on paper and other surfaces.* (A communication.) Dated November 14, 1867.

This invention relates to apparatus for applying bronze and other powders on paper or other surfaces with continuous action. The apparatus consists of two vertical frames or uprights, at the upper part of which is mounted a hollow cylinder or drum, having a slit or opening parallel to its axis. Beneath this cylinder is a roller of small size in contact with the upper one, and covered with velvet, flannel, or other suitable material, rotating in a trough containing the bronze or other powder. Opposite the opening in the drum there is placed a table, on which are disposed the sheets of paper, fabric, or other surface to be bronzed; this table has to and fro motion imparted to it, which moves in towards and from the drum at each revolution of the latter, in order that a clip disposed in the slit or opening may seize the sheet at the desired time. The sheets are fed up to the drum in succession, which seizes them one by one, and delivers them to the small roller turning in the trough, which deposits the bronze on the sheet; and the motion of the cylinder being continuous, the said sheet is then brought under the action, first, of a circular brush, driven at a high speed, which removes any superfluous bronze, and afterwards of a series of rubbing surfaces covered with velvet or flannel for fixing and equalizing the bronze powder remaining on the sheet; the paper or other surface continues its motion on the drum until released by the clip, when it is delivered on a receiving table disposed above the one before mentioned. Another sheet is then seized by the clip, and so on. The drum, bronzing roller, brushes, and table are set in motion by means of gearing suitably disposed.—Patent completed.

3230 J. P. L. HECKMANS and F. J. NUNNEY. *Improvements in washing machines.* Dated November 14, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

3231 W. R. LAKE. *Improvements in steering apparatus.* (A communication.) Dated November 14, 1867.

This invention relates to novel and powerful means for controlling and operating the rudder of a steam ship or other vessel, and consists, chiefly, in the combination, with the other parts of the apparatus, of an externally toothed wheel, and an internally toothed wheel or ring, either of which may be attached to the rudder post while the other is fitted upon an eccentric or crank fixed upon the steering wheel shaft or some intermediate shaft connected with the same. A connection with some fixed part of the apparatus or vessel keeps the wheel carried by the eccentric from rotating on its axis, but allows the said wheel to follow the movements of the eccentric as the latter is turned in either direction. Each tooth of this wheel is caused, at each revolution of the eccentric, to act in succession upon all the teeth of the wheel on the rudder head, the rudder being thereby easily turned in either direction. —Patent completed.

3232 J. CLARK and A. ESILMAN. *Improvements in decomposing the sulphides of copper, silver, nickel, cobalt, barium, strontium, and calcium, and in obtaining copper, sulphur, and other products.* Dated November 14, 1867.

This invention consists in treating the materials referred to with persalts of iron, being based on the fact ascertained by the present applicants that the persalts of iron have the property of decomposing the sulphides of the above-mentioned metals, separating sulphur, and forming a salt of the metal of the material operated upon. —Patent abandoned.

3233 R. G. HARCOURT. *Improvements in the manufacture and composition of fire-lighting material.* Dated November 15, 1867.

The ingredients here employed are sawdust, pounded coal, pitch, rosin, gas tar, and paraffin, petroleum, naphtha, or any other volatile mineral or vegetable oil or spirit.—Patent abandoned.

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3234 P. M. PARSONS. *Improvements in the manufacture of artificial granite suitable for buildings, engineering structures, pavements, and other similar purposes.* (A communication.) Dated November 15, 1867.

Here the inventor employs disintegrated natural granite mixed with clay, together with pounded glass, lava, or iron slags. The disintegrated granite he obtains by submitting fragments of natural granite to a strong heat (about 700deg. or 800deg. Cent.) in an oven or furnace, by which, after a sufficient time, it becomes dissolved into a granitic sand, the constituent parts of which quartz or felspar possess great powers of adhesion. One part of this granite sand is then mixed with about an equal quantity of pounded glass, or the constituents of glass, or lava, or iron slag, or a mixture of all or any of them, to which is added from twenty to thirty parts of refractory clay, or from thirty to fifty parts of ordinary clay; this mixture is thoroughly kneaded together with a sufficient quantity of water to make it of a pasty consistency; it is then moulded to any form required, and submitted to a degree of heat sufficient to vitrify the mass, for about thirty-six hours, which converts it into a hard and durable substance resembling granite.—Patent completed.

3235 G. R. SOLOMON and M. BEBRO. *Improvements applicable to apparatus employed as a ticket register.* Dated November 15, 1867.

This invention relates to a former patent granted to the present inventor, dated September 28, 1867 (No. 2740), and the said apparatus consists in the employment of a box or case containing a continuous strip, ribbon, or roll of tickets, consecutively numbered, which strip is coiled round a central drum or shaft, and the box is locked by an authorized person, so that the collector has no access thereto, excepting to obtain tickets therefrom in the proper manner by the mechanism arranged for the purpose. In the side of the box a slit is provided through which the ticket strip is caused to pass out by means of a knob or handle outside, and a pair of elastic covered feed rollers within the box, which it passes, and which are geared together and provided with a ratchet pawl so as to prevent any reverse motion. The present improvements consist, first, in the adaptation and combination of a dial and finger and gearing to indicate the collective number of tickets issued from the box or case in a certain time; a toothed wheel, forming one of a multiplying train of gearing, is secured to the shaft of one of the elastic delivery rollers, through and by which the consecutively numbered tickets are delivered, and, as the wheels rotate, they actuate a finger beneath, which moves on a dial plate numbered in accordance. Second, the improvements consist in the adaptation and combination of a bell within the box, which is struck by a spring hammer actuated by studs or equivalents, so arranged on one of the said delivery rollers or its shaft that the hammer strikes the bell as the roller rotates at the delivery of every ticket. Third, the improvements consist in combining the whole apparatus constituting the ticket register, or parts with a bag or satchel, so constructed that the box or register may be readily attached or detached; and it has also two pockets or compartments—one locked—into which the tickets, when collected, are to be passed through the slot or opening provided, so that the collector has no further access to them and into the other pocket the money received is to be placed, so that the consecutive numbers of the tickets, the finger and dial, and numbers of collected tickets and the cash in the bag must all correspond, or any informality will be detected. Lastly, the improvements consist in the application and combination of a small lamp with a satchel and other apparatus to enable the ticket distributor to perform his duties correctly at night. The apparatus described for registering either alone or in combination with the dial, bell, satchel, or light may be used and applied for registering the number of persons travelling in vehicles passing in or out of places of amusement or resort, or for any other similar purposes where the number of persons or the number of articles distributed is desired to be ascertained.—Patent completed.

3236 J. CROSSLEY. *Improvements in looms for weaving.* Dated November 15, 1867.

This invention relates to looms for weaving textile fabrics in which different colours or kinds of weft are used, and for which purpose "rising boxes" or change shuttle boxes are employed, and also jacquard apparatus, or other indicating or pattern surface for selecting the kind or colour of weft required; and the object is to simplify the construction, and thereby reduce the friction, and, consequently, the power required for driving the same; also to facilitate the readjustment or rearrangement of the several parts of the loom when the weft becomes used up or broken, the loom having continued in motion for several picks after the occurrence of such deficiency of weft. The invention comprises various arrangements for carrying out these objects.—Paten abandoned.

3237 W. E. GEDGE. *An improved gas engine.* (A communication.) Dated November 15, 1867.

The principle upon which this engine is based consists in the condensation or cooling of the burnt gases after their action on the driving piston. The object of this condensation is to produce the vacuum behind the piston by the construction of the burnt gases.—Patent abandoned.

3238 A. AIRIAU. *An hydraulic clock.* Dated November 15, 1867.

This invention is not described apart from the drawings. —Patent completed.

3239 R. MORSON. *Improvements in keys for locks.* Dated November 15, 1867.

Here the inventor bores the barrel of the key through from end to end, so as to obtain an opening at the rear end of the barrel within the key bow. In a key thus constructed the barrel cannot become choked, as, should any dirt enter it, it is rammed down by the pin of the lock as the key is used, until at last it passes out of the barrel at the back.—Patent abandoned.

3240 L. B. BERTRAM. *An improved tobacco pipe.* Dated November 15, 1867.

This invention consists, chiefly, in providing the bowl of the pipe with an interior cup, which is perforated at the bottom, to communicate with a space in the lower part of the bowl, and is provided with a flange, or number of flanges, to intercept the oil and nicotine, and retain them in the said space while the smoke is drawn into the stem through small apertures or perforations in the said flanges, and through an annular space surrounding the cup, which space is closed by a flange or collar at the top of the bowl. If desired, the perforated flange may be formed around the inside of the bowl, instead of upon the cup, or may be made separately or detached and inserted between the cup and bowl.—Patent completed.

3241 E. FARRINGTON. *An improved tubular cannon.* Dated November 15, 1867.

This invention is not described apart from the drawings. —Patent abandoned.

3242 R. C. ADDY. *Improvements in spinning and twisting frames.* Dated November 15, 1867.

This invention consists in dispensing with the use of the ordinary thread plate, and bringing the thread in a direct line from the delivery roller to the top of the flyer. The flyer consists of two broadened legs, having an eye at the lower extremity of one or both legs, and it is furnished also with an eye at the top in the line of the axis of the spindle, and above the socket of the flyer, and through which eye the thread passes from the delivery roller to the eye at the lower extremity of either of the legs.—Patent abandoned.

3243 A. M. CLARK. *Improvements in refining copper.* (A communication.) Dated November 15, 1867.

The patentee claims, first, the application of air insufflated into the bath of copper for effecting the expeditious refining of copper, as described. Second, the reduction of the silicate of copper by the aid of a mixture of lime and charcoal, or of limestone and charcoal, as described.— Patent completed.

3244 J. TEMPLEMAN. *Improvements in the manufacture of fire-lighters, applicable also for temporary fires or heaters, and in the means or apparatus employed therein.* Dated November 15, 1867.

The patentee claims, first, the manufacture of compressed hard tough fire-lighters, with granular dry combustible body matter, and resinous or pitchy material combined, as a whole generally, and their use, substantially as described. Second, the manufacture of compressed hard tough fire-lighters of a hollow or grooved form or construction, with granular dry combustible body matters, and resinous or pitchy material combined, substantially as described. Third, the construction and use of moulds for the compressing of fire-lighters, and that of the loose lower and upper pressing plates, or ends of the same, for the purpose of removal therefrom along with the compressed fire-lighters, substantially as described.—Patent completed.

3245 R. HOWSON. *An improved gas furnace.* Dated November 15, 1867.

Here the patentee constructs the furnace with a hollow hearth, somewhat like that of an ordinary reverberatory furnace, with one or more flues leading to a chimney. In the corner of the furnace immediately over the hearth he places a pipe or casing, by means of which the gas is introduced through one or more perforations opening downwards, and in the same casing he places one or more nozzles through which air is blown under pressure through the aforesaid perforations. The effect of this arrangement is, that each jet of air causes an induced current of gas to be projected downwards upon the material lying in the hearth, while the air is at the same time intimately mixed with the gas, so that the result is the production of an intense heat in the chamber of the furnace.—Patent completed.

3246 R. HEATHFIELD. *Improvements in machinery for the manufacture of cut nails.* (A communication.) Dated November 15, 1867.

This improved mechanism consists, essentially, of a hollow cylinder having guides through which the nail plate or strip passes, the said hollow cylinder being carried by a table, or rest, or slide, and having a reciprocating rotary motion communicated to it (which motion is communicated to the nail plate or strip) substantially in the ways described and illustrated. Second, the invention consists in the combination with, or the adaptation to, the said turning-over mechanism, of mechanism for feeding or advancing the nail plate or strip to the cutter, substantially in the manner described.—Patent completed.

3247 H. A. BONNEVILLE. *Improvements in apparatus for propelling vessels.* (A communication.) Dated November 16, 1867.

This invention consists in placing at the bottom of ships' boats, and other vessels, along their whole length from stem to stern, and at the lowest part, a cylindrical or such like capacity, the two extremities of which are open at the fore and aft of the vessel. This capacity is divided in the middle of its length by a transversal partition, and the two separate parts are made to communicate by means of a lift and force pump by a steam motive power. The water is sucked up into the capacity in front, and forced from the stern part by means of the pump, and this double action of sucking and forcing propels the ship or vessel.—Patent abandoned.

3249 R. HOLLIDAY. *Improvements in cleansing wool and other similar animal fibres.* Dated November 16, 1867.

This invention relates to the use of hydrocarbon liquors, such as the distillates of coal, tar, petroleum, and paraffin, schist or shale oils, in the cleansing of wool and other animal fibres. In carrying out the improvements the patentee (according to one method) places the fibre to be operated upon in a close vessel supplied with the liquid hydrocarbon (by preference coal tar, naphtha, or petroleum spirit), and when the fibre has become saturated with the liquid hydrocarbon, he allows such liquid to flow from it into a still. He then allows steam under pressure to flow through such tube into a condenser for recovery. After continuing the operation for some time, in proportion to the tar, grease, and dirt contained in the wool and other fibre, he shuts off the hydrocarbon, but continues the steam through the fibre and condenser till all the hydrocarbon is brought over and recovered.—Patent completed.

3250 C. E. BROOMAN. *Improvements in ornamenting bottles and other articles of glass or crystal.* (A communication.(Dated November 16, 1867.

The object here is to ornament or decorate bottles and other articles of glass or crystal. This decoration, which is applied to the exterior of the bottle, has the peculiar property of being diaphanous, and of preserving the transparency of the glass. The ornamentation consists in a special layer of gilding, silvering, or colouring applied to the exterior, and the property just mentioned constitutes a chief point of the invention.—Patent completed.

3251 R. GARBETT. *Improvements in indoor games.* Dated November 16, 1867.

This invention has for its object the adaptation of the ordinary games of American bowls or ten pins, skittles, and nine pins, so that they may be played upon a board or table. For the purpose of American bowls or ten pins the game is played upon a board which the patentee proposes to form of wood, or a slab of slate covered with cloth, and placed horizontally in a frame upon legs or supports, or laid flat upon a table, and with this table are furnished three or more balls and ten pins; the pins are placed in the form of a triangle, or other required shape, at one end of the slab or board, and are played at from the other end, with the balls propelled from a cue or mace. Surrounding the upper end of the board on which the game is played is constructed a trough or margin, or in some instances he prefers to employ bags or pockets to receive dead or fallen pins, or to retain ill-played balls, and the sides of the slab or board are padded to protect the frame; the pin end is raised to prevent the pins from being knocked off the table, and he proposes, if preferred, to form the pins to be used with the improved games in such manner that the resistive power of each pin will be equal to the weight of each ball employed. With some slight modifications he employs similar arrangements to those already specified for the purpose of playing the games of skittles or nine pins upon bagatelle boards or billiard tables.—Patent completed.

3252 A. V. NEWTON. *Improvements in manufacturing and securing envelopes.* (A communication.) Dated November 16, 1867.

This invention relates, first, to a new and improved mode of cutting the envelopes, whereby a saving in paper is effected; and, second, to securing the envelopes by means of eyelets whereby the former cannot possibly be opened and refastened without evidence being left of the fact.— Patent abandoned.

3253 F. W. RUSSELL. *Improvements in cask stands.* Dated November 16, 1867.

This invention relates to means by which the cask may be readily tilted without disturbing the liquid contained. The inventor provides a suitable stand or base, across the top of which near the middle is mounted a bar, the ends of which form trunnions working in bearings in the side frame. This transverse bar forms a lever for tilting cradle placed on the base or stand when the bar is raised, on being partially rotated in its bearings. The cradle is formed of a suitable frame of wood hinged at its front end to the base frame, the rear end being free to rise for the purpose of tilting the cask placed upon said cradle. On one end of the transverse bar projecting from the side frame is fixed a hand lever, by means of which the transverse bar is partially rotated for the purpose above menttoned. This hand lever is fixed on the transverse bar in nearly the same plane with the lever formed thereon, but in the opposite direction, so that when the cask is first placed on the stand, with the cradle resting its whole length upon the base frame, the hand lever will be in a more or less horizontal position alongside the stand, when, by simply depressing the hand lever, the transverse bar will be partially rotated, raising the lever formed thereon, and with it the cradle, thus gradually tilting the cask. The cradle is held in its raised position by the end of the bar taking into a recess made in its underside for the purpose.—Patent abandoned.

3254 C. RITCHIE. *Improvements in apparatus for brushing, combing, cleansing, drying, and perfuming hair.* Dated November 16, 1867.

According to one portion of this invention the inventor employs in brushing hair a bar or axis which is held by the operator in his two hands, one at each end; just within the grasp at one end of the bar or axis a collar or stop is formed, and in a similar position at the other end of the bar or axis is an annular groove. The bar receives upon it a circular brush, a driving drum, and a tubular stop-piece, which slips on to the bar or axis. This stop-piece is secured by a screw which enters into the groove in the bar. The brush, the driving drum, and the stop-piece may be formed together, but it is more convenient to make them separately, and arrange the brush and the driving drum to clutch the one to the other. He employs a flat endless driving band, and he makes the part of the driving drums over which the band passes of elastic or compressible material. In order to render the apparatus applicable for brushing long hair, he applies a small roller (or rollers) parallel to the brush, which roller (or rollers) should be driven at a greater surface speed. The hair, whilst it is brushed, rests or is carried on this roller (or rollers), which, by its rapid motion, keeps it distended, and prevents it lapping around the brush, which is applied between the roller and the head of the person. —Patent abandoned.

3255 R. W. PEARSE. *Improvements in the means of and apparatus for developing or extending the power or sound of pianofortes or other similar keyed instruments.* Dated November 16, 1867.

The patentee claims the construction of the apparatus described, consisting of a hollow foundation or base and sounding-board or bridge, and the other accessories, such as the partitions, sounding posts, and insulated castors, or other insulated supports, applicable to pianofortes or other similar keyed instruments, for the purpose of developing or extending their power or sound.—Patent completed.

3256 J. E. RICHTER. *Improvements in breech-loading fire-arms.* Dated November 16, 1867.

This invention relates to certain improvements in breech-loading firearms, in which the central fire cartridge is used. The opening and closing of the breech is effected by the sliding motion of the plunger backwards and forwards in a line with, and at the rear of, the barrel, the arm requiring only two movements when used, viz., the opening and closing of the breech, which is done by a handle attached to the plunger. The act of drawing back the plunger cocks the hammer and extracts the cartridge, and, a new cartridge being pushed in, the old case is driven out. The act of driving forward the plunger pushes the cartridge forward and into the barrel, and the act of locking the plunger releases the tumbler and discharges the arm, no trigger being required. The details of this invention are voluminous. —Patent abandoned.

3257 J. M. NAPIER. *Improvements in machines for printing calico and other fabrics.* Dated November 16, 1867.

Here the patentee employs in place of "doctors" or "scrapers," wiping rollers having yielding surfaces, and

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the colour which is removed from the engraved cylinders by such wiping rollers he causes to be transferred to hard rollers or surfaces from which it is gathered by a scraper or doctor. The wiping rollers he prefers to form of india-rubber covered with leather; the india-rubber should be vulcanized.—Patent completed.

3258 W. R. LAKE. *Covering buckles, saddletrees, turrets, hooks, and other metallic trimmings for carriages and harness, with a coating of vulcanized or hard rubber, gutta percha, or other gum.* (A communication.) Dated November 16, 1867.

This invention consists in projecting the various metallic trimmings used upon carriages and harness from rust and tarnishing by covering their surfaces with a coating of vulcanized caoutchouc or hard rubber, gutta-percha, or prepared gum—Patent completed.

3259 W. BAILEY. *An improved system or mode of ornamenting paper hangings, and machinery and apparatus therefor.* Dated November 16, 1867.

Here the ornaments are formed on the paper in leaf or bronze of gold or other metal. For securing the leaf to the paper the inventor employs the size or gum therefor in the form of a powder, or otherwise, and he has the pattern or design to form the ornament, heated when impressed on the paper, all in the usual manner. Heretofore, however, the operation has been intermittent, while in this new mode of manipulation the operation is continuous. He, therefore, has the design or pattern affixed to or carved upon a suitable surface capable of having a continuous motion imparted to it, the simplest form of which is that at the periphery of a cylinder. Such patterns or designs when not carved upon are so attached to the cylinder as to admit of ready removal to give place to others of different design. The paper is caused to pass between this and a similarly moving surface or cylinder, care being taken mechanically to prevent rents or wrinkles in the paper as it enters. He provides each of the two surfaces or cylinders with cogs, or the like, to cause them to move in unison. To make the impression on the paper, one of the cylinders is forced against the other, but undue pressure is prevented by adjustable stops, by which the amount of pressure is limited. He combines with this machinery a heating apparatus consisting of a steam generator, or its equivalent, and in connecting the same with the pattern carrying cylinder he uses joints or "stuffing boxes," one part of which, or of the machine, or of the said connections, is permitted to move or rotate, while the part or parts corresponding therewith remain stationary. He also employs one or more endless "registering" belts to which the paper is temporarily attached when required.—Patent abandoned.

3260 J. G. TONGUE. *Improvements in the process and apparatus employed for ageing and refining wines, alcoholic spirits, and other liquors.* (A communication.) Dated November 16, 1867.

The patentee claims, first, the process, substantially as described, of treating wines or other liquors in vacuo, and under the influence of heat, by agitating it in a distributed form, so as to convert it into a spray, and afterwards circulating the same in a more compact or liquid state in thin layers or streams, essentially as and for the purpose or purposes described. Second, the combination with the vacuum chain of one or more perforated vessels having perforated receiving distributors at or near their top, and agitators operating within them, substantially as described and shown in the drawings. Third, in combination with the vacuum chamber and vessel or vessels, having agitators operating within them, of a series of reversely inclined trays or surface distributors, arranged for operation in connection with the agitators, substantially as described.—Patent completed.

3261 L. and W. BRIERLEY and J. BONNELL. *Certain improvements in the construction of waggons and other carriages employed on railways or tramways.* Dated November 18, 1867.

This invention consists in attaching or connecting the ends of the draw bars together by a link or connection at about the middle of the length of each waggon, and this link or coupling is so arranged that the two screwed extremities of the "draw bars" project sufficiently far through holes provided in the link (one from each end) as to admit of india-rubber rings, or other elastic or yielding surfaces, being inserted, against which a metal washer is placed, the whole being secured and screwed up by means of nuts; a collar or shoulder is formed on the opposite end of the draw bars, just behind the hook, which, when the bars are being screwed up, presses against the outside surfaces of the waggon headstock. By this arrangement it will be seen that the framework of the waggon is released from the strain of traction, which is transferred direct to all the draw bars throughout the train.—Patent abandoned.

3262 R. HUSBAND. *Certain improvements in the manufacture of hats.* Dated November 18, 1867.

In ordinary silk hats the underside of the brim is covered with paramatta, or other cognate material, and the inner edge of the said material is fastened to the inside of the band of the body, without any regard to its appearance there, and is then hidden from view by the leather which forms part of the hat lining. In these improvements the leather does not fit to the band of the body completely round the hat, but at the part intended for the forehead is unsewn, and making an arc shorter in sweep and of larger radius than the corresponding arc of the hat is constructed in scope, so that between the two conterminous front curves—that of the hat and that of the leather—there is enclosed a vacant crescent-shaped space, through which air can pass, as up a flue when the hat is on the head. At this part of the hat the improvements, provide that the inside of the band of the body be finished with a covering like the underside of the brim, and by preference with a continuation of the same covering prolonged over the inside edge of the brim, and finished in like manner, so far as required for sightliness, regard being had to the fact that the open space there between the leather and the body will permit of the covered part being seen. The leather at the part unsewn is fortified by a lining of silk, or linen, or other material cemented on the back thereof.—Patent completed.

3263 E. LORD. *Improvements in machinery for opening and cleaning cotton and other fibrous substances.* Dated November 18, 1867.

This machinery consists of a horizontal beater revolving rapidly within a circular grid, the grate-bars of which are capable of adjustment at one or both ends, so as to increase or reduce the space between the grid and the beater, particularly at the feeding end of the machine. The grate-bars are moved by a plate with spiral grooves, into which their ends enter, and this plate is turned round in either direction by a pinion and wheel; or other equivalent agent may be adopted to move the grate-bars. The fibrous substances are drawn into and through the circular grid by a fan, and a certain space is left between the end of the grid and the case of the fan to allow the fibrous substances escaping with the dirt to be drawn back again into the fan. The fibrous substances are blown over a longitudinal grid, and pass between two perforated cylinders, in which a partial vacuum is formed by another fan. The fibrous substances, thoroughly opened and cleaned, are then delivered on to a creeper which drops them on to the floor, or are formed into lap, either immediately or after passing through one or more beaters.—Patent completed.

3264 C. E. BROOMAN. *A new or improved process of and apparatus or furnaces for the manufacture of metal direct from the ore.* (A communication.) Dated November 18, 1867.

The apparatus employed for carrying out the invention is not described apart from the drawings.—Patent completed.

3265 E. T. HUGHES. *Improvements in knitting machines.* (A communication.) Dated November 18, 1867.

This invention is not described apart from the drawings.—Patent completed.

3266 W., J., and J. BUSFIELD. *Improvements in preparing slivers of wool for spinning and dyeing.* Dated November 18, 1867.

This invention consists in re-winding the silver as taken from the interior of the ball upon a fixed or non-rotary bobbin of equal or nearly equal diameter to the spindle upon which the ball was formed by means of an ordinary spindle and flyer, the bobbin being placed on the lifting rail, and the spindle passing through the bobbin, so that the diameter of the bobbin increases in the same ratio as the diameter of the interior of the ball, or the hole formed therein by the drawing out of the silver. For dyeing purposes a little twist is required to be left in the silver; this the patentees effect by having the bobbin either larger or smaller in diameter than the spindle upon which the ball has been formed.—Patent completed.

3267 W. J. HANSON and J. C. ELLISON. *An improved method of and means or apparatus for dyeing textile fabrics, yarns, and fibrous substances.* Dated November 18, 1867.

This invention consists in the employment of a series of lattice sheets, endless aprons, or "brats" of any suitable material carried on rollers in or through the dyeing vessel, so arranged that two of such endless sheets, aprons, or "brats" will move in contact with each other, and thereby convey and conduct textile fabrics, yarns, or fibrous substances betwixt their surfaces through the dye liquor, and deliver the same betwixt another similar pair of surfaces, and so on through the whole series of surfaces. Or, for the dyeing of hanks of yarn or fibrous substances, the inventors employ two or more rollers for the said hanks to be placed upon or around, and which are caused to rotate in the dye liquor.—Patent abandoned.

3268 J. V. THORNTON and C. ABERCROMBIE. *Improvements in machinery for twisting yarns of two or more colours and kinds, commonly called "French twist" or "Knotted yarn."* Dated November 18, 1867.

This invention relates to machinery for twisting together two or more yarns or threads of different colours or kinds of material, and not in a regular manner, but irregular, so as to produce knots or spots at intervals on the said twisted yarn. To effect this the inventors produce an intermittent motion to either the back or front rollers of spinning or twisting frames, by the application of a cog-wheel having blank spaces, or parts of its circumference without cogs, or by the employment of the well-known star-wheel motion, or other mechanical equivalent means of imparting an intermittent motion to one of the ordinary pairs of rollers, so that one thread may pass betwixt one pair and the other thread betwixt the other pair of rollers, the one thread having continuous and the other intermittent motion. Both yarns pass thence over, through, or by guides placed betwixt the front rollers and the ordinary guide board, and, meeting, are twisted together, the stoppage at intervals of one thread giving time for the other thread to be wound thereon in a knot or spot.—Patent abandoned.

3269 J. COLEBROOK. *A new or improved butter basket.* Dated November 18, 1867.

This invention consists of a holder in the form of a basket or vase of wood, basket-work, or metal, or of electro-plated or gilt metal, with a handle attached. The butter holder is, by preference, formed of glass or porcelain, and is set in the holder by means of a suitable cress, into which it fits; the border of the butter dish, or the holder, is provided with vertical metallic knife rests, across which the butter knife is placed, in order that the basket and butter dish may be moved in conjunction with the knife. The rests may consist of various ornamental devices, allowing spaces for the blade and shoulder or handle of the knife to rest and be secured from falling.—Patent abandoned.

3270 G. FITT. *Improvements in the manufacture of artificial manure.* Dated November 18, 1867.

The patentee claims the manufacture of manure consisting of cinder ash or "breeze," in combination with fatty or oily matters and alkalies, with or without brown acid, substantially as specified.—Patent completed.

3272 T. WOOD. *Improvements in the construction of lamps for burning paraffin, petroleum, or other mineral oils.* Dated November 18, 1867.

This invention is not described apart from the drawings.—Patent completed.

3273 R. WARD and T. TRAVIS. *Improvements in the manufacture of woven fabrics.* Dated November 19, 1867.

This invention is particularly applicable to the manufacture of the cotton fabrics known as velveteens, beaverteens, or moleskins, and consists in making such fabrics with a ribbed face, instead or plain, as heretofore. In performing the invention the patentees employ a loom of the ordinary construction, having four or other greater number of shafts or healds. The invention is not fully described apart from the drawings.—Patent completed.

3274 E. REYNOLDS. *Improvements in the manufacture of wheels for railway carriages and other rolling stock.* Dated November 19, 1867.

This invention has reference to the manufacture of wheels for railway carriages and other rolling stock of cast steel, and consists in first casting the wheel, or, by preference, the skeleton upon which a loose tire is afterwards to be fixed, and whether with spokes or arms or of the disc form approximately to shape, and then working it to the desired form by pressing or stamping in dies, after which, when required, it may be turned or bored to the exact dimensions.—Patent abandoned.

3275 W. J. and A. COLEMAN. *Improvements in the combination and mode of treating and employing certain preparations for various articles of food.* Dated November 19, 1867.

The patentees claim the manufacture of biscuits, lozenges, and similar articles of food, by compounding Liebig's extract of meat with farinaceous materials, then rolling or pressing the mixture together, so as to form sheets or thin pieces, and drying or baking the same.—Patent completed.

3276 H. ENGLISH and J. FARNDON. *Improvements in apparatus for operating the shuttles of looms for weaving narrow fabrics.* Dated November 19, 1867.

Here the parts taking immediate effect on the shuttles in the operation of driving are comprised entirely within the limits of the length of the race, and consist of levers mounted on axes having spur or other gearing taking into a rack bar below, by which the motion is communicated. These levers each consist of two arms of equal length, and diametrically opposite on the axis; the extremity of the arms each terminate in curved branches, spreading in opposite directions, and described of a radius about equal to half the radius of the lever arm. The curved branches are in the plane of the motion given to the levers, and are each provided with a cam groove, which meet in an apex towards the centre of motion; on the back of the shuttle two pegs project which take into these cam grooves, the motion of which causes the shuttle to traverse. During the traverse in one direction, the peg, in its direct motion in the shuttle race, at same time proceeds in the cam groove of one arm of lever (two branches), entering at the extremity of one, and proceeding by the curve towards the conjunction (the apex before-mentioned) with the other, thence passing up that branch from which it escapes. Any form of peg that will traverse the groove may do, but the inventors prefer one of a double wedge form, so as to readily enter the cam grooves, and also to direct its course at their conjunction. Each of the double levers performs about a revolution on its axis, and then reverses for the traverse of the shuttle in both directions, and each operates two shuttles, that is to say, it receives a shuttle on the one side, while it is delivering one on the other; hold of the shuttle on the one side is always taken before it is let go on the other. The invention further consists in providing an arrangement by which the inventors are enabled to operate a double set of shuttles, one set above the other, in two distinct races. The invention comprises other features. The wording of this specification is, to say the least, ambiguous, but we give it as we receive it, rather than run the risk of increasing its ambiguity.—Patent abandoned.

3277 W. ANDERSON. *Improvements in evaporating apparatus, and in utilizing the steam derivable from such apparatus.* Dated November 19, 1867.

This invention relates to a novel arrangement of evaporating apparatus for concentrating solutions, and recovering their chemical ingredients, whereby an economy both in respect of fuel and duration of the apparatus will be secured. The invention further relates to the utilization of the steam generated in the evaporating apparatus, and the employment of the same as a motive power. The liquor to be concentrated is admitted into a closed tank or boiler set above a furnace, the flue from which conducts the flame and heated gases over an incinerating hearth, and under a second closed tank or boiler set above this hearth. The heated gases then pass through a horizontal passage or heating chamber leading to the chimney, upon which is mounted a third boiler. These boilers all communicate by means of steam pipes with a steam chest, say of a condensing engine, into which the steam as it is generated is led off to be utilized. The boilers are fitted with scraping apparatus, which keeps them clean, and thus prevents their rapid destruction. The liquor to be concentrated, say, for example, the black alkaline liquor from straw pulp, is admitted to the closed tanks or boilers, which are in communication with each other by end openings in both the liquor and steam spaces. As this liquor is heated, steam is generated and led off to be utilized, and so soon as the liquor is sufficiently concentrated it is discharged on to the hearth below the second tank or boiler, and the fluid particles remaining are quickly vaporized and driven off by the passing flame. The dry resultant matter then ignites, and when the combustible portion is burnt, a residuum, consisting chiefly of salts of soda, will be obtained. This mode of applying heat, so far as the exposure to the direct action of the flame is concerned, is only applicable to substances not liable to deterioration from contact with the flame and gases of combustion.—Patent completed.

3278 R. A. E. SCOTT. *Improvements in mounting and working ordnance.* Dated November 19, 1867.

The principal object of the present invention is to reduce to a minimum the injurious effect of the firing of heavy guns upon the platform and slide, and also upon weak floors, or upon the decks of vessels. The strain and shock produced on these parts by the firing of heavy guns arises, in a great measure, from the gun being mounted upon so high a carriage that the shock is transferred from the trunnions of the gun to the platform and slide, and thence to the deck at an angle too nearly approaching the vertical. The patentee states that he has discovered that if this angle be lessened, so as to bring the line of strain into a more horizontal position, that the injurious effect of the shock of firing is very much diminished, and hence, by means of these improvements, very heavy guns may be carried by wooden ships, or upon weak floors of batteries, or light upper decks. He effects this by reducing the depth of carriage considerably, and removing the gear below the gun to the outside of the slide, so as to allow the breech of the gun (when firing at an elevation) to pass freely down between the two sides or girders of the slide. The downward shock or strain produced on the platform or slide, and upon the floor or deck by the firing of the gun, is thus reduced by being delivered nearly in the horizontal line. By these means he can safely use cast-iron or other cheap material for the frame of the carriage, and for portions of its machinery.—Patent completed.

3279 A. BARCLAY. *Improvements in motive power engines.* Dated November 19, 1867.

This invention relates, in the first place, to certain improvements in single-acting engines, whereby the consumption of steam, and therefore fuel, is economized, is based upon other inventions, for which letters patent were granted to the present inventor, dated February 22 1861 (No. 453). To effect the economy above referred to,

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two steam cylinders are employed, one being of much greater capacity than the other. The small cylinder is that into which steam is first admitted; this being let in on the under side of the piston raises it, and when, at the end of the stroke, a valve is opened, by which the steam filling the space on the underside of the piston is admitted to the upper side, whereby the piston descends through the weight or load attached to it, the whole of the steam passing to the upper side of the piston, the part of the cylinder above the piston thus constituting a receiver or reservoir for the steam by which it had been lifted, and wherein it is contained until a fresh upstroke takes place. When the piston has descended to the bottom of its stroke, the admission valves are reversed, and the full pressure of steam again admitted to the underside of the smaller piston; and at the same instant the valve closing the passage between the upper end of the small cylinder and the lower end of the large cylinder is opened, so that the steam contained in the upper side of the small cylinder instantly escapes and expands into steam of a lower pressure in the large cylinder, wherein it acts and lifts the piston therein. The steam, after it has expanded and lifted the larger piston, may escape direct into the condenser; or, in place of passing thereinto at once, it may be passed to the upper side of the piston, thus keeping the cylinder as warm as possible by imparting its own heat to the metal, until the instant a fresh admission on the underside of the piston takes place, when the passage between the upper end of cylinder and the condenser is opened. The second part of this invention relates to the application of a screw and link motion for adjusting the amount of opening of the admission and exhaust valves of this class of engines. For this purpose the link is suspended at one end, and, by turning the adjusting screw, the valve rod or rods to which it is coupled may be shifted to any part of the link, and the amount of throw of the valves thus adjusted.—Patent completed.

3280 E. T. TRENERY. *Improvements in traction engines* Dated November 19, 1867.

Here both the hind and front axles are driving axles, the one deriving its rotary motion from the crank shaft of the engine through the medium of toothed gearing or pitch chains, and the other receiving its motion from the first axle by the intervention of a counter shaft and level gearing. The front axle is made in three lengths jointed together by universal joints, in order to afford facility for its assuming an annular position when turning curves or corners. One of the wheels on each axle is made fast thereon, whilst the wheel on the opposite end of the axle is loose, whereby greater freedom of evolution is obtained. Sometimes the inventor couples one or both of these loose wheels, with their axles, by the aid of a sliding clutch or clutches, in which case he is enabled to have at will two, three, or even four wheels. The steering is effected from the fire-box end of the engine by the aid of a longitudinal rod, worked either by a nut and screw or by a worm wheel and rack, or otherwise, which rod is connected at its front end to a lever arm in a vertical rocking shaft carried in suitable supports at the front of the engine. To the lower end of this shaft there are keyed transversely two horizontal lever arms, each of which is coupled by a link to one end of the front axle, or to pedestals or bearings carrying the axle, such pedestals or bearings being free to slide between suitable guides in the main framing. By moving the longitudinal rod to or fro the rocking shaft will be turned more or less, and the front axle will be caused to assume the angle required, according to the direction in which the engine is to travel. The whole is mounted upon a strong frame, which is extended sufficiently far behind the fire-box to carry a tender containing a supply of coals and water.—Patent abandoned.

3281 C. MOLE. *Improvements in the manufature of soles and heels for boots and shoes.* Dated November 20, 1867.

The patentee claims, first, the insertion of plugs of metal or other material into soles and heels before their application to boots or shoes, not by cutting holes for their reception, but making way for them by displacing the substance of the leather laterally (using the apparatus described, or any other means which may be found available for such purpose), the effect being that the leather itself is rendered closer and less penetrable by moisture. Second, the method described of inserting the plugs by causing them to follow a piercer driven through the leather, and to remain in the opening thus prepared for them.—Patent completed.

3282 W. H. RICHARDSON. *Certain improvements in the manufacture of iron and steel.* Dated November 20, 1867.

This invention relates to four former patents granted to the present patentee, the numbers thereof and the years in which they were granted being as follow:—No. 3189, year 1866; No. 1635, year 1867; No. 1905, year 1867; No. 3226, year 1867. The patentee claims under the present invention, first, the manufacture of improved malleable iron in a direct manner without cooling after the metal leaves the blast furnace, or by purifying re-melted metal in a separate vessel, and afterwards finishing it in a puddling furnace, the metal not being allowed to cool from the time it is first melted, or until finished as malleable iron, as described. Second, purifying crude molten iron in a Bessemer converter, but in place of finishing it therein, stopping the injection of blast or other oxidizing agent before the iron is completely carburized, and in place of casting the purified iron into ingots or moulds from the converter, discharging it into a puddling or other similar furnace, and therein finishing it as malleable iron. Third, the process of manufacturing steel, consisting of refining iron by oxidizing the impurities in a separate vessel, and afterwards treating it in a puddling furnace, and adding carbonaceous matters thereto at any of the points of such manufacture, as described.—Patent completed.

3283 S. COULSON. *Improvements in the manufacture of coffins.* Dated November 20, 1867.

This invention consists in making coffins partly of metal and partly of other materials, so as to form them semi-metallic, or nearly semi-metallic, for which purpose the inventor forms the framework of the bodies, bottoms, or lids, or all of them, of metal, or the bottoms or lids, or both, entirely of metal, which metal, whether as a frame or as a bottom or lid, or partly a bottom or partly a lid, he has made wrought or cast, and made whole, or in parts, or segments, and he has them plain or ornamental, painted, japanned, enamelled, galvanized, bronzed, lacquered, gilded, silvered, or electro-plated. He makes bodies, and also the bottoms and lids (except when he has the bottoms and lids of metal) of timber, paper, clay, porcelain, or glass, or partly of such materials.—Patent abandoned.

3284 H. H. LLOYD. *Improvements in means of communication applied to railway carriages, and in apparatus for making signals, which improvements are in part applicable to other purposes.* Dated November 20, 1867.

This invention consists, under one head, in an improved mode of attaching and employing signal cords for the purpose of ringing signal bells applied to a railway train. We cannot here produce the details of the invention.—Patent abandoned.

3285 T. H. TILLEY. *Improvements in couplings for boring tools.* Dated November 20, 1867.

This invention relates to a novel mode of coupling the rods used in boring earth with each other, and with their bitts or boring instruments. In order to avoid certain well-known difficulties, the patentee makes the coupling rods with a screwed socket at their opposite ends to receive a detached coupling screw, made alike at both ends, and the stem of the bitt or boring instrument he forms with a similar screwed socket, so that, by inserting the screw for (say) one half of its length in one socket, and securing the socket that is to be coupled upon the other end of the screw, a firm and strong coupling is obtained.—Patent completed.

3286 J. OPPENHEIMER. *Improvements in telegraph posts, and in apparatus for fixing the same.* Dated November 20, 1867.

This invention consists, first, in making telegraph posts by joining together a series of tubes of decreasing diameter upwards. To effect this the patentee obtains two iron tubes or pipes, made by drawing or welding in the usual manner, the one smaller than the other, and of such relative diameter that it will not pass into the larger when cold. This larger one he then heats, by which means it becomes expanded, and the smaller tube can then be passed into it. The shrinking of the heated tube for cooling binds the two together. He also shrinks hoops around the aforesaid tubes. To fix the posts they are placed in clamps formed in earth plates, and are held securely therein by screws and nuts.—Patent completed.

3287 H. GREENE. *An improved safety lamp suitable for reading and night purposes.* Dated November 20, 1867.

The patentee claims the application to lamps of an extinguisher capable of being actuated by a stem and handle, or other equivalent means, and also of a mica or talc protector of any suitable form, in conjunction or not with an ornamental or other ring above the chimney, substantially as and for the purposes specified.—Patent completed.

3288 BARONESS C. DE LAVENANT. *Improvements in coating metals and metallic articles for the purpose of protecting or preserving the same from oxidation and decay, also in the materials, machinery, and apparatus to be employed therein.* Dated November 20, 1867.

The inventress claims, first, the use of a base or compound composed of crystal or glass opal, glass borax, minium and carbonate of potash, in the proportions set forth, with or without the admixture of colouring ingredients for the purpose of protecting or preserving metals or metallic articles. Second, the use of the several compounds set forth for imparting to the aforesaid base any desired colour when mixed therewith, and subjected to the action of heat. Third, the peculiar arrangement of furnace, oven, or muffle for glazing, melting, or burning the composition applied to the surface of the meter, or other object described with reference to the drawings. Fourth, the arrangement of waggons or carriers on rails, and machinery for working the same, for conveying the articles to be operated on into and out of the furnace, all substantially as specified.—Patent completed.

3289 J. STAINCLIFFE. *Improvements in smoke consuming apparatus, parts of which improvements are applicable to other purposes.* Dated November 20, 1867.

This invention has for its chief object the consumption of smoke by, in the first instance, withdrawing the gases contained in the furnace flue, and afterwards returning the same to the furnace in a state of combustion, more or less. This result the inventor effects (taking, for example, an ordinary fluid boiler) by placing a chamber or box at the chimney end of the flue, and within it he places a fan of ordinary construction. This fan absorbs, as before named, the gas within the flue, the firing end of which is closed to the outer air. The gases collected by the fan are conveyed in a suitable pipe to the under side of the firebars, and there forced up through the same, the result being that such gases are thoroughly consumed.—Patent abandoned.

3290 W. BREWSTER. *Improvements in apparatus for boiling, washing, or cleansing and dyeing clothes and fabrics, and for other like purposes.* (A communication.) Dated November 20, 1867.

The patentee claims the construction and addition to vessels in which clothes or fabrics are boiled, washed, cleansed, or dyed, of a perforated partition or false bottom, and circulating pipes or tubes, substantially as described and illustrated, whereby a circulation of the water or liquid in the said vessels is set up, and the clothes or fabrics thereby thoroughly washed, cleansed or dyed.—Patent completed.

3291 L. B. JOSEPH. *Improvements in tramways for common roads, and also in wheels for carriages.* Dated November 20, 1867.

Here the patentee makes the tramway of a trough-like form, with the sides of the trough rapidly tapering, so that stones cannot wedge in them, and the rails are sunk so that the surface of the road is flush with the top of the rail, and the trough is made so narrow that the tire of an ordinary road wheel is unable to enter into it. The upper edges of the trough rails are suitably formed to support the wheels running upon them. The rails may be of cast or wrought-iron, or of other material, and they may be laid on longitudinal or transverse sleepers, or by any other method.—Patent completed.

3292 J. OWENS. *Improvements in the manufacture of pile and other fabrics.* Dated November 21, 1867.

This invention is applicable to those pile fabrics in which the pile is produced by floating the weft threads over the warp threads, and then cutting the weft threads, and it consists in an improved mode of weaving, by which the whole of the pile weft appears on the face, and the back is plain or bevelled.—Patent completed.

3293 W. R. LAKE. *Improvements in packing for the piston heads of steam cylinders.* (A communication.) Dated November 21, 1867.

These improvements relate to metallic packing composed of segmental rings which are kept in contact with the surface of the cylinder by the pressure of steam behind them. The improvements consist, chiefly, in the peculiar construction of the segments, whereby each one is fitted to the other in such a manner as to form a continuous steam-tight ring, which lies in a groove in the piston head. This ring is forced outward with a pressure varying with the pressure in the cylinder, and works with the slightest possible friction. Each ring is fitted into a separate groove, and the segments are constructed with tongues and recesses, which may be formed on one side of each segment, or centrally with the same. The steam is admitted into the grooves behind the rings through holes or apertures in the same, or in the piston head. When only one ring is employed, these apertures must be provided with valves. The tongues are rounded or curved from their extremities inward, and the corresponding surface of the recesses is formed and curved in such a manner that the ring may assume an oval shape without breaking the joints or forming a passage for the steam at these parts. A mortice or aperture may be formed through a portion of the segments to diminish the pressure of the same upon the surface of the cylinder, and to receive a light spring which prevents the shaking and rattling of the segments when there is no steam behind the rings.—Patent completed.

3294 G. F. REDFERN. *Improvements in paving.* (A communication.) Dated November 21, 1867.

According to this invention the patentee makes blocks or slabs of small stones, bound or cemented together in moulds of the required sizes, with asphalte or other bituminous cement. These blocks or slabs are laid on a concrete foundation, and can be laid down and taken up from the streets and roads as easily as the flagstones of foot pavements.—Patent abandoned.

3295 J. TOWNSEND. *Improvements in the manufacture of soda and potash.* Dated November 21, 1867.

This invention has for its object the manufacture of soda and potash in a more economical manner than that hitherto in use. It consists in adding to a solution of sulphate of soda or of potash, carbonate of baryta or carbonate of strontia, and lime or magnesia.—Patent completed.

3296 C. BUTLER. *Improvements in lamps for burning liquid volatile hydrocarbons.* Dated November 21, 1867.

In the reservoir containing the volatile oil a conical tube open at both ends is secured, the wide end of the tube being uppermost. The said wide end of the tube is made by preference to fit air-tight in the mouth of the reservoir. The lower narrow end of the tube reaches nearly to the bottom of the reservoir. The lower end of the said tube is filled with cotton wool or other porous material. In the top of the said tube the wick holder is screwed, the lower end of the wick resting on the cotton wool or other porous substance in the tube. The oil in the reservoir is thus cut off from direct communication with the wick, the said oil being transmitted to the wick through the capillary attraction of the cotton wool or other porous substance in the tube. The wick absorbs the oil from the cotton wool, and the cotton wool replenishes itself from the reservoir. By this arrangement the upsetting of the lamp is not attended by the spilling of the oil, and the dangerous accidents which frequently happen with lamps in which volatile oils are burned cannot occur with lamps constructed according to this invention.—Patent abandoned.

3297 S. and B. BARCZINSKY. *Improved means of producing illusory exhibitions.* (A communication.) Dated November 21, 1867.

The inventors employ boxes or casings having portions of their depths provided with a series of slits or openings. Within the box are placed illustrations in varied attitudes or positions of the figures or bodies which it is desired to exhibit. In these illustrations each view of the figure or object to be represented is delineated in an attitude or position modified from that of its neighbour, so that, when the casing is caused to rotate, and the illustrations contained therein are viewed through the slits or apertures, the figures or objects in varied attitudes, being caused, by the rotation of the casing, to pass the eye in rapid succession, convey to observers the effect of animate figures or objects continually moving or changing position.—Patent abandoned.

3298 J. F. WATSON. *The improvement of watches and other timekeepers known as the escapement.* Dated November 21, 1867.

This invention relates to that part of watches and timekeepers known as the escapement; it consists in the construction of a detent or pallet in a manner that has not hitherto been employed. The detent or pallet is made to embrace two or three teeth of the scape wheel; on the outer edge of the detent the scape wheel is locked to prevent the detent from going beyond a certain depth; into the scape wheel a reverse angle to that of the locking which is made on the detent or on the wheel. On the arbor of the detent is an arm about the same length from the centre as the locking. This arm is brought to a fine point, and should stand in a direct line to the balance staff when the wheel is locked. On the balance staff is an unlocking pallet which comes in contact with the arm and unlocks the scape wheel when it falls on the impulse pallet; before it has finally completed the impulse it comes in contact with the inner flange of the detent, and again locks the wheel; on the return of the balance the unlocking pallet moves the arm and brings the tooth of the wheel on the incline plane of the detent, but the force of the wheel brings it back to its original place, and so on.—Patent abandoned.

3299 W. R. GREEN and J. G. FREEMAN. *Improvements in steam and other motive power engines, and in valves for engines.* Dated November 21, 1867.

The patentees claim, first, constructing engines in which the cylinder moves and the piston is stationary, and in which the valves are contained in the piston, substantially as described and represented in the drawings. Second, constructing engines in which the cylinder moves and the piston is stationary, and in which supply and exhaust pipes form guide rods for the movements of the cylinder, substantially as described and represented in the drawings. Third, constructing or arranging valves for engines, substantially as described and represented in the drawings. Fourth, the combination of parts of engines consisting of cylinder, piston, valves, supply pipe, and exhaust pipe, arranged and acting substantially as described and represented in the drawings.—Patent completed.

3300 W. BLUNDELL. *Improvements in cowls or guards for chimneys, and other like purposes.* Dated November 21, 1867.

The primary object of this invention is so to construct cowls or guards as to prevent all draught down the

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chimneys or shafts to which they are applied. The invention mainly consists in the employment of a conical cap which, no matter how frequently the wind changes, always protects the chimney or shaft on the windward side, but allows free passage for the smoke on the leeward side. The conical cap is fitted or balanced on a spherical bearing or point ball and socket or other suitable joint on the top of a vertical rod carried up from the centre of a crossbar or frame at the upper part of the chimney or shaft, and the length of this rod, and the size of the cap, are so proportioned that the lower part of the cap comes on the windward side below the level of the top of the chimney when acted on by the wind. The cap being balanced on the top of the rod, the side of the cap acted upon by the wind is forced against the side of the chimney, thereby preventing the wind getting down the chimney, or by the pressure of its velocity hindering rapid discharge from the orifice of the chimney, while the opposite side of the cap at the same time rises, leaving an ample opening at the top of the chimney for the egress of smoke. —Patent completed.

3303 E. THOROLD. *Improvements in lamps for burning petroleum and other volatile oils or essences.* Dated November 21, 1867.

We cannot here give space to the voluminous details of this invention.—Patent abandoned.

3304 E. W. HUGHES. *Improvements in rotary engines and pumps.* Dated November 21, 1867.

In constructing rotary engines and pumps the inventor forms a ring which in section is a rectangular trough, having the open side inwards, or towards the centre. Within this ring a drum is fitted, so that its periphery closes the annular trough; the drum is mounted on an axis, so as to be able to rotate. In order that the joint between the two parts may be tight, the drum has flanges on either side overlapping the edge of the trough, in each of which a groove is turned, and the flange overlapping it has a corresponding groove in it. Into one of these grooves a round packing ring of vulcanized india-rubber is fitted, and it is covered with a thin annular plate of steel or other metal. Into the other groove a metal ring is fixed, and it projects so as to bear upon the thin plate, and the elasticity of the india-rubber maintains a close contact between the surfaces; or both of the grooves may contain elastic packing rings covered as above described, and holding the metal ring freely between them. When steam is used in the engine, metallic springs are substituted for the vulcanized india-rubber rings. The thin annular plates are roughened on the underside, so that they may not turn on the india-rubber packing rings. The drum has upon it a piston or stop which accurately fits the annular trough, and closes it so that steam or fluid cannot pass in the trough from one side of the piston or stop to the other. The annular trough also has two or other number of accurately fitting stops in its circumference; they slide in and out to allow the piston or stop on the drum to pass. The axis of the drum is hollow, and the inlet passage for the water or fluid is at one end of it, and the outlet at the other. These passages are continued through an arm of the drum to the periphery, where they open into the annular space close to the piston or stop which the drum carries, and one on either side of it. If the steam or fluid under pressure be supplied at the inlet, it enters the annular space on one side of the piston or stop on the drum, and its pressure acting on this side whilst it is shut off by the sliding stop in the annular trough from acting on the other side, causes the rotation of the drum. The steam or fluid in advance of the piston or stop on the drum escapes by the outlet passage; or conversely, if the fluid is not under pressure and the drum is driven, a vacuum is formed, and the fluid is drawn in at the inlet passage, and expelled at the outlet.—Patent abandoned.

3305 H. JAMES and E. DREWETT. *Improvements in water-closets.* Dated November 21, 1867.

In water-closets as at present constructed, the pan is necessarily open at the top when the valve at the bottom of the pan is open, and, consequently, an escape of foul air results from the opening of the valve. Now according to this invention the patentees arrange the handle, by which the valve of the pan is opened, at one side of the closet, so that it can be acted on when the flap or lid which closes the pan is shut down air-tight, and so as to prevent the escape of any foul gases. In order that the flaps or lids may close perfectly air-tight, an india-rubber seating is provided. Also, according to the invention, immediately under the seat of the closet, and fitting closely to it, and around the pan, they arrange a trough for containing disinfecting material, which at once deodorizes any gases which may issue from the pan on the opening of the valve. Also they ventilate this trough, which, when the flap or lid is shut, forms an enclosed chamber by means of inlet and outlet air pipes, one or both of which may be fitted with valves in connection with the flap or lid, so that, when the flap or lid is open, and the closet in use, the air-pipe or pipes may be closed, but, when the flap or lid is shut down, the air-valve or valves are open to ensure the thorough ventilation of the enclosed chamber around the pan.—Patent completed.

3306 R. LEIGHTON and T. KIRKHAM. *Improvements in the method of sewing sheets of paper forming books and pamphlets, and in machinery for effecting the same.* Dated November 22, 1867.

This invention consists in securing the leaves of the sheet firmly together by a continuous series of stitches along and through the back of each sheet, and at the same time sewing the sheets to tapes or other woven material. —Patent completed.

3307 V. BURCHELL. *A new and improved process and machinery for the manufacture of soda water and other aerated liquids.* Dated November 22, 1867.

We cannot here give space to the voluminous details of this invention.—Patent abandoned.

3308 J. WORMALD and W. B. DALTON. *An improved apparatus by which central-fire breech-loading firearms may be converted into muzzle-loaders at pleasure, and which also forms an indestructible cartridge case.* Dated November 22, 1867.

Where suitable cartridges cannot be procured, a central-fire breech-loading firearm becomes a useless weapon, there being no means of igniting a loose charge or an ordinary muzzle-loading cartridge, and the main object of this invention is to provide an apparatus by which this defect may be obviated. The apparatus consists of a loose or supplementary chamber made out of a solid piece of steel or other hard metal, bored at the one end of an inner diameter, and to a depth suitable to the charge, and, at the other, to receive a nipple, the solid piece dividing the compartment containing the nipple from the chamber which is to receive the charge being pierced with a central hole, tapped for the screwing on of the nipple. In turning this loading chamber to an outer diameter, permitting it to fit closely in the chamber of the firearm, the inventors leave an outer rim at its breech end to permit its easy withdrawal, but they cut away a part of this rim in order that the extractor by which the ordinary cartridge-case is withdrawn may pass the apparatus without extracting it. All kinds of nipples may be used for igniting the charge in the front, centre, or back, but, in order to obtain more room for the charge, they use a nipple of a peculiar construction.—Patent abandoned.

PROVISIONAL PROTECTIONS.

Dated March 10, 1868.

832 R. Cocker, Cockspur-street, Charing-cross, City. Improvements in the treatment of flax, hemp, jute, china grass, and other fibrous materials, and in apparatus to be used therein. (A communication.)

Dated March 14, 1868.

870 N. Jacobsohn, Berlin, Prussia, merchant. A new self-acting letter-box for receipt and payment, provided with a controlling and signalizing apparatus.

Dated April 20, 1868.

1280 L. M. Ruiz, Rue d'Antin, Paris, merchant. Improvements in apparatus for signalling or giving orders on board ships and in other places. (A communication.)

Dated April 29, 1868.

1396 T. and G. Cope, Liverpool, tobacco manufacturers. Improvements in machinery for moulding, pressing, and stamping cavendish and other tobacco into any desired form by suitable die-pieces.

Dated May 2, 1868.

1440 J. Maistre, Ville-neuvette, Department de l'Herault, France, manufactnrer. An improved process for dyeing wool.

Dated May 7, 1868.

1501 K. H. Cornish, South Molton-street, Middlesex. Improvements in the construction of entrenching tools, intended to be applied to firearms.

1503 A. Strauss, Basinghall-street, City, merchant. An improvement in pipes for smoking.

1507 R. Evans, miller, and J. Bruce, engineer, Birmingham. Improvements in machinery or apparatus for dressing millstones.

Dated May 8, 1868.

1509 R. K. Miller, and A. B. Herbert, Edinburgh, and H. Watson, Newcastle-on-Tyne. Improvements in knotters for straining paper pulp.

1510 G. Bowden and J. R. Dickinson, Oxford-street. Improvements in apparatus or means for protecting the points of brushes and pencils.

1511 H. N. Penrice, Wilton House, near Norwich. Improvements in machinery employed in forming tunnels and galleries in rocks.

Dated May 9, 1868.

1519 J. Norman, Glasgow, engineer. Improvements in calcining, burning, or oxidizing ores, minerals, metals, and other substances, and in reducing oxides and salts of metals and other substances, and in apparatus for these purposes.

1521 H. H. Hazard, New Cross-road, Deptford, Kent, and W. Grimwood, North-road, New Cross-road, Kent, engineers. Improvements in coiling or revolving shutters.

1523 R. Waygood, Newington, Surrey. Improvements in stoves for cooking.

1525 W. H. Wilkinson, Southampton-buildings, Chancery-lane. An improved method of combining or uniting types, and constructing cases to contain the same, for the purposes of type composition.

1526 J. H. Crane, Royal Exchange, City, gun maker. Improvements in breech-loading firearms.

1527 G. T. Seydell, Tavistock-place, Tavistock-square, Middlesex, engineer. Improvements in apparatus for heating and ventilating buildings, part of which improvements are also applicable to steam boilers or steam generators.

1528 S. Hall, Swansea, civil engineer. Improvements in the manufacture of artificial fuel.

Dated May 11, 1868.

1530 R. Moore, Glasgow. Improvements in the manufacture or treatment of crushed sugar. (A communication.)

1531 J. Crossley, Heckmondwike, Yorkshire, manager. Improvements in looms for weaving.

1532 W. Webster, whitesmith, and R. W. Barnes, photographic artist, Southport, Lancashire. Improvements in head and waist rests for the use of photographers.

1533 A. D. E. Boucher, Fumay, Departement des Ardennes, France, iron founder. An improved process of moulding hollow metallic pieces provided with a single aperture, such as shells, hollow balls, door knobs, and all articles of the same description.

1535 A. M. Dix, Shelton, Staffordshire, brewer. An improved mode of, and apparatus for, supplying finings or other liquids to casks or other vessels.

1536 C. E. Brooman, Fleet-street, City, patent agent. Improvements in furnaces or heating apparatus. (A communication.)

1537 W. R. Lake, Southampton-buildings, Chancery-lane. An improved device for holding scrubbing brushes. (A communication.)

1540 R. Lecke and J. Beevers, Barnsley, Yorkshire. Improvements in apparatus for the prevention of smoke in steam boiler and other furnaces.

Dated May 12, 1868.

1541 S. Buxton, Southgate-road, Kingsland, Middlesex, clerk. Improvements in writing and printing pens.

1542 T. Briggs, Manchester, tarpauling manufacturer. Improvements in connecting the ends of metal bands for securing bales.

1543 G. A. H. Dean, Ludgate-hill, City, stationer. Improvements in envelopes. (A communication.)

1544 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in fans, and in the method of combining the same with pocket books and other like articles. (A communication.)

1545 T. Pope, Twickenham, Middlesex. An improved curry-comb.

1546 S. P. Armstead, Barnsbury-street, Islington. An improved blow-pipe apparatus.

1547 C. Vero, Atherstone, Warwickshire, hat manufacturer. Improvements in the manufacture of hats or coverings for the head.

1548 T. Shinton, Blaina, near Newport, Monmouthshire. Improvements in forming the ends and joints of pipes.

1549 W. D. Brown, Mains, Turin, Forfarshire. Improvements in reaping and mowing machines.

1550 J. H. Nutt, Kingston-upon-Hull, oil-press, hair, and bagging manufacturer. An improved manufacture of straining surface for oil and other like presses.

Dated May 13, 1868.

1552 S. B. Boulton, King William-street, City. Improvements in the means and apparatus for landing, loading, and conveying timber in timber yards and saw mills, as also in apparatus for facilitating the sawing of such timber.

1553 F. W. and W. J. Crossley, engineers, Manchester. Improvements in machinery for breaking the boon or refuse portion of flax and other plants, and separating it from the fibres thereof.

1554 H. B. Barlow, Manchester. Improvements in apparatus for preventing the incrustation of steam boilers. (A communication.)

1555 G. Dixon, Canonbury, St. Mary, Islington. Improvements in the manufacture of upholsterers' fringes and other trimmings.

1557 S. B. Allen, Boston, Massachusetts, U.S. An improvement in rasps. (A communication.)

1558 C. Farrow, Great Tower-street, City. Improvements in apparatus for cleansing bottles, jars, and casks.

1561 W. Taylor, Woodstock-road, Poplar, Middlesex. Improvements in the construction of iron and steel ships, and in the mode of fixing wood planks to the sides and bottoms thereof to receive the metal sheathing.

1562 W. Baldwin, Blackburn, weaver. Improvements in looms for weaving.

1564 C. Iles, Balsall Heath, Worcestershire, manufacturer. Improvements in the manufacture and ornamenting of thimbles.

1565 R. M. Clunes and F. W. Davis, Worcester. Improvements in harrows.

1566 W. E. Newton, Chancery-lane. Improvements in braces or suspenders. (A communication.)

1567 F. Dixon, Clipstone-street, Middlesex, labourer. Improvements in the construction of packing cases or boxes for holding bottles containing liquids.

1568 W. E. Newton, Chancery-lane. Improvements in axles and axle boxes. (A communication.)

1569 W. Tasker, jun., Waterloo Iron Works, near Andover, Hants. Improvements in steam engines.

Dated May 14, 1868.

1571 H. Marsden and T. H. Blamires, Huddersfield. Improvements in means or apparatus employed in the process of manufacturing wadding or felted fabrics.

1572 W. Gadd, Nottinghamshire, and J. Moore, Manchester, manufacturer. Improvements in looms for weaving.

1573 J. Ashford, black ornament manufacturer, and W. H. Collins, jeweller, Birmingham. Improvements in dress ornaments.

1574 G. de S. Marie, Arcueil, near Paris, manufacturer. An improved mode of colouring or ornamenting capsules, tubes, and metallic foil.

1575 T. B. Kay, Bolton, Lancashire. Certain improvements in carding engines to be employed for carding cotton and other fibrous substances.

1576 O. Konig, Watling-street, City, merchant. A new or improved album or case for exhibiting a series of photographic or other pictures, designs, or drawings. (A communication.)

1577 J. Driver, Keighley, Yorkshire. Improvements in effecting the consumption of smoke and economy of fuel in steam boiler and other furnaces.

1580 W. E. Newton, Chancery-lane. Improvements in the manufacture of felt hats. (A communication.)

1581 W. E. Newton, Chancery-lane. Improvements in steam engines. (A communication.)

1582 V. G. Bell, St. John's Wood, Middlesex, engineer. Improvements in locomotive engines and tenders.

1584 N. Basevi, San Remo, Belgrave-road, Torquay, Devonshire. Improvements in projectiles. (A communication.)

1585 E. Ashworth, Carr Bank, Ramsbottom, Manchester. Improvements in the construction of telescopic rollers for use in machines for drying and tentering fabrics, and for other purposes.

1587 J. G. Walker, Bonnington, Mid Lothian. Improvements in dressing stone, and in the machinery or apparatus employed therefor.

Dated May 15, 1868.

1590 H. C. Crofts, Chatham, Kent, chemist. Improvements in the manufacture of bricks or building blocks.

1591 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of hollow bricks or blocks to be used for the floors, ceilings, and other parts of buildings, and in apparatus for moulding the same. (A communication.)

1592 J. H. Johnson, Lincoln's Inn-fields. Improvements in frames for containing photographs, miniatures, engravings, and other like articles, and in apparatus employed in their manufacture. (A communication.)

1593 J. Hicks, Ifield-road, Fulham-road, Kensington. The application of a method of connecting or disconnecting the bellows, or the bellows and windchest, with the notes or reeds and keyboard in certain musical instruments.

1594 F. Hyde, Hazel-grove, near Stockport, Chester, mill manager. Improvements in the construction of bevel gearing.

1595 T. Singleton, Over Darwen, Lancashire. Improvements in looms for weaving, and in shuttles used therein.

1596 S. Chambers and C. Broadhead, Brightside, Sheffield, engineers. Improved means of preventing the radiation of heat from steam pipes, cylinders, and boilers.

1597 A. Pelard, Passage des Petites Ecuries, Paris, merchant. An improved portable hydrotherapic apparatus.

1598 A. V. Newton, Chancery-lane. Improvements in liquid meters. (A communication.)

1599 J. Robey, Victoria Sugar Refinery, Newcastle-under-Lyme. Improvements in furnaces for consuming smoke.

1600 W. and G. B. Smith, Kennington Park-road, Surrey, gas meter manufacturers. Improvements in dry and wet gas meters.

1601 A. M. Clark, Chancery-lane. Improvements in the permanent way of railways. (A communication.)

1602 W. R. Lake, Southampton-buildings, Chancery-lane. An improved mode of embalming or preserving dead bodies. (A communication.)

1603 J. Price, Dublin, engineer. Improvements in testing the durability and strength of rails, and for ascertain-

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ing the efficiency of the various parts, forms, and arrangements of permanent way of railways, and in the machinery employed therefor.

Dated May 16, 1868.

1606 H. J. H. King, J. Auchinvole, and A. Patrick, Glasgow. Improvements in gauges or apparatus for ascertaining pressure.

1607 T. Briggs, Street-lane, Ripley, Derbyshire. Machinery for communicating and signalling between passengers, guards, and drivers of railway trains.

1608 A. J. Murray, Albany-road, Camberwell, Surrey. Improvements in reaping machines.

1609 R. Rayner, Lower Clapton, Middlesex. Improvements in apparatus employed for cooking, boiling, melting, and evaporating purposes. (A communication.)

1611 J. A. Adams, Edinburgh. Improvements in cooking ranges.

1612 C. Golden, Bradford, Yorkshire, gun maker. Improvements in breech-loading guns.

1613 W. Allday, Birmingham, bellows manufacturer. Improvements in forge and other bellows.

1614 A. Parkes, Liverpool-street, Birmingham. Improvements in the manufacture of parkesine or compounds of pyroxyline to render such materials more suitable for making billiard balls and for other purposes.

1615 G. Price, Dover-street, Ryde. Improvements in pianos and other keyed musical instruments.

1617 W. E. Gedge, Wellington-street, Strand. An improved process for extracting or removing wool and hair from hides or skins. (A communication.)

Dated May 18, 1868.

1621 E. Billington, Reddish, Lancashire, engineer, and W. Jolley, Heaton Norris, Lancashire, foreman. Improvements in apparatus for conveying and regulating the pressure of steam passing through pipes or other vessels, and taking off condensed water from the same. (Partly a communication.)

1623 G. Watson, Bromley-street, Commercial-road, Middlesex, engineer. Improvements in apparatus for raising and lowering weights.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated May 21, 1868.

1665 C. Chapman, Spurstowe-road, Hackney, Middlesex, master mariner, and J. Lilley, London-street, City, nautical instrument maker. Improvements in instruments used in the navigation of ships.

Dated May 22, 1868.

1693 C. Delafield, Factory Ville, Richmond, New York, U.S. An improvement in furnaces to be used in oxidizing lead, or in the manufacture of litharge.

Dated May 25, 1868.

1721 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in horses' harness. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," June 2, 1868.

175 B. T. Moore. Apparatus for protecting water pipes from injury by frost.

206 C. W. Brown. Construction of truncheons used by police constables.

211 T. V. Lee. Producing charcoal and fuel from peat.

235 T. Cook. Machinery for uniting together materials employed in the manufacture of boots and shoes.

239 H. Hodge. Gas stoves.

240 G. Kirk and W. Murray. Self-acting mules for spinning wool.

241 J. C. Sanders. Door knobs.

246 G. Allibon and A. Manbie. Steam boilers.

251 W. J. Jennings. Permanent way of railways.

254 E. W. de Rusett and R. F. Dale. Water-closets.

263 C. Kilburn. Swimming belts.

265 C. Ritchie. Apparatus for utilizing heat for warming and ventilating.

272 F. Wirth. Apparatus for heating and decomposing water. (A communication.)

284 J. Roberts and J. Morgan. Joining metallic pipes.

294 A. Pickering. Machinery for cutting out and embossing lozenges.

300 A. C. Pilliner and J. C. Hill. Machinery for obtaining motive power.

301 J. H. Johnson. Lithographic printing machines. (A communication.)

302 J. D. Brunton. Machinery for cutting and shaping stone.

325 W. Hartnell and S. Guthrie. Steam engines.

350 J. V. Jones and G. J. Williams. Manufacture of metallic tubes.

351 R. C. Smith. Construction of sinks.

354 A. M. Clark. Utilizing and increasing the lighting power of gases. (A communication.)

355 D. Murray. Coverings for the head.

360 J. and W. Weems. Apparatus for drying grain.

363 J. M. Domenech and F. P. Jonte. Photographic apparatus for outdoor operations.

450 A. M. Clark. Breech-loading ordnance. (A communication.)

453 J. Tansley. Apparatus for working the rollers of blinds.

467 W. E. Newton. Apparatus for saving life in cases of shipwreck. (A communication.)

533 A. M. Clark. Vegetable extract for culinary purposes. (A communication.)

806 W. Hartley. Preparing yarn.

1051 G. Hodgkinson. Method of producing designs upon woven fabrics.

1068 W. J. Addis. Permanent way of railways.

1198 G. T. Bousfield. Dies. (A communication.)

1261 J. Erskine. Breech loading firearms.

1290 J. Woolfield. Machinery for corrugating or fluting sheets of metal.

1343 C. Brown. Apparatus for baking, also applicable to hot pressing.

1439 H. Y. D. Scott. Kilns for burning lime.

1482 C. J. Chubb. Apparatus for getting coal

1488 W. E. Newton. Combs. (A communication.)

1495 M. A. Muir and J. M'Ilwhan. Power looms.

1498 R. A. Green. Bearings, shafts, or pivots applicable to machinery.

1511 H. N. Penrice. Machinery employed in forming tunnels.

1575 T. B. Kay. Carding engines.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed May 29, 1868.

3310	T. G. F. Dolby	3437	J. Thorpe
3413	J. C. Woolfield	3464	J. A. Scott
3414	G. Heiron	3512	Holcroft and W. [illegible] Dack
3420	D. Barker		
3421	W. Black and T. Hawthorn	3515	A. Camme and F. Delpech
3429	W. B. Leachman and J. Holroyd	3628	E. Lord
3431	S. Vaile	1078	H. Johnson
3432	J. Collingham and T. E. Smith	1083	S. Tyson
		1130	H. Johnson

Sealed June 2, 1868.

3430	J. H. Wilson	3470	E. A. Pontifex
3447	T., G. B., and B. Stephenson	351	A. M. Clark
3450	R. R. Gray	35[illegible]	W. Brownhill
3451	E. T. Hughes	35[illegible]	Paxman
3453	E. Walker	36[illegible]	A. Bonneville
3456	J. F. Clarke	200[illegible]	H. Johnson
3462	J. Mabson	215	J. H. Johnson
3463	S. Perkins and W. Smellie	405	W. E. Newton
		493	W. R. Lake
3468	T. J. Leigh	1085	J. Jordan

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1245	G. Davies	1503	W. J. Burgess
1407	J. M. Clements	1508	T. Brinsmead
1445	W. Clark	1512	H. Mallet
1466	W. Settle	1602	T. Routledge and W. H. Richardson
1494	H. Monier		
1497	F. N. Gisborne	1714	J. H. Johnson
1498	T. Summerson		

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1245	G. Davies	1430	S. Hawkins
1352	J. Ronald	1461	J. Howard and E. T. Bousfield
1358	W. Hunter		
1386	H. N. Penrice	1499	W. H. Walker
1411	E. C. Stanford		

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending May 30, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2358	0 4	2905	0 10	2965	0 4	2983	0 4	2999	0 4	3017	0 4
2304	0 4	2951	0 4	2967	0 4	2984	0 4	3004	0 4	3018	0 4
2625	0 4	2952	0 4	2970	0 4	2985	0 4	3005	0 4	3019	0 4
2802	0 6	2953	0 4	2974	0 4	2986	0 4	3006	0 10	3021	0 4
2853	0 10	2954	0 4	2977	0 4	2[illegible]	0 4	3007	0 4	3022	0 4
2878	0 6	2959	0 4	2978	0 4	2988	0 4	3008	0 4	3024	0 4
2890	0 6	2963	0 4	2979	0 4	2989	0 4	3012	0 4	3025	0 4
2892	0 8	2964	0 4	2981	1 0	2997	0 4	3014	0 4		

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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PLAIN AND ORNAMENTAL.
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Lamp Brackets do. do.
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Fountains—Garden and Drinking.
Gates, Railings, &c., &c.
Vases for Gardens, Terraces, &c., &c.
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May be Secured
BY AN ANNUAL PAYMENT OF FROM £3 to £6
To the
RAILWAY PASSENGERS' ASSURANCE COMPANY.
64, CORNHILL, and 10, REGENT STREET.
W. J. VIAN, Secretary.
A 55

WROUGHT IRON TANKS, CISTERNS
GIRDERS, FUNNELS, &c., Plain or Galvanized.
Cattle Troughs, Iron Cart Bodies, &c.
GALVANIZED OR LEAD SERVICE PIPE, BRASS BALL VALVES, ETC.
Merchants and Shippers Supplied.
HENRY WATSON & Co.,
60, VAUXHALL STREET, LAMBETH, LONDON.
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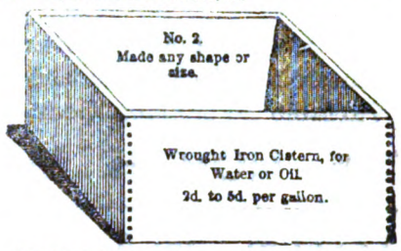
Elwell & Bartlett
IRON MERCHANTS,
SNOW HILL,
BIRMINGHAM.
One Minute's walk from the Great Western Railway Station.

BOOKS OF SECTIONS SUPPLIED ON APPLICATION.
Orders from Stock Executed on Receipt.
A 45

WROUGHT-IRON TANKS, CISTERNS
GIRDERS, FUNNELS, &c., plain or galvanised; CATTLE TROUGHS, IRON CART-BODIES, &c.


BURNEY AND CO.,
(Late BURNEY and BELLAMY,)
TANK FACTORY,
MILLWALL, LONDON, E.
A 24

PATENTED IN ENGLAND, FRANCE, &c., &c.

THE NEEDLE LUBRICATOR
(LIEUVAIN'S PATENT).
Samples 1s. 3d. each. 15s. per dozen.
This invention saves 75 per cent. in oil.
It is generally adopted for shafting, &c.
It supersedes all others at any price.
Its action is simple, effective, and complete.
Sole Consignees,
CLARKE AND DUNHAM,
PATENTEES OF THE MILLSTONE BALANCE.
48, MARK LANE, LONDON. B 42

GOLD MEDAL
PARIS, 1867.
BURYS AND CO.
LIMITED,
REGENT WORKS,
SHEFFIELD,
STEEL
AND
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FILES,
TOOLS,
SAWS. A 13

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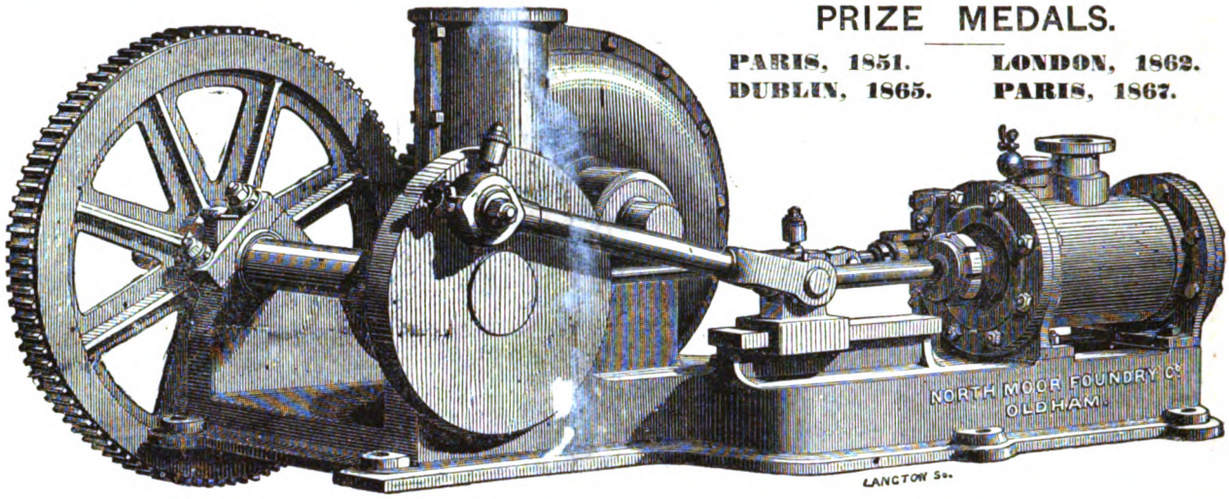


The above shows a Steam Engine and Centrifugal Pump, complete, on one frame, capable of raising 140,000 gallons per hour to a height of 25ft. Price, £150.

Schiele's Turbines, Platt and Schiele's Fans, Schiele's Blast Engines, Schiele's Governors, Schiele's Ship Ventilators, Platt and Schiele's Mine Ventilators, Schiele's Gas Exhausters, Variable Expansion Gear, Centrifugal Pumps, Patent Couplings, Cotton Gins, &c., &c.

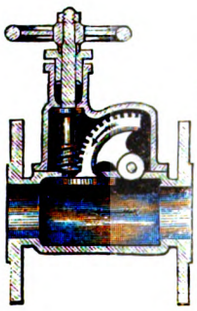
THE NORTH MOOR FOUNDRY COMPANY, OLDHAM.

B 43

JOHN WARNER AND SONS,

8, CRESCENT, CRIPPLEGATE, LONDON,

Bell and Brass Founders to Her Majesty.



WARNER'S PATENT QUADRANT MOTION SLUICE OR GAS VALVE.

It will be seen by reference to the drawing, that by this simple method a clear water-way is obtained, the disc being drawn by the screw or worm entirely out of the way; thus all the advantages of the ordinary sluice valve are obtained at much less cost, and the liability to set fast and get out of order entirely obviated. They are adapted for all purposes for hot or cold water, and equally suited for high or low pressure, and in case of need of repair a new valve seat can be applied without removing the body or case of the valve.

HYDRAULIC MACHINERY

W. & SONS' Catalogue contains Drawings and Prices of all descriptions of Hydraulic Machinery, Garden Engines, Syringes, Fire Engines, Earthenware, Cocks, Water Closets, General Plumbers' Brass Work, Baths, Bells, Braziery Goods, Lamps, Gas Fittings, and Beer Engines. A 6

WOOD BROTHERS'

PATENT OBLIQUE TRANSVERSE TUBES

For the Flues of Cornish Steam Boilers.

THESE Tubes are exceedingly simple in construction and application, and very durable. They give a greater amount of heating surface than any other transverse tube that can be put in a flue of the same piameter, consequently will generate more steam with greater economy of fuel, and they can be repaired or replaced much more readily than any others.

As these Tubes are put in obliquely, and at a proper inclination, having the flanches at both ends inside the flue, they may be put in or taken out of their places through the flue without passing inside the boiler at all, thus giving the opportunity of applying them to boilers already in use without disturbing them or taking out the flues, whatever be the relative dimensions of the shell and flue.

FOR PRICES, AND A LITHOGRAPH OF THE BOILERS, APPLY TO

WOOD BROTHERS, DON BOILER WORKS, SHEFFIELD.

B 1

THE

LIQUID METER COMPANY

(LIMITED),

A. A. CROLL, *Chairman*. GEORGE RAIT, *Managing Director*.

238, Kingsland Road, London, N.E A 19

GOUT and RHEUMATISM.—The excruciating pain of Gout or Rheumatism is quickly relieved and cured in a few days by that celebrated medicine, BLAIR'S GOUT and RHEUMATIC PILLS.

They require no restraint of diet or confinement during their use and are certain to prevent the disease attacking any vital part.

Sold by all Medicine Vendors, at 1s. 1½d. and 2s. 9d. per box or obtained through any Chemist. A 4

DINNEFORD'S FLUID MAGNESIA.—The Medical Profession for thirty years have approved of this pure Solution of Magnesia as the best remedy for Acidity of the Stomach, Heartburn, Headache, Gout, and Indigestion: and as the best mild aperient for delicate constitutions, especially adapted for Ladies, Children, and Infants.

DINNEFORD AND Co., CHEMISTS,
172, New Bond-street, London,
And of all other chemists throughout the world. A 59

THE BEST REMEDY FOR INDIGESTION.

NORTON'S CAMOMILE PILLS are confidently recommended as a simple but certain remedy for Indigestion. They act as a powerful tonic and gentle aperient, are mild in their operation; safe under any circumstances; and thousands of persons can now bear testimony to the benefits to be derived from their use.

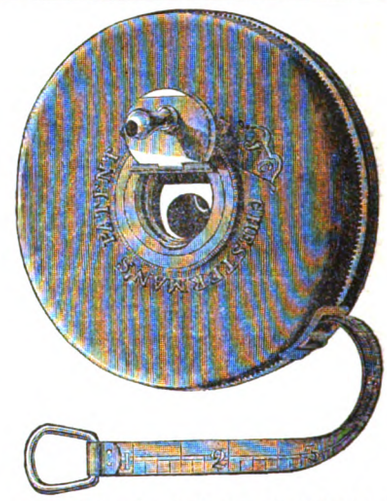
Sold in bottles at 1s. 1½d., 2s. 9d., and 11s. each, in every town in the Kingdom.

CAUTION!—Be sure to ask for "NORTON'S PILLS," and do not bepersuaded to purchase the various imitations. A 54

SECOND-HAND CASES of MATHEMATICAL INSTRUMENTS, Theodolites, Levels, Pentagraphs Quadrants, Sextants, Universal Dials, Protractors, Circumferentors, Prismatic and Beam Compasses, Ivory, and Boxwood Scales, Land Chains, Tapes, &c., by Troughton and Simms, Elliott, Dolland, and others, at WM. LAWLEY'S 78, Farringdon-street, City.

Photographic Camera Lenses, Magic Lanterns, Slides, Dissolving View Apparatus, Microscopes, Telescopes, Opera, Race and Tourists' Glasses, by Voigtlander, Ross, Dolland, and others. Instruments bought or exchanged.

N.B.—Revised and enlarged Catalogues forwarded on receipt of three stamps for each. A 42



(Half-size drawing of Chesterman's Patent Steel Measuring Tape, 66 feet.)

JAMES CHESTERMAN & CO.,

SOLE MANUFACTURERS OF CHESTERMAN'S PATENT

SPRING, METALLIC, STEEL,

AND OTHER

MEASURING TAPES,

IRON & STEEL LAND CHAINS;

SINGLE & DOUBLE-ACTING DOOR-SPRINGS

ENGINEERS' TOOLS, &c., &c.

BOW WORKS, ECCLESALL ROAD, SHEFFIELD.

NOTICE.—*All goods marked with the name and*

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A 27

Printed by ROBERT SMILES, and Published by him at the Office of ROBERTSON, BROOMAN, and Co., 166, Fleet-street, in the Parish of St. Dunstan-in-the-West, in the City of London.—Friday, June 5, 1868.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JUNE 12, 1868.

THE COST OF OUR SHIPS OF WAR.

IN our impression of March 20 last, we called attention to the absurdity of the method of account-keeping adopted by the Admiralty, in which immense sums of money, designated "incidental expenses" and "establishment charges," are charged to the cost of ships built in our Royal dockyards, whereby Government-built ships are represented as costing over 50 per cent. more than ships built in private establishments. In the one comparison we instituted between the alleged cost of the "Bellerophon" and the "Agincourt," we showed by figures taken from the printed official return that the former vessel, built at Chatham, was charged with no less a sum than £114,424 for "incidental expenses" and "establishment charges." As we know that our criticisms—written, as they always are, in a spirit of reason and fairness—have not previously been void of good results, we intend making a few additional remarks upon this important question.

On reference to the return before us, printed July 22, 1867 (the latest return published), we notice an item of £30,000 for landing, surveying, receiving, depositing, and issuing timber for the several home and foreign dockyards. Now, the distribution of the whole of this item over the ships built and repaired does not offer grounds of fair comparison between the cost of ships built in private and in Government yards. It must be apparent that the large stores of timber kept in our Royal dockyards, on which this additional outlay of £30,000 is expended, is an accumulated stock, and largely in excess of the present demands of the service, whereas but very small stocks of timber are required to be kept in private yards. We cannot in justice accuse the shipbuilding officers of her Majesty's dockyards of mismanagement and want of judgment in accumulating such large stocks of timber as we appear to possess; these immense stores of timber have resulted from the desire of successive Boards of Admiralty to possess the means of greatly increasing our navy in the event of war. There is now, in these days of iron and steel ships, no necessity, if there ever was, for keeping these huge stacks of timber to perform their part in swallowing up the Navy Estimates; no private shipbuilder thinks of purchasing such a stock as we have stacked in our public dockyards, and it is evident that our Government-built ships have to bear a charge in this respect which private-built ships have not.

The next item we notice is an aggregate amount of £56,000 for landing, surveying, receiving, depositing, and issuing stores for the several home and foreign yards. A large portion of this sum is expended on stores supplied for the maintenance of ships in commission and reserve, and it certainly is the reverse of all correct business-views to charge sums so expended to ships repairing and building.

In the return before us, page 23, we find the immense sum of £409,883 1s. 1d. for "establishment charges." This tremendous item is not so explicit as we could desire. It stands as follows:—

	£	s.	d.
For salaries paid for supervision and for establishment contingencies	161,498	3	3
For wages of dockyard craftmen	18,250	15	11
For wages of the Metropolitan Police force employed in the dockyards	30,481	0	0
For freight and sundry charges on naval stores	20,349	7	11
For survey valuations	1,548	3	9
For amount of interest charge for plant	44,787	0	0
For loss on stock ascertained on its re-valuation at the end of the year.	116,981	2	2
For difference between the rate-book value of manufactured articles and the cost at which they have been produced	16,007	8	1
	£409,883	1	1

It is possible that this vast total may comprise charges as little connected with the actual cost of shipbuilding and repairing as with shipwrecking. But however this may be, it is certain that our dockyard establishments are supported on a scale, and maintained in a way, which render it unreasonable to compare them with the scale and manner of private shipbuilding firms.

There is an item of £7,659 for shipping off timber and stores to other dockyards at home and abroad. This is a comparatively small amount, but why it should be charged to ships building and repairing at our home yards we are, as in the other cases, at a loss to divine. There is also a further sum of £8,918 for the preservation and deterioration of timber and stores, the principal part of which outlay is incurred, we should say, from a deliberate State policy, and not from the actual requirements of the existing dockyard works.

We have quoted sufficient figures to show the gross anomalies and unintelligible arrangements which exist in the present system of dockyard, or, rather, Admiralty account-keeping. We do not say, looking to all the objects of our dockyards, that the whole of these expenses are unnecessary, and, therefore, useless and wasteful; but we do say that it is out of all reason to charge these immense and various sums to ships building and repairing in our Royal dockyards; and it is of necessity destructive of a correct basis of comparison between the cost of ships built in our public and private shipbuilding establishments. The blunder of the present system will be immediately seen if we imagine all shipbuilding and large repairs to be excluded from our Royal dockyards. This arrangement would not dispense with our principal home dockyards, nor our eleven dockyards abroad, the cost of which would still go on in refitting and repairing ships in ordinary and commission; but these minor works would have to bear the whole cost of these dockyards, and the apparent cost of these trifling refits and repairs would be enormously increased.

Here is another point deserving attention. It is well known that steam engines of large size are not manufactured in the factories in connection with our Government dockyards, these factories being principally occupied in repairing engines and replacing old or worn-out boilers. The original engines and boilers, being first manufactured by private firms, are not charged with any portion of the cost of maintaining these factories, while the ships building in her Majesty's dockyards are charged with the greater part of them.

It must be manifest that the great and important objects which our Royal dockyards are intended to fulfil, in times both of peace and of war, are not of a description to warrant our semi-naval accountants in charging the whole of these so-called "incidental expenses" and "establishment charges" to the building and repairing of ships. These dockyards are a national institution, intended for the safety and protection of the country at large. Whether they subserve that purpose, or whether we should do better to entirely rely upon private firms, is another question. Be this as it may, it is no part of our purpose to raise a howl for the closing of our Government establishments. There is no doubt upon our minds, from what we have ourselves seen and know, that there always has been, and still is, a shameful waste of the public money in the management of our public dockyards. But this is no reason why we should clamour for their abolition. We ask for their complete reform, not their destruction. We do not see the reason for keeping up the heavy establishment expenses which at present exist. We have no hesitation in objecting to the present naval superintendents and their staff, to a large portion of the existing storekeeping, account-keeping, and clerical staff, to a considerable part of the metropolitan police force, and many other sources of expenditure. We do not say that these services are absolutely useless, looking, as we before observed, to all the objects of our public dockyards, but we do say that they may with safety be curtailed without the least injury to the public service. At any rate, they form no part of the legitimate cost of shipbuilding and repairing. The accounts before us are little better than a huge jumble of words and figures, serving to annoy the faithful critic, but affording little reliable information. It would be well if some member of Parliament were to move for a return of every person employed, together with the salaries they receive, in the account-keeping department of the Royal dockyards and Admiralty. We should then know what we pay for these pretentious accounts, which are, to say the least, like "sounding brass or a tinkling cymbal," signifying nothing.

PHOTOGRAPHY AS AN ART.

THE art-claims of photography do not stand upon a very firm footing, as the most biassed artist-photographers unconsciously admit, by writing so vigorously in defence of those claims. If photography naturally took its position as one of the highest arts, the subject could never have been made a matter of dispute at all, for the bare fact would be so self-evident as to be beyond question. The painter in oil, with trained skill, is able to put the purest and brightest of the ideas floating through his brain, upon canvas. The photographer may have those ideas, yet what can he do? Suppose a lady, with an outline like that of a giraffe, and a face like a pelican, to come into his studio, no artistical taste upon earth will enable him to produce from such a form a "thing of beauty" which shall be a "joy for ever." The photographer may have a perfect idea of the utmost beauty possible in the human leg, but let a real leg be placed before his camera, and the faithful lens will limn the protruding veins, the disfigurements caused by the boot or garter, and many other little matter-of-fact things which the artist in oil is enabled to suppress. Hence hard facts prevent photography from taking a high place as a fine art. The artist with the camera deals with hard facts, but the artist with the brushes deals with the glorious pictures of the imagination.

Yet is good taste and a knowledge of the principles of art, an inestimable boon to the photographer. He can then soften down the peculiarities of nature, and render personal defects less obtrusive. By judiciously arranging his lens for diffusion of focus, he will get rid of freckles on the face; by properly arranging the sitter, he will manage that a nose of vast prominence shall not be taken from a side-face point of view; and he will refuse altogether a lady with black hair who insists upon being taken in a white dress. With gentle words he will persuade those stout old ladies who always carry blue cotton gingham umbrellas not to be taken before a background representing a vast mansion with terraces and marble fountains, and when sitters take their places in an arm chair he will not choose as a background a representation of the free and roaring sea. Where do ordinary people lean against pillars, or convulsively grasp the backs of tall chairs, except in photographs? As a rule, photographers who perpetrate these deeds have no art taste. These are the men who place the arm of the sitter upon the table, and let the hand hang down flat

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like a flounder, while the eyes stare very hard at nothing, and they have no ideas in their heads to lead them beyond such a performance. The mind of an artist is, strange to say, so visible in his photographs, that sometimes his pictures may be recognized by the art principles alone which they embody.

Children are the greatest nuisances to photographers. The little ones will never sit or stand still; so, if the photographer is not clever enough to keep his chemicals and apparatus in the best order, so as to work nearly instantaneously, so many pictures usually have to be taken that he gains little by a successful issue to his exertions. The same plan is adopted in taking children as in taking horses, that is to say, when the plate is ready for exposure their attention is suddenly arrested by a shrill whistle, or something of the kind, which makes them prick up their ears and keep quiet for a second or two. Sometimes the attention of children must be arrested for a longer time, and the unfortunate photographer is obliged to go behind his camera, then jump up and down and crow like a cock, clapping his hands at the same time, and if these gymnastic performances make the child stare at him steadily without moving, for thirty seconds, that photographer is a happy man, and may find a good likeness on the plate. But photographic faults have a knack of coming more upon these plates than upon others less troublesome to expose, and he probably finds in the picture a broad black comet springing from the nose of the child, so that all the work has to be done over again.

Very frequently it is the fault of the parents, and not of the photographer, that the pictures of their children are unpleasing. They bring the little one, dressed up within an inch of its life, with hair curled with mathematical smoothness and accuracy, the whole resulting in a picture like that of a dressed-up doll. Children have a natural grace of their own, and the less they are artificially ornamented, the more pleasing, as a rule, is the resulting figure. M. Adam Salomon, whose pictures created such excitement at the Paris Exhibition, acts very summarily in cases like that just mentioned. He usually makes the mother take off most of the clothes and artificial trappings of the child, and photographs it very nearly in a state of nature, preferably while lying on a couch and playing with a toy or flower. English mothers would not so readily submit to such dictation, possibly because the education of the people, and, consequently, the public taste, is at a much lower ebb here than in France. This very fact, irrespective of the capabilities of the photographer, is one reason why the Parisians excel us in portraiture.

In landscape photography a taste for the beautiful combined with an accurate knowledge of the powers of his lenses, is a great help to taking good pictures. Wide stretches of open country are seldom pleasing in photographs, except, perhaps, when the operator is so skilled in his art as to be able to secure great fleecy masses of natural clouds. A good foreground is everything in a landscape photograph, and this part of the picture at once shows whether the manipulator is a high-class man or not. In short, there is nothing so easy as to become a bad photographer, or so difficult as to become a good one, and a good taste for high art is one of the essential requisites necessary to raise a photographer above the dead level of those who work with the camera, without sufficient qualifications to do credit to the craft.

NEW PROCESS FOR COATING IRON WITH BRASS AND SILVER.

IT appears that Bavaria is inflicted with patents of impossible processes just as we are. We noticed lately, in our "Notes on Recent Discoveries," a process by one Toderer. His process is for silvering hooks and eyes made of iron wire. Even his process for cleaning the hooks and eyes is unique. He suspends them by means of zinc in a copper vessel containing diluted sulphuric acid until the iron shows a clean surface. In the first place, why a copper vessel? Apparently, it does not assist in producing an electric current, for the zinc and the iron will act as an electric pair, making the iron negative. If the copper vessel were connected with the hooks and eyes, it ought to be by means of iron or copper wire: then the hooks and eyes would be positive, which, we think, would be the most likely way to cleanse the iron in a mineral acid; but apparently that is not the mode, and if it is not, then we should recommend a stoneware pan to contain the acid. After the hooks and eyes are thoroughly cleaned, they are rinsed and placed in a brassing solution composed of a mixture of sulphate of copper, sulphate of zinc, and cyanide of potassium.

We consider this an impossible solution. Of course, these ingredients can be mixed, but the moment they are so, the cyanide and the sulphates will commence to destroy each other, and in the end the solution must be either a sulphate solution or a cyanide solution—it cannot be a mixed one. The addition of the cyanide of potassium to the sulphates would cause a reaction to take place; cyanides of copper and zinc and sulphate of potassium will be produced, and if there be not sufficient cyanide of potassium added to decompose the whole of the sulphate and to dissolve the precipitate, all that will take place will be that the sulphate solution will be deprived of part of its metal, the cyanides of copper and zinc being insoluble in the sulphate solution. But there must be sufficient cyanide to throw down all the metal and to dissolve the precipitate, otherwise brass cannot be deposited from these ingredients, for brass cannot be deposited from a sulphate solution; therefore, really the solution is an impure cyanide solution of zinc and copper. When this solution is pure it is an indifferent brassing solution, and making it in this manner will cause it to be half sulphate of potassium, which will make it still worse.

The proper way to make it is to first prepare the cyanides of copper and zinc, and, after having washed these salts in pure water, dissolve them in an excess of the solution of cyanide of potassium. Though this solution were prepared as carefully as possible, it is one that we certainly should not use for brassing, because the cyanide dissolves the copper twice as rapidly as it does the zinc, and also deposits it in the same ratio. We next come to the silver solution, which is certainly an extraordinary one. It is a mixture of nitrate of silver, cyanide of potassium, and sulphate of soda, which, when the reaction has taken place, will be cyanide of silver, cyanide of potassium, nitrate of potassium, and sulphate of sodium. The real depositing solution in this mixture is cyanide of silver dissolved in cyanide of potassium. The sulphate of sodium and nitrate of potassium are merely impurities which prevent the proper working of the solution. But Dingler says that it "answers all requirements." All we can say is, that the requirements are not great or very particular, or the users of it would have availed themselves of some other process out of the many infinitely superior processes which are already in use, and not have taken the trouble to patent such a hodge-podge as this.

Certainly, we have no room to boast of our superiority in the matter of patents over the Bavarians. Let anyone go to our Patent Office Library and take a day at reading specifications, and we think he will be impressed with the idea, at the end of that day, that our Patent Office is the receptacle for all the absurdities under the sun. But then there are true inventions described in some of these specifications, and one of these is sufficient to redeem the institution from the follies of a thousand of the others. It certainly would be a great advantage if true inventions could be sifted from the pretended ones; but we do not see that it is possible. Who is to decide, in many cases, what is a true invention and what is not? We do not see that any tribunal could be trusted in such a matter, for many real inventions have been denounced as chimerical; for example, Bessemer steel, and Gifford's injector. It is the danger of rejecting such as these that makes us willing to tolerate the perpetration of such folly as we see in the greater number of patents.

THE SOCIETY OF ENGINEERS AT THE MIDLAND RAILWAY WORKS.

THE first of the series of visits by the Society of Engineers, during the present vacation, to public works, was made on Friday last, when the members and associates mustered strongly on the works of the Midland Extension Railway at St. Pancras. The great centre of attraction was, of course, the magnificent roof now in course of erection, which is at present the largest in the world. How long it may remain so we cannot say, as the present fashion of bigness in works of this class is very likely to lead to its eclipse—if only by a few inches. However, this roof is certainly a triumph of engineering skill, and requires to be seen to be realized. We saw the working drawings many months since, but until we examined the structure itself we could not properly conceive its magnitude. In order to convey to our readers some idea of this great work we have illustrated and described it generally in our present number on another page, and shall, in succeeding numbers, give further drawings of the details. It will be, therefore, unnecessary here to do more than refer to the progress of the roof, which was designed by Mr. W. H. Barlow, the consulting engineer of the works. The engineering details of the superstructure were designed by Mr. R. M. Ordish. Mr. F. Campion is the resident engineer of the extension line, the assistant resident engineer being Mr. W. M. Grier, by whom the company were received and courteously conducted over the works on the present occasion. Amongst the members and associates present were Messrs. Baldwin Latham (president), C. J. Light (vice-president), William Adams, John H. Adams, Alfred Williams (honorary secretary and treasurer), Perry F. Nursey (auditor), G. W. Harris (secretary), George W. Allan, Frederick Colyer, Francis E. Houghton, George Waller, John J. Horner, Lewis Olrick, John Pinchbeck, Thomas F. Fillary, W. Lloyd Wise, Henry J. Coles, J. C. Mewburn, Henry Gore, James Knox, F. J. Marshall, James Howard, William Hendry, &c.

The roof is 689ft. 4in. long, 240ft. wide (being 5ft. wider than the timber roof of the Imperial Riding House at Moscow), and 100ft. high at centre from the top side of the girders carrying the platform to the underside of the arched ribs. The total quantity of wrought and cast iron required for this structure is about 6,000 tons, which is supplied by the Butterley Iron Company, who have designed two remarkably fine travelling stages for constructing the roof. The contract price for the roof proper, including iron, slate, glass, and wood, is £120,000, which will, no doubt, be somewhat exceeded before the contract is completed. With regard to the progress of the works, we may observe that fourteen of the main ribs are in place, and a portion of the roof is covered in with slates and glass. The flooring, which is laid with Mallet's wrought-iron buckled plates, is nearly completed.

After inspecting the roof and the station works, the party proceeded down the line to the Agar Town coal depôt, which has been

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designed and constructed by the proprietor, Mr. Samuel Plimsoll, with the view of facilitating the delivery of coal from the railway to the merchants. The arrangements for economizing time and labour in delivery, and for ensuring a minimum of smalls, are practically perfect, and reflect great credit on Mr. Plimsoll in an engineering point of view. The tramways are carried on an elevated platform or viaduct, along which are thirty shoots through which the coals are delivered into the sacks below, where they are loaded into the vans. There are thirty delivery sheds under the platform corresponding with the number of shoots, and these are rented by the various coal merchants. The coal trucks from the adjoining railway are first placed on a traverser at a point central to the length of the viaduct. The lines of rail have a slight inclination from this point to each end of the works, so that a traverser, with its loaded truck, has only to be started on its course, by horse power, when it continues on its way of itself, being stopped by brakes opposite the shoot for which it is destined. Each shoot is approached by a short line of rails at right angles to the main line, and upon which there is room for three trucks to stand at one time. As soon as a truck is emptied it is pushed beyond the shoot on to another traverser upon a line of rails, by which it is brought up to the centre point again and passed back to the railway. This arrangement permits the operations of delivering coal to the merchants to be carried on without any delay or confusion whatever. The full trucks come on and are moved to the various delivery points, and the empties are drawn off and returned to the railway with rapidity and precision.

The weighing into sacks and loading into vans below is also quickly performed, the tail of the van being close against the weighing machine. The coals are screened as they pass down the shoots by means of screens formed of perforated plates, the holes in which are so arranged that there is no continuous surface down which the slack can run from the trucks into the sack. As already observed, the fracture of the coal is reduced to a minimum, by keeping the shoots always full; a trap door at the bottom of each shoot enables the delivery to be regulated. This saving in breakage is estimated to enhance the value of the coal about 1s. per ton. In short, these works are exceedingly well arranged, and all their details carefully studied. We cannot perhaps give any better proof of their perfectness than by stating that the coal depôt of the Midland station at St. Pancras is arranged on the same principle; in fact, the engineer of the line obtained plans from Mr. Plimsoll, which have been carried out under his superintendence.

The trip concluded by a visit to the Midland Railway goods depôt, which is very extensive and well arranged. A traverser particularly attracted attention, being worked by hydraulic power, and completely under the control of the brakesman, who can start and stop instantly. On the whole, the trip was highly successful, as affording valuable information upon points of engineering in a work of construction, the largest of its kind in the world.

SALT IN FRANCE.

FRANCE is by no means well or cheaply supplied with that great necessity of life—salt. On the contrary, this commodity is comparatively scarce, and therefore dear, besides which it is, as a rule, of very inferior quality. Its scarcity is especially felt in the western parts of France, as evidenced by the fact that while on the east side of that country, the works of Nancy, Dieuze, Salins, Marseilles, and Cette, annually manufacture 550,000 tons of salt, the west only furnishes 150,000 tons. Of this quantity only 10,000 tons are of good quality, being derived from the small works of Salies, Briscous, and Villefranque, and being the produce chiefly of the evaporation of brine springs. The other 140,000 tons are furnished by the Marais Salants de l'Ouest, being the produce of the evaporation of sea-water, and containing 14·20 per cent. of impurity. It must, therefore, be a matter of congratulation with our neighbours to have discovered a deposit of rock salt, of a superior quality, and in the very locality where it is most needed. This discovery has been made in the department of the Landes, near the town of Dax. The salt was first discovered by borings made close to the ramparts of the town, on which occasion the chief government mining engineer, in his official report to the Prefect, stated that a first layer of salt had been pierced of 15 metres (nearly 50ft.) thick. This first layer was subsequently proved to overlie a second one, being only separated from it by a thin layer of saliferous clay. A shaft has been sunk on the spot, and the above-named second layer of salt has been reached. A fresh boring has been executed at about one mile from the first, due south, and within the limits of the concession. Here several layers of rock salt have been pierced, of a total thickness of 131ft.; in fact, the part of the concession now proved to contain salt will furnish about 200 millions of tons, for all practical purposes an inexhaustible quantity. The average composition of the rock salt, as it is brought to surface, will be seen by the following analysis, which has been made by Mr. F. Maxwell Lyte, F.C.S. It shows that the salt, as it comes up in the rough state, contains 97¾rds per cent. of pure salt.

	Parts.
Chloride of sodium (salt) . .	97·6790
Sulphate of lime.	0·4012
Chloride of calcium . . .	0·4588
Chloride of magnesium, Chloride of potassium, Bromine	Trace.
Insoluble residue, clay, siliceous sand, selenite	1·4610
Total . . .	100

Looking at the discovery in a commercial light, there can be no doubt that it presents great attractions for the capitalist. These are enhanced by the circumstance that the deposit is situated at the junction of three lines of rail, on the Chemin de Fer du Midi, one leading north to Bordeaux, 100 miles; another south to Bayonne, 30 miles, and thence to the centre of Spain; and a third east to Pau, and along the chain of the Pyrenees, through the southern departments of France. The Adour, a navigable river, running into the sea at Bayonne, flows through the territory in which the salt was discovered. Taking all these matters into consideration, it is not surprising to find that a company has been formed for purchasing and carrying out a concession of this salt deposit, which has been granted by the French Government upon highly favourable conditions. The objects of the company are twofold. In the first place, they propose to establish salt works which will produce 30,000 tons of refined salt per annum. Fuel—the most important item in the manufacture of salt—is obtainable from large deposits of lignite coal in the neighbournood of Dax, at a very low cost. Labour is also cheap, so that estimates of returns show a very good interest upon the outlay in this respect. Then, the works will include the extraction and sale of rock salt for agricultural and manufacturing purposes, and for exportation, for which purposes salt is exempt from duty. Beyond this, it is proposed, in course of time, to establish chemical works for the manufacture of alkali, bleaching powder, muriatic acid, and the other derivatives of salt, but this extension of operations will be postponed until the manufacture and sale of salt have been brought into thorough working order. Apart from the importance of the discovery to France, in a national point of view, it is of consequence as a means of legitimately employing capital, and we are glad to observe the spirited way in which the matter is being taken up. The development of the salt produce and manufacture in the west of France will not only benefit the country, but will—if carried out as proposed—prove remunerative to private enterprise.

PRACTICAL TELEGRAPHY.

THE value of such a work as Mr. Culley's "Handbook of Practical Telegraphy" * cannot be better shown than by the short time it has taken to arrive at its third editions Of its utility and the way it is appreciated, the fact that it is adopted by the Electric and International Telegraph Company and by the Indian Government Telegraph Department as a text book is ample evidence. It is the exception rather than the rule that works on telegraphic or electrical subjects should extend beyond a first edition. We cannot, therefore, but hail the fact of a book on this technical subject running to a third edition as a proof of the greater interest that is felt now in the science than formerly.

The edition before us is a revision and an enlargement of the previous one. The principal addition appears to be in the appendix, where we find considerable matter that increases the value of the present work. Amongst this matter we may mention a table of "Resistances of a knot-pound of copper wire of varying conductivity, at different temperatures," which cannot but be of great value to all electricians, particularly to those in any way engaged in testing submarine cables—a branch in which the careful testing of the copper conductor for resistance, and for conductivity as compared with pure copper now plays so important a part. The table of squares and logarithms is particularly useful, and to those engaged in out-door work, or any operation where carrying a number of books is undesirable, this addition will be especially welcome, as it will enable them to make difficult calculations easily, and obviate the necessity of always carrying about with them a book of logarithms. Where large multipliers are used, as, for instance, in giving the resistance of the insulation of wires, the use of logarithms is a necessity, and we doubt not that all who use Mr. Culley's book will be grateful to him for supplying them with the means of making those calculations in a more expeditious manner.

The book, as in the previous edition, is full of original and valuable information, carefully culled from standard works, and also contributed by well-known electricians, all of which are in the most praiseworthy manner properly credited to their several authors. Mr. Culley is very particular in this respect, and he states in his preface that he "thanks his friend Mr. Preece for his valuable help, and expresses his obligation to those members of his staff who have so kindly and effectively assisted him." And "he must also thank Mr. Chatterton, Mr. Latimer Clark, Mr. Fuller, Mr. Hooper, Mr. Flemming Jenkins, Mr. Varley, and Sir C. Wheatstone for the information they have so courteously supplied." In this particular respect Mr. Culley sets an example that all authors should be careful to follow, for it may be relied upon that information will be the more likely to be given when it is known that it will be properly acknowledged than when the case is otherwise.

The explanation of rules or laws, or any matter touching difficult or intricate points,

* "A Handbook of Practical Telegraphy." By R. S. CULLEY. Third Edition. London: Longman, Green, Reader, and Dyer. 1868.

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is always anything but an easy task, however plain and simple the explanation may be; but, from our own experience, nothing is explained so easily, or fixed so indelibly on the mind, as when the information is accompanied with a plain and straightforward diagram. It is in this respect, and in this only, we notice any shortcoming in Mr. Culley's handbook, and we submit for his particular consideration the policy of giving in his next edition more diagrams explanatory of the various points at present without illustration. We believe the policy will be a wise one, rendering the book more valuable and more sought for. When so many excellencies are found collected together, it is difficult to find one more than another that deserves special mention. If we were to make an exception, it would be in favour of the various chapters on testing, in which more varied and useful information will be found collected than can be obtained from any other work.

By publishing such a work Mr. Culley deserves the thanks of all interested in the progress of telegraphy. He places in the hands of the manipulator, of the inspector, in fact of all engaged in telegraphy, a means of accumulating knowledge of the science they are humble workers in. To those unacquainted —as doubtless many are—with any of the mysteries of the science, he places within easy reach a method of making them practically and theoretically acquainted with facts and laws that must of necessity, by increasing their own knowledge, render themselves more valuable not only to themselves but to their employers. To the electrician, to the telegraphist to whatever particular duty he may be assigned, to all interested in telegraphy, we specially recommend the volume before us. To the electrician and telegraphist it will be handy as furnishing facts and memoranda it will be so constantly necessary for him to refer to in his ordinary daily routine. To the scientific man and erudite professor of science it will afford practical examples and facts that may probably prove the correctness of many a well-thought theory. We congratulate Mr. Culley on his rôle as an author, and consider he has done a beneficial act in giving to the world the result of the experiences gained in a life long given up to the study and practical operations of telegraphy.

ENGINEERS AND ARCHITECTS' DIRECTORY.*

THIS is a great book literally, extending as it does to nearly 1,000 pages imperial octavo; as regards paper and printing it is capitally "got up"; but it has merits of a much higher order than those that attach to mere bulk or typography. It is the last addition to the genus Annual, species Directory, and a finer child, or one giving better promise of vigorous life, was never before added to that large family. The publishers, in their preface and elsewhere, modestly bespeak the indulgence of their subscribers and professional friends for any shortcomings that may attach to their first attempt at compiling such a work as they have produced, and profess themselves fully alive to the scope for error—of omission and commission—which it presents. That omissions may have been made may be readily believed, but that wilful sins of either omission or commission have been committed, will not, we think, be alleged. The book contains sufficiently abundant internal evidence of care and impartiality in its preparation to prevent even the suspicion of such faults.

The plan of the book is based upon enlarged and liberal ideas, and, so to speak, the framework leaves nothing to be desired, although the panels may probably, by the help of the trades and professional men interested and appealed to, be more completely filled up in future editions. It must be evident, indeed, that this bold enterprise can only prove successful and the book be made as useful as it ought to be, and as it is capable of being made, by the cordial assistance and co-operation of the professional men most immediately interested. The publishers appear to have done their duty, and it must, to a considerable extent, depend upon the generous co-operation of others whether the publishers' care and cost has been squandered fruitlessly or well applied.

We note the following among the principal features of the book:—A professional directory, comprising an alphabetical classification of architects, sculptors, engineers, surveyors, and constructors of important public works in London, and the chief cities, towns, and places in England, Scotland, and Wales; including a record of noteworthy facts in the professional history of our living architects, engineers, and others, and of those prominently identified with the execution of important public undertakings. And, again, a trades' directory, comprising in one general alphabetical classification of trades the names and addresses of builders, contractors, shipbuilders, and engineers; granite, stone, slate, brick, and timber merchants; metal founders, and of the other industries connected with architecture and engineering in England, Scotland, and Wales. The information collected in this division has only existed hitherto in the diffuse and scattered form of a library of separate city and provincial directories, which could only be consulted at a heavy cost of time and money. The next section of the work consists of an alphabetical list of cities and towns in Great Britain, giving a classified local directory for each place, specially adapted to the requirements of architects, engineers, contractors, builders, shipbuilders, iron and brass founders, stone and metal workers, art workmen, clerks of works, out-door foremen, and other classes of industry connected with construction. The lists in this division are, in some instances, rather meagre, but it will be comparatively easy, the plan being laid down, to supplement them in future editions. Great difficulty attaches to the compilation of such lists, from the fact that there are firms doing very large businesses, as contractors, for instance, who may have a dozen temporary offices in various parts of the country, according to the exigencies of their contracts, and who may not have withal any settled local habitations as firms. The completeness of the lists in all such cases must necessarily depend upon the communication of the necessary information by the firms themselves, to whom a cue may not readily be found by the compilers.

Another division of the book, the place as well as the importance of which should have entitled it to an earlier notice at our hands, is the concise yet comparatively exhaustive account given of the institutions and societies connected with architecture, engineering, and practical science. We do not know of any other single volume which contains, in as compact a form, as full information as is given here concerning these associations.

The classified list of protections to inventions granted in 1867, is novel, and will be useful, we doubt not; but we venture to suggest that in future editions it will be better to give, under a similar classification, which appears to be thoughtfully done, the patents actually sealed, rather than those for which provisional protection has been granted. There is an advantage, doubtless, in the precision secured in taking the applications for the year; and even abandoned patents, although many of them are egregiously foolish, have often a certain degree of scientific interest and value attaching to them; but we submit that, upon the whole, the compilers would economize space with advantage by enumerating the titles of the sealed patents only, even at the expense of sacrificing something in the direction of exactitude in dates and numbers.

The proprietors of this work have engaged upon a delicate and difficult task in entering upon biographical sketches of the principal architects, engineers, and others. They do well, however, in dealing with this part of the volume, to confine themselves very much to statement of facts, rather than to the expression of opinions. A directory is not usually a book from which quotations can be successfully made; in the volume before us there is, however, an embarrassing abundance of quotable matter; but we could neither do justice to ourselves nor to the book by commencing quotations, so forbear altogether. While we have to speak in strong terms of the merits of Messrs. Wymans' work, we are not ignorant of, at least, some of its defects. Notwithstanding these, it is an honest and creditable piece of work, and really a marvel in having so much in it worthy of approval—so many excellencies and so few defects, and those few such as are easily remediable in succeeding editions.

* "The Architects, Engineers, and Building Trades' Directory. A Business Book of Reference for the Various Industries connected with the Arts of Construction throughout England, Scotland, and Wales. 1868." Wyman and Sons, Great Queen-street, London; and Wyman Brothers, Calcutta and Allahabad.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

NEW CEMENTS—COMPOSITION FOR ELECTROTYPE MOULDS—SILICATE PAINT FOR STOVES AND OVENS —PRESERVATICN OF BUILDING MATERIALS.

FEW things are in more constant demand among mechanics than cements, and it must be admitted that most of those in common use are open to improvement. We have recently met with some receipts in the French and German journals, which we put together for the information of our readers. The first is an iron cement, which looks likely to be useful. It is made by mixing from four to five parts of dry clay, two parts of iron filings, one part oxide of manganese, half a part of salt, and half a part of borax. When the cement is wanted for use, this mixture is made with water into a paste, which is applied immediately to the pieces to be joined. It is then allowed to dry gradually, and is subsequently heated to whiteness. After this the cement will resist water, and of course heat. Another, said by Stinde to be a very useful cement, is made by mixing equal parts of oxide of manganese and oxide of zinc, and making them into a thinnish paste with the solution of silicate of soda of commerce. This paste must be applied quickly, as, no doubt, it sets very rapidly. It is not calculated to resist heat and water—the latter, at all events, not for any length of time. Another receipt we find is for a strong liquid glue. To make this the inventor puts three parts of glue with eight parts of cold water, and lets them stand for several hours to soften the glue. He then adds half a part of muriatic acid and three-quarters of a part of sulphate of zinc, and heats the mixture to 185deg. Fah. for ten or twelve hours. The mixture remains liquid after cooling, and is said to be very useful for sticking wood, crockery, and glass together.

The use of gutta-percha for electrotype moulds presents many inconveniences when the medallion or plate to be copied is large. Kness has therefore invented composition for the mould which may be used with articles of any dimensions. It is made by first melting together 6lb. of white wax, 2lb. of asphalte, 2lb. of stearine, and 1lb. of suet. When a homogeneous paste in obtained, he stirs in enough lamp-black to give the whole a deep black colour, and a little very fine plaster of Paris, to give it more body, and prevent it from sticking to the model. When used the pattern must be smeared with a little oil, and the composition poured on at the lowest temperature that it will run well, for if too hot, it will adhere. After cooling it detaches very easily, and forms a hard mould not at all brittle nor likely to get out of shape.

Black lead is a great institution in this country, and probably few but cooks and housemaids would care to see its use diminished. It certainly has its recommendations, but it can hardly be said to be ornamental, while it entails an immense amount

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of labour on our servants. In Germany, where a stove and sort of kitchen range is continually to be found in the common sitting-room of a respectable family, the unsightliness seems to have been felt, and a suggestion has been made to do away with the black lead and paint the stoves and ovens. Oil paint, of course, cannot be employed, but water-glass (silicate of potash) coloured with pigment to match the paint of the apartment is the material recommended. Before this is applied the iron must be thoroughly cleansed from grease, and all rust spots must be rubbed off with a scratch brush. Two or three coats of the paint may then be put on and allowed to dry, after which the fire may be lighted without fear of injury to the colour, which may, indeed, be heated to redness. Grease or milk spilt over the paint has no effect upon it, and it may be kept clean by washing with soap and water. Dutch ovens and like utensils may also be coated with the same materials, and the labour spent in polishing be saved. A good coating of the paint, the author says, will last a year or two.

M. Payen has paid a good deal of attention to the preservation of building materials, and especially of wood. There is no novelty in his latest suggestion for the superficial carbonization of timber, for we know that it was practised by the Romans. M. Payen, however, recommends that the whole surface of ships should be carbonized, and for this purpose suggests the use of the gas blow-pipe, or, when gas is not at hand, a blow-pipe and lamp fed with heavy petroleum oils. He would treat all woodwork exposed to wet in the same way. The utility of this plan of treatment is incontestable, the only question being whether the same end cannot be gained at less cost.

SUSPENDED RAILWAY WHEELS.

THE disadvantages or defects of ordinary railway wheels are their tendency to mount the rails, and their liability to sliding and lateral concussions, thereby occasioning oscillations of the train, matters which not only engineers but ordinary railway passengers cannot fail to have observed. But, beyond these defects, are loss of power in traction by the unequal wear and tear of the tyres; also unequal expansion and contraction of the tyres and bodies, torsion of the cranks and axles. These defects are greatly increased should the frames of the engine or carriages get out of the square by twisting or straining, leaving out of the question bad roads, unequal lengths of the rails at the various curves, all of which have to be taken into consideration, independently of the straining and vibration of the bridges when passing over, as well as the enlargement of the engine-tyres when they have to be taken off and re-set. There is also the ever-present danger of the tyres, when at high speed, separating or breaking from the body of the wheel, to the destruction of the train, and danger of life, all owing to their being fixed on the axles. These objections are fairly met in a wheel which has been invented by Mr. George Smith, junr., of Donegal-square West, Belfast, and which we here illustrate. Fig. 1 is a half section and half elevation of a portion of the wheel, fig. 2 being an enlarged cross section through the tyre. The novelty of these wheels consists in the body, hoops, spokes, or discs being suspended to the tyres. By such an arrangement the tyres are in compression as well as the body, spokes, or discs, while the hoop is always in tension, the reverse in principle to the constructions at present adopted. Referring to the engraving, A is the tyre into which one of the wrought-iron flanges B is let in and welded over, and the other so arranged as to be removable when required. C is a spring steel or iron hoop, a little larger in diameter than the flanges on B, on which it rests, or the rim of the body of the wheel D, which rests in it. It will be seen that by this arrangement the weight of carriage and body of the wheel D is borne by the steel hoop C, which in its turn is suspended from the top of the wheel by the flanges B B. Thus, any irregularities in the road are compensated for by the play of the steel spring C in the space F.

The advantages presented by this form of wheel are cheapness, lightness, durability, greater safety to the trains, especially at high speeds, as the tyres cannot separate or break from the body, hoops, spokes, or discs of the wheel; nor can they mount the rails. As the tyre sheers instead of biting, there are less jolts, less tear and wear to engines or carriages, and permanent way, no skidding, sliding, or lateral concussions, nor any necessity for double rails at sharp curves. The improvement also prevents torsion to cranks and axles. As the tyres regulate themselves to the irregularities of the permanent way, there will be less straining or vibration of the bridges, on account of the elasticity of these wheels. Lastly, it is found that with these wheels in use, there is no need to loosen the ballast, as is often done, to give elasticity to the rails, so as to lessen the hammering of the rigid wheels as at present constructed. The jolts and jars now felt in going over loose joints of the rails, and especially on bad, rigid, or frozen roads, are greatly prevented—a boon to passengers—especially in long journeys. The arrangement also enhances the safety of the body's spokes, or discs of the wheels, whether made of wrought or cast iron. As they are loosely suspended in elastic steel or iron hoops, they may expand or contract without strain or contortion to the several parts, under all changes of temperature, whereas in the tyre and body of the old wheel there is a constant danger, in consequence of their unequal expansion

FIG. 1

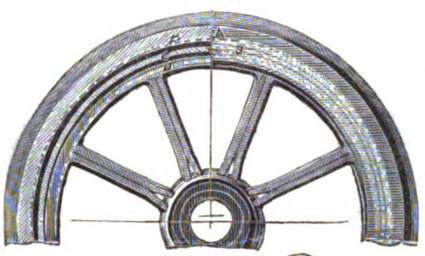
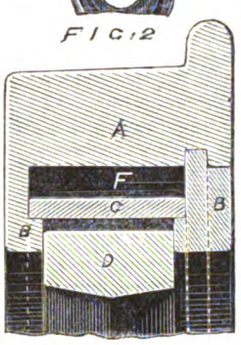


FIG. 2



and contraction, more particularly in sudden changes of the weather. A set of four of these wheels have been running on the Great Western Railway over eleven months under a high-sided goods truck, which, when laden, weighed over seventeen tons, thus giving four and a-quarter tons per wheel. When the inspection took place on May 6 last, these wheels—which have done many thousand miles of work—showed little or no wear, whereas tyres of the same quality of steel and running from the same date and the same distance showed a diminution in the thickness of the tyre on the tread fully equal to $\frac{1}{4}$in. The North London Railway Company have also had some of these wheels in use for more than a year, and we are glad to say they are there giving every satisfaction.

ROYAL CORNWALL POLYTECHNIC SOCIETY.

WE append a list of premiums and prizes in the mechanical department for 1868, offered by the Council of the above useful institution. The mechanical department includes natural philosophy, chemical analysis, mechanical and other scientific inventions and improvements; models of machinery not displaying invention; and naval architecture — in all of which subjects medals and prizes will be awarded by the Society. The special premiums are as follow:—Premiums of £10 for the best model, and £5 for the best plan for improving the ventilation of mines. A premium of £20, by the editor of the "Mining Journal" and by the Society (or such portion thereof as the judges shall consider suitable), to the originator of, improvements in the dressing of ore, such improvements to have been in successful operation for a period of not less than six months. A premium of £5, by the editor of the "Mining Journal," for the best paper containing an account of any methods or plans practised in any other mining districts, advantageously applicable to the Cornish mines; to be accompanied by the necessary drawings. A premium of £2, by the Society, and £3, by Colonel Tremaine, for the most exact account of the phenomena of mineral veins in any mine or district, their dip, direction, variations in productiveness, slides, heaves, &c. The Society being especially desirous of cultivating close habits of observation in our miners, will give prizes for accurately drawn cross sections; for collections of ore and country in which the relations of one to the other are carefully marked; for drawings and descriptions of any remarkable phenomena observed in lodes, &c. The introduction of improved methods of drawing the ores and rubbish from the Cornish mines appears to the committee to be worthy of attention with reference to these premiums. A premium of £5 5s. is given by the Society, for the best working plan of a mine in full work (sections of the lodes not required); the plan to be corrected to some time within three months previous to its exhibition, and to be drawn by the person who dialled the mine-workings.

The following has been forwarded by Charles Fox, Esq:—The value of copper ore in any state is soon ascertained, and unless of very low produce, can bear the expense of carriage. Tin-stuff, when in considerable quantities, requires more investigation to judge of its value. In many parts of the county, purchasers of it in the stone are not to be met with, whilst the expense of carriage to stamps (if the use of any be attainable) may be too heavy an item in the returning charges. This also applies to some copper halvans and skimpings. I therefore offer premiums of three, two, and one guineas, for the first, second, and third-class models of steam stamps (to possess a stamping power equivalent to that of three or four heads) which may be removable from place to place, whether attached to wheels or on frames, to be transported on a waggon. Or for such improvements, especially in the stamping part, in steam stamps, whether stationary or locomotive, as may simplify the machinery, whether of the engine or of the stamps, without impairing its efficiency. Should the judges be unable to decide that such alterations are, on the whole, an undoubted improvement, the premium should be considered as earned, if they recommend them as clearly deserving of trial.

A premium of £1 is offered by Mr. R. R. Broad, and £2 by the Society, for the best practical essay on the improvement of Cornish river fisheries, especially with reference to salmon. An additional premium of £1 by Mr. R. R. Broad, and £1 by the Society, will be awarded if the suggestions are carried into effect. Finally, there is offered a prize, by the editor of the "Mining Journal," of Burgh's large folio of "Practical Illustrations of Steam Boilers and Engines," with pocket-book of practical rules for the same, for the best (original) mechanical drawing by youths not receiving another prize. Premiums are also offered in the fine arts, photography, &c. We should add that further information respecting the Society generally, and the above objects in particular, may be obtained from the acting hon. secretaries, W. P. Dymond, Esq., and A. Lloyd Fox, Esq., Polytechnic-hall, Falmouth; or from Mr. J. C. Stephens, the manager of the Art Union of Cornwall.

SILKWORMS' EGGS.

THE Italian correspondent of the "Times" writes as follows:—You are aware that of late years there has been a very large importation of silkworms' eggs from Japan to Italy, with a view to repairing the ravages of disease among the worms in this country. To a considerable extent the plan has proved successful, although the descendants of the Japanese by no means invariably escape—at least, in the second and third generation—the mysterious affliction which has long played such havoc with one of the most important and lucrative of Italian productions. Latterly, complaints have been heard even of the eggs imported direct from Japan. To all appearance they were of good quality, but it seemed they were not proof against the prevailing epidemic. A circular that has just been addressed to the presidents of agricultural committees, by the Minister of Agriculture and Commerce, accounts otherwise for the deterioration. A system of fraud has been detected. The Minister declares it to have come to his knowledge that a great number of cases containing empty papers of the kind in which the Japanese eggs are usually sent, have been received by a Milan house. These papers are duly stamped and inscribed in Japanese; they bear the Custom-House mark usually put on them at Yeddo on their way to the Yokohama market. The Minister declares it beyond a doubt that these papers were intended to receive Italian eggs, which would be sold to the public as genuine Japanese—thus discrediting the only eggs on which is now based a hope of reviving sericulture in this country. The discovery appears to have been due to the refusal of certain Japanese houses to submit their papers of eggs to the inspection and stamp of the Italian agents and consuls in Japan. The Minister promises great vigilance to defeat these frauds, for, he adds, he has reason to believe that other persons are on the alert to follow the example of the Milan house above alluded to. According to an official publication, in 1863, the total value of the cocoons produced in the provinces which now compose the kingdom of Italy was upwards of four millions sterling. To obtain this there had been imported 56,129 kilogrammes of eggs, at a cost of twenty-four millions of francs, or nearly a milloin sterling.

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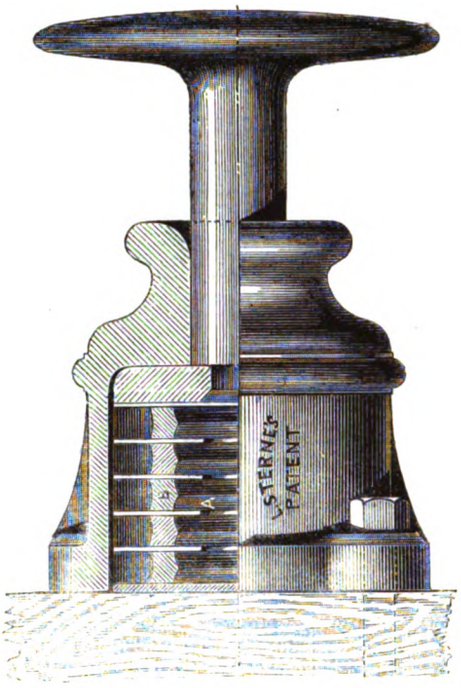
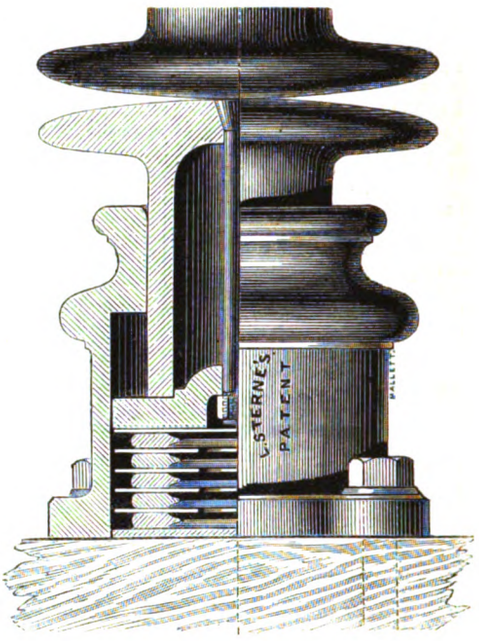
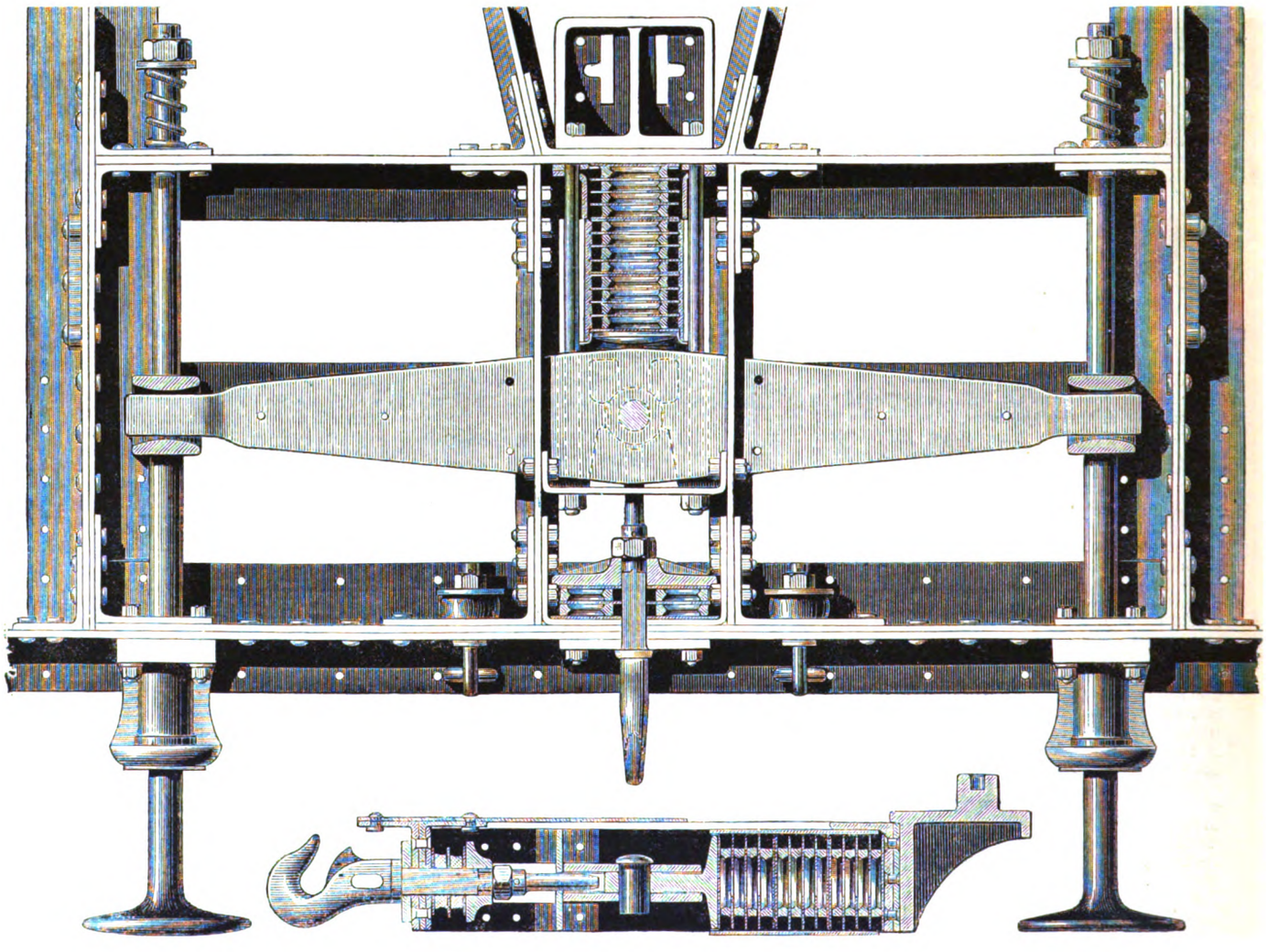
PNEUMATIC RUBBER BUFFERS, BEARING AND DRAWING SPRINGS.

BY MR. L. STERNE.







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PNEUMATIC RUBBER BUFFERS AND DRAW SPRINGS.

IN our notice of the conversazione of the Institution of Civil Engineers we referred in passing to the pneumatic rubber buffers and draw springs exhibited by Mr. Louis Sterne, of No. 8, Great Queen-street, Westminster. We now have much pleasure in illustrating this invention, which is being adopted with thorough success in several lines of railway, and is no longer an experiment. The buffers and springs, as shown in our engraving, are built up of soft india-rubber rings and circular steel, iron, brass, or other metal plates; the terminal plates of each spring being complete discs, while the others have each a hole through the centre. During the process of vulcanization the buffer rings become inseparably united with the plates, and each spring thus becomes a perfectly air-tight chamber. When pressure is brought to bear on the springs the air within them becomes compressed and offers a resistance proportionate to the amount of such compression, and to the area of the discs upon which the pressure of the air is exerted. The india-rubber rings not only perform the office of securely retaining the air within them, but resist sudden concussions better than any rubber buffers ordinarily used. In order to avoid friction upon the rubber, by which it would be quickly destroyed, the circular plates are extended beyond the rings to a distance in proportion to the depth of these rubber rings. The india-rubber, therefore, can never be injured or come in contact with the inner surface of the cylinder. Fig. 1 represents the buffer at rest, and fig. 2 compressed in action.

In practice it is found that these buffers are capable of resisting more compressive force than a steel spring, possessing greater sensitiveness, and all liability to accident from breakage is completely avoided. Unlike a steel spring, which, if made to resist great force, is rigid until a considerable weight is brought to bear upon it, this buffer spring is sensitive to a very slight pressure, and yet absorbs a power of 14 tons, being 100 per cent. more than the resisting power of any steel springs used for this purpose. These buffers may fairly be said to possess greater resisting power, greater sensitiveness and range of elasticity, combined with great freedom of action, simplicity of construction, ease of adjustment, and undoubted durability than any others. They are in use on the Great Western, London and South Western, Metropolitan, Great Southern and Western of Ireland, the Scinde and Delhi, Great Southern of India, and other lines of railway at home and abroad.

At fig. 3 of our engraving we show the application of these springs as buffers and draw springs, as adopted by the Metropolitan Railway Company. Each buffer rod carries a kind of shoe embracing the ends of a compensating travelling beam, which extends from one spindle to the other. This transmits the pressure fairly to the springs, at the same time enabling the buffer rods to accommodate themselves freely to the position of the carriages passing round curves. The buffing spring occupies a length of 13½in. when uncompressed, and is capable of being compressed 9in. The light spiral springs at the end of the buffer spindles are merely placed there to prevent chattering. The draw-spring is formed by a pair of pneumatic springs placed one on each side of the draw-bar, and composed of two rings of rubber each.

Some important experiments were recently made by Mr. Kirkaldy with Mr. Sterne's buffing apparatus, to show their resistance, the results of which we append. The following tabulated statement gives the results of experiments to ascertain resistance to depression under a gradually increased thrusting stress of seven of these buffer springs.

Test No.	Description.	No. of Rubber Rings.	Diam. of Rings.	STRESS IN POUNDS—DEPRESSION IN INCHES. 1.000	2.	3.	4.	5.000	6.	7.	8.	9.	10.000	11.	12.	13.	14.	15.000	16.	17.	18.	19.	20.000	21.	22.	23.	24.	25.000	26.	27.	28.	29.	30.000	REMARKS.—Rubber and connection with plates sound.
B 3152	GREY RUBBER.	4	4·94	·320	·640	1·04	1·29	1·50	1·57	1·66	1·75	1·81	1·87	1·92	1·96	2·00	2·03	2·06	2·09	2·11	2·13	2·15	2·18	...	...	...	...	...	...	...	...	...	...	
3174		4	4·93	·310	·630	1·00	1·28	1·44	1·57	1·66	1·75	1·81	1·86	1·90	1·94	1·98	2·01	2·04	2·07	2·09	2·11	2·13	2·14	...	...	...	...	...	...	...	...	...	...	
3175		4	4·93	·350	·739	1·14	1·40	1·55	1·67	1·75	1·81	1·87	1·93	1·97	2·00	2·03	2·06	2·08	2·11	2·14	2·16	2·17	2·19	...	...	...	...	...	...	...	...	...	...	
3245		4	4·93	·360	·752	1·19	1·47	1·56	1·63	1·72	1·78	1·82	1·85	1·89	1·92	1·95	1·97	1·99	2·02	2·04	2·05	2·07	2·09	2·12	2·14	2·15	2·16	2·17	2·19	2·20	2·21	2·22	2·23	
3246		4	4·94	·370	·805	...	1·61	...	1·80	...	1·98	...	2·05	...	2·12	...	2·18	...	2·23	...	2·27	...	2·30	...	...	...	...	...	...	...	...	...	...	
3247		4	4·37	·350	·710	...	1·27	...	1·52	...	1·64	...	1·71	...	1·80	...	1·87	...	1·94	...	1·98	...	2·02	...	2·05	...	2·07	...	2·10	...	2·12	...	2·14	
3248		4	4·37	·360	·720	...	1·31	...	1·62	...	1·79	...	1·90	...	2·00	...	2·07	...	2·12	...	2·17	...	2·20	...	2·23	...	2·26	...	...	...	...	...	...	

Tested in cast-iron case, with wrought-iron plunger.—The above depressions are each the mean of four readings.

Whilst on this subject, we may add the results of some experiments made by Mr. Kirkaldy to ascertain the resistance to depression under a gradually increased thrusting stress of Mr. Sterne's rubber washer for armour-plate bolts:—

Stress in pounds.....	4·000	8·000	12·000	16·000	20·000	24·000	28·000	32·000	36·000	40·000	44·000	48·000	52·000	56·000	60·000	64·000	68·000
Depression, inches.....	·283	·504	·615	·702	·755	·800	·830	·854	·875	·891	·903	·919	·931	·944	·958	·972	·984

RESULTS OF EXPERIMENTS to Ascertain the Resistance to Depression under a Gradually Increased Thrusting Stress of two of L. Sterne's Patent Pneumatic Rubber Buffers in Cases:—

Test Number.	Description.	Tested.	STRESS IN POUNDS, AND DEPRESSION IN INCHES. 1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
C 254	Five Rubber Rings.	March 21	1·02	1·60	1·91	2·04	2·17	2·26	2·32	2·40	2·48	2·51
255	"	"	1·07	1·62	1·94	2·10	2·18	2·28	2·36	2·43	2·49	2·53

The above depressions are each the mean of four observations.

With these satisfactory results we cannot doubt the ultimate general adoption of this principle of pneumatic buffers and springs.

FORTIFICATIONS.

THE following instructions, signed by Sir J. Pakington, for the guidance of the committee recently appointed to inquire into the construction, condition, and cost of fortifications, have been issued as a Parliamentary paper:—It appears to me extremely desirable (having reference to questions recently raised in the House of Commons) that a full inquiry should be made into the construction, condition, and cost of the fortifications and works erected, or in the course of erection, under the 30 and 31 Vict. c. 145, and previous statutes, by a competent committee. I have the honour to inform you that the officers and gentlemen named in the margin have consented to undertake such inquiry, under your presidency, and to report to me the result. Plans of the works in course of construction will be laid before you; and, accepting as approved the position of the forts, and the general design of the works, the matters upon which I desire the information and the opinion of the committee are—1. Whether these forts and works have been well and skilfully constructed, with reference —(.) To their stability and permanency. (*b.*) To the arrangements made, or proposed to be made, in them for the service of the guns, and otherwise to meet the requirements of a modern armament. (*c.*) To the power of resistance (offensive and defensive) that they offer to any attack to which they may be exposed. (*d.*) To the cost incurred and to the future expenditure that may be needed for their completion (if this inquiry can be readily accomplished by the committee, and without involving them in a considerable sacrifice of time). 2. Whether any and which of the works, so far as the same have yet proceeded, are, with reference to their foundations, or otherwise, in an insecure condition, and need any and what support or reparation, and what would be the probable cost of such support or reparation. 3. Whether the estimates in the schedule of the Fortification Act of 1867, before referred to, will suffice for the completion of the works as contemplated, and, if not, what additional sums will probably be required. 4. For the purpose of enabling you to carry out this inquiry, I have requested his Royal Highness the Field Marshal Commanding in Chief to cause the general officers commanding at the stations to be instructed to give the committee all requisite facilities. I have also desired the officers of the War Department to give you the fullest information upon every matter upon which the members of the committee may require it; and I have to express a hope that the inquiry will be conducted with as little delay as may be compatible with full investigation and report, and that the committee will, if they deem it to be expedient, make a preliminary report on any of the subjects of inquiry.

THE HANDEL FESTIVAL.

THE grand triennial festival which takes place next week at the Crystal Palace will be held under improved conditions. Various alterations have been made in the Handel orchestra, and the great transept has been enclosed with screens, thus forming a magnificent concert hall, possessing a power of concentrating sound far greater than has ever been previously attained at the Palace festivals. For the comfort of the visitors a very wise precaution has been taken in having the roof covered on the outside to screen it from the heat of the sun, proper ventilation being at the same time effectually provided. The stage of the theatre fronting the Handel orchestra is being fitted up with Royal boxes, a reception room, floral parterres with fountains and sculpture, as on the occasion of the visit of the Sultan last year. An important feature is the increase of railway facilities since the last festival—the different points of departure and the additional service in this respect being now amply sufficient for the conveyance to and fro of the maximum amount of expected visitors without delay or embarrassment. Everything, as far as arrangements are concerned, promises to render the Handel Festival of 1868 a thorough success.

THE Prussian Reichsrath has voted a sum of £900 to defray the cost of a scientific mission to Aden to observe the eclipse of the sun on the 18th of August.

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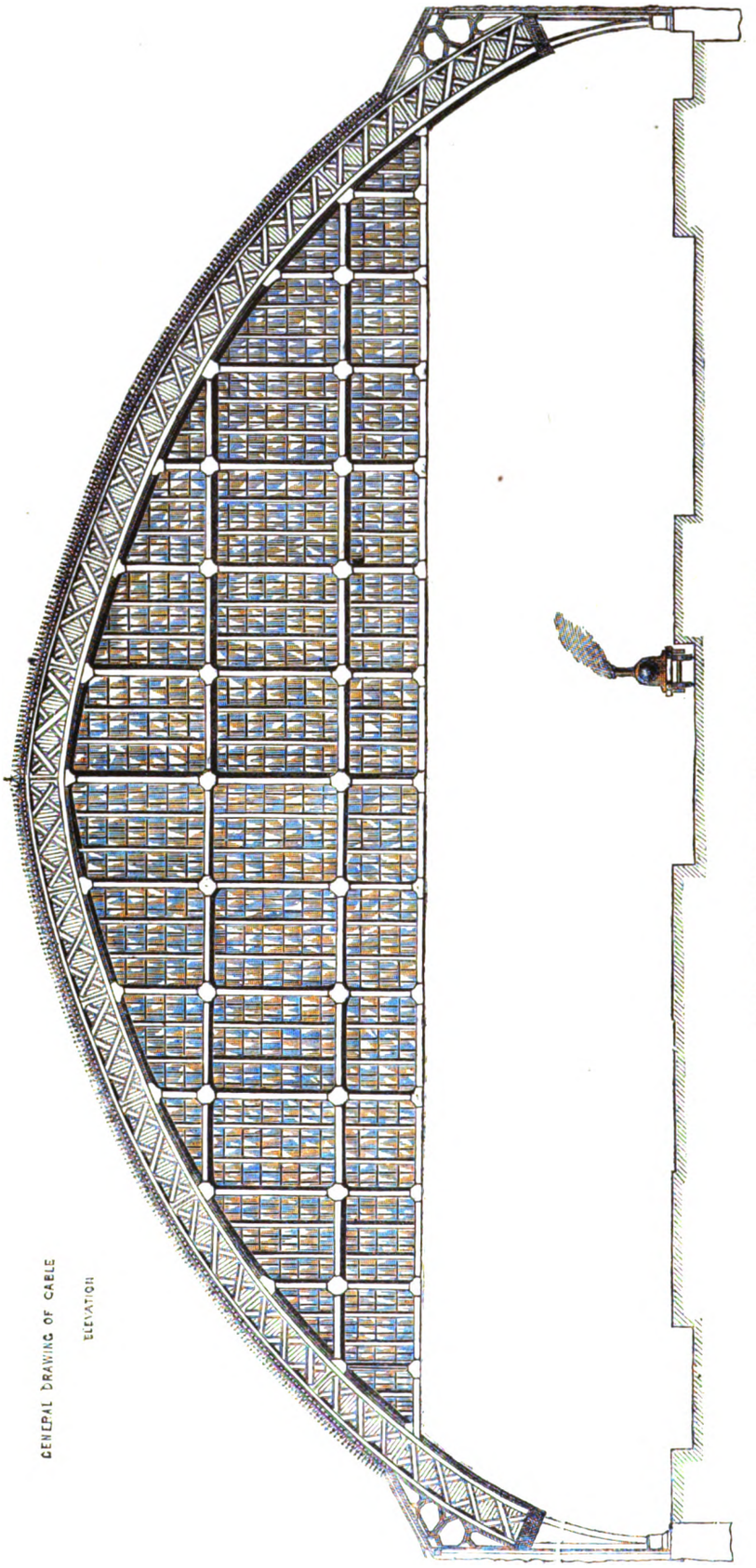
THE ST. PANCRAS STATION, MIDLAND RAILWAY EXTENSION.

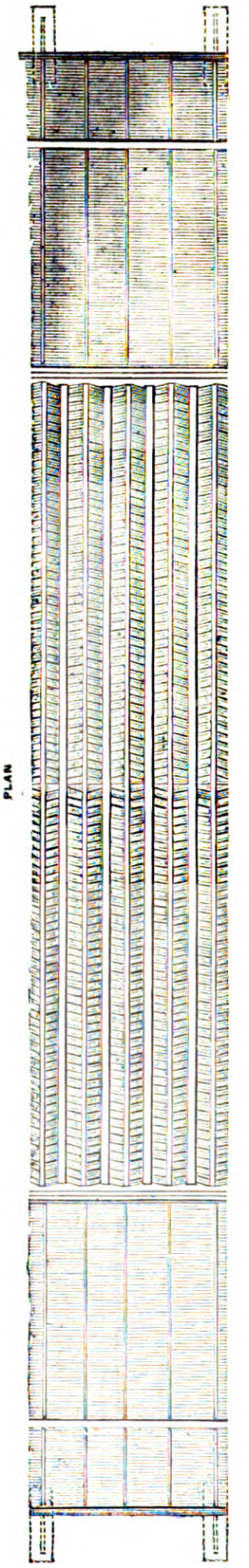
MR. W. F. BARLOW, C.E., F.R.S., ENGINEER.



GENERAL DRAWING OF CABLE

ELEVATION

END ELEVATION, SHOWING GLASS SCREEN.



PLAN

PLAN OF ONE BAY.

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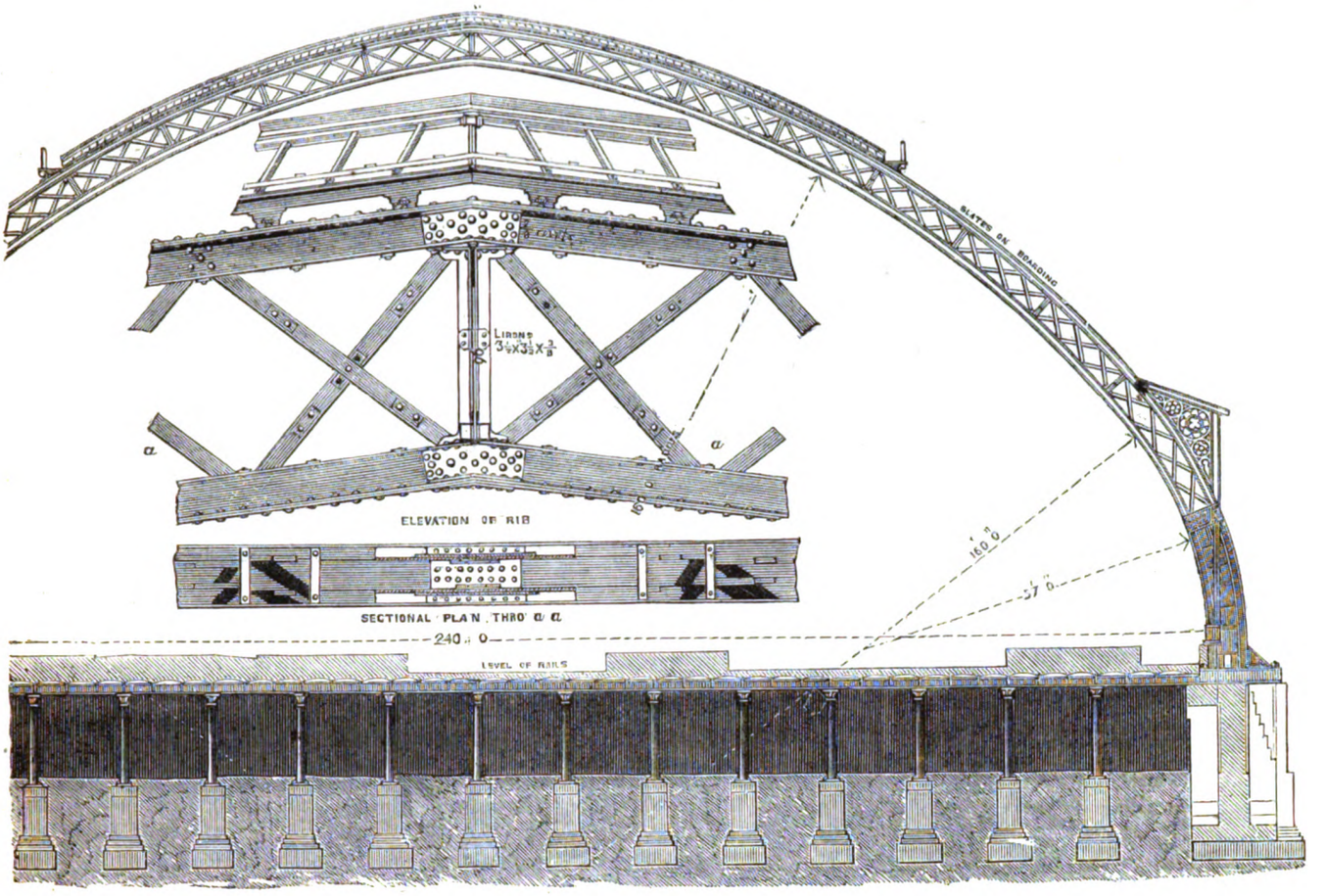
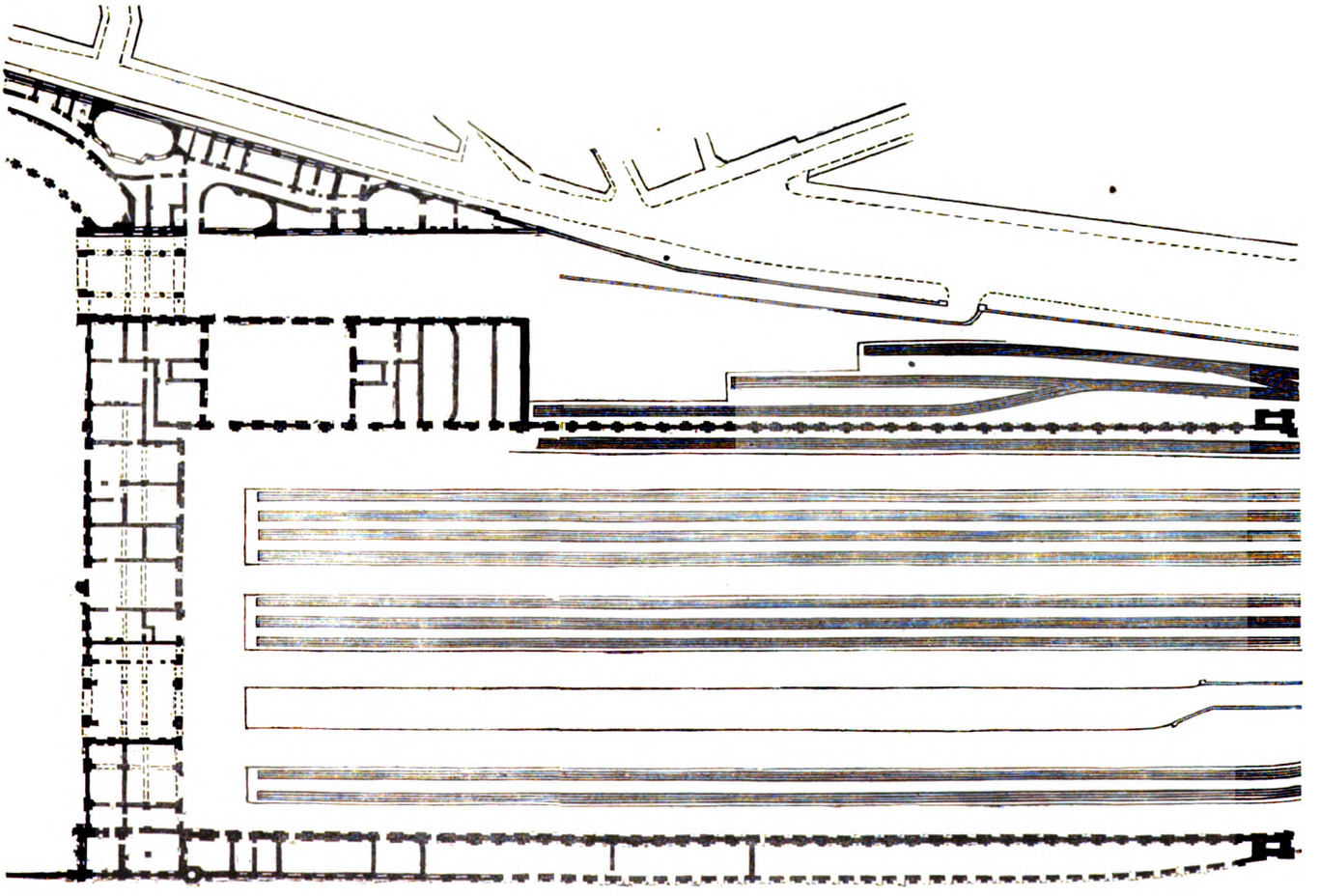
THE ST. PANCRAS STATION, MIDLAND RAILWAY EXTENSION.



SECTION SHOWING PART OF RIB IN ELEVATION.



GENERAL PLAN OF STATION AND HOTEL.

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THE MIDLAND RAILWAY EXTENSION WORKS.

THE visit of the Society of Engineers to the St. Pancras Station of the Midland Railway, on Friday last, as noticed on another page, afforded us an opportunity of looking over the works generally, and of placing before our readers drawings and particulars of the same. For this purpose we will commence at a point about two miles from the London terminus, and follow the course of the line until we arrive at the St. Pancras station, where the line terminates. The railway is constructed for four lines of way for a considerably further distance than we have named, and at the point from which we started it emerges from under the Hampstead Junction Railway, which line is carried by a heavy brick viaduct of two arches. On the east side of the line, near the bridge, are large engine sheds, fitting shops, blacksmiths' shops, and other buildings necessary for the repair and fitting-up of locomotives. The line then passes under the Kentish Town-road, through a double-arched bridge, the crown of which was roofed in with cast-iron plates, so that the requisite headway might be obtained without disturbing the levels of the road. The site of the Kentish Town station is in this arched bridge, and substantial retaining walls are built on either side the line through the cutting. The line then passes under Hammond-street, Islip-street, Caversham-road, and Gaisford-street, through brick arches. We then arrive at the site of the Camden-road station, the building of which is situate on the top of the covered way near the Camden-road. The arch of this covered way is elliptical and built of five-ring work. At the south end of this covered way the lines commence to widen out, and at the junction of Paul's-road, St. Augustin's-road, and Murray-street, which are carried by a wide bridge of wrought-iron girders, with brick arches between them, the several lines begin to assume their distinctive character. The main lines go direct to the terminus, while the St. Pancras branch leaves the main line on the east side, and the several other lines which will serve the existing goods station diverge to the west; all these lines are carried under the North London Railway, near Camden Town station, by bridges of various construction, those for the main lines being composed of wrought-iron girders and planking, and that for the St. Pancras branch by a brick arch or tunnel. We will follow the course of the main line to the terminus first, and then give a description of the Pancras branch, or that portion of the line which will connect the Metropolitan line with the great system of the Midland Railway.

After passing under the North London Railway the main line runs alongside the existing goods station and crosses over the Regent's Canal and Cambridge-street, by wrought-iron girders and platforms, and then arrives at the Old St. Pancras burial ground. Here the bridge which carries the railway is in three spans, and is supported on brick abutments and piers formed of cast-iron cylinders built in segments and bolted together. These cylinders are well sunk in the blue clay, and are filled in with concrete and brickwork. After the brickwork had set each pier was tested with loads varying from 200 to 300 tons, and, after the load was removed, large stones of Bramley Fall were fitted to the cylinders, and the superstructure was then proceeded with. After passing over the burial ground the line is carried in brick arches of 25ft. span until it intersects the Old St. Pancras-road, where it joins Brewer-street, Wharf-road, and Elstree-street. The arching carries the sheds necessary for railway carriages and other requirements which are requisite at a large terminus, for the making up of trains, such as turntables, shunting sidings, &c. These arches will no doubt prove valuable property, being available for storage of goods, &c., and, having a good frontage in the Old St. Pancras-road, will probably be made use of by the public. At the extremity of this arching the line is carried over the Old St. Pancras-road by wrought-iron bridges varying in span, and widening out to suit the position of the lines going into the terminus.

We now come to the St. Pancras terminus, at the entrance of which the rail level is 17½ft. above that of the road and the adjoining streets. At the frontage the height is 12ft. above the Euston-road. The opportunity thus opened was taken advantage of, and the space afforded by these levels was turned to good account in the following manner:—In consequence of arrangements already made, a cellarage for beer was designed, the height of which, from ground level to top of columns is 13ft. 6in. There are besides this cellarage, which occupies about four acres, seven acres more at the goods' stations, devoted to the same purpose. In order to economize the space in the cellarage under the terminus, cast-iron columns about 12in. diameter have been used instead of brick piers. These columns are put upon brick piers capped with stone. The columns are in rectangular lines 14ft. 8in. centres, the spaces between the columns being convenient for the stacking of barrels. There are in all about 700 columns ranged in the manner described, and the large space over which these columns extend is about 700ft. by 240ft. On the top of these columns are placed wrought-iron girders about 2ft. deep, the main girders running across the building and having cross-girders between them, the flooring being made of Mallet's buckled plates, which connect all the main and cross-girders together. The main and cross-girders take their bearing upon the columns, and are consequently all of a uniform span, thus rendering the manufacture of so large a quantity of similar work simple and easy to contractors. It was at once seen by the engineer that these girders would form a most excellent tie to a large arched roof, and accordingly a roof was designed which, when finished, will be the largest single span in the world. Those most nearly approaching to it, though of different construction, are the roofs of the Riding School at Moscow, and that of the Birmingham station roof. The tie in this roof being completely hid there will be no tie-rods, ring posts, or other fittings, which detract considerably from the appearance of a structure of this kind.

Our engravings show elevations, sections, plans, and details of portions of this roof, and we purpose placing further details before our readers next week. The clear span is 240ft., springing from platform level, and the rib will be a four-centred arch, Gothic in character. The height from platform level is 96ft., and the total length of roof 690ft. The principal ribs are composed of plate flanges with diagonal lattice bars connecting them, the total depth of each main rib being 6ft., and are placed at a distance of 29ft. 4in. apart, centre to centre. The ends of these ribs are connected to the transverse girders, as before stated. It should be noticed that provision has been made in the transverse girders not only to take the thrust of the roof, but strength enough has been given to them to carry the weight of the platform, rolling load, and ballast. Between the main principals are placed three intermediate ribs to support the planking, &c., at equal distances of 7ft. 4in., and the whole is braced together by trussed purlins, which occur at equal distances of 17ft. 6in., and correspond to the vertical joints of the arched main ribs. The arched main and intermediate ribs carry the gutters, which form a springing for sash frames, and about 70ft. of each side from centre of the roof is glazed, and the remainder being slated on boarding. The glass is carried by sash bars, which are placed at equal distances apart, and grooved to receive the glass; the sash bars form a ridge-and-furrow roof over the arched rib, and are secured to the purlins by tie bars. As each bar of main principal is divided into lengths of 17ft. 6in., which each contain six diagonals between the flanges, inclined at an angle of 90deg., the disjointed piers are capable of being very easily riveted together in place. For about 30ft. from the springing at each side the main principals are made of plate and angle ironwork instead of lattice work, and is fastened to a plate box which rests on the walls, and is well secured by holding down bolts to anchor plates built in the foundations of the walls. We notice that provision has been made in the two end main ribs for taking the horizontal thrust in the gable end occasioned by the wind. These two principals are placed 14ft. 8in. apart, and are braced together horizontally.

Although the space of this roof is large yet there are several elements of economy in its construction as compared with other roofs of large span. In the first place, the tie is provided for it in the girders which support the flooring. Secondly, there is no wrought work in forging, turning, and screwing, and the fitting of gibs, cottars, and fastening requiring expensive workmanship, but the whole is formed of riveted plate ironwork, such as is employed in ordinary bridges. Thirdly, the side walls are not required to support the weight of the roof, and are therefore made much lighter than would be necessary were the great weight of the roof borne upon the walls. And, fourthly, no provision is required for expansion by temperature, the effect of expansion being a slight elevation in the crown of the roof. Thus the complications of roller frames and adjusting bearings are avoided in this construction.

Upon entering the North London tunnel this portion of the line is carried though a large covered way made for two lines of way; it passes first under the Regent's Canal, where the construction is peculiar. Having to save headway, so as not to approach too near the bed of the canal, cast iron plates are used, well cemented together and bolted, and covered over with concrete and puddle. There are numerous shafts which will ventilate this covered way well. It then passes under the old St. Pancras burial ground, and especial care has been taken to drain the portion well; the arch is well protected by asphalte, and drain pipes are laid alongside the arch on both sides to take off any drainage there may be. It then passes underneath the arching which carries the main line before described, and reaches the Old St. Pancras-road where it intersects the Fleet sewer, this sewer being carried over by a cast-iron pipe supported by wrought-iron girders. After passing the Fleet sewer, it finds its way under the diverted Brewer-street into the St. Pancras station, under which it travels; this branch will connect with the Metropolitan system at King's Cross, in connection with a second Metropolitan line now being made down the Euston-road.

We may mention that Bessemer steel rails are being extensively used on this line, and it is believed that the use of this most excellent material for permanent way may not only prove beneficial and economical to the Midland, but may tend to show to other railways which have not yet adopted it the necessity of doing so, as although the first outlay is considerable, the wear which this steel is capable of bearing will more than repay the difference of cost between iron and steel rails. There are several cab approaches and footway approaches to this station, and every space available seems to have been made good use of. There are shops with handsome frontages, both in the St. Pancras-road and the Brewer-street side, some of which have convenient cellarage. Nothing can be finer than the quality of the work, both in brick and stone. Great care has been taken in preserving the bond of the brick-work, and every piece of cut work is beautifully wrought.

WRECKS IN 1867.

THE annual summary of wrecks and casualties during the past year has been issued by the Statistical Committee of Lloyd's. From a comparison of these with those which occurred in 1866, we have the following results. The cases reported during the past year were 11,424 against 10,587 in the preceding 12 months. The instances of total loss were 2,238, of which 105 were steamers; of constructive loss 323, of which 10 were steamers; of great damage 1,563, of which 132 were steamers; and of minor damage, 3,877, of which 298 were steamers. Forty-four ships and 11 steamers were raised after sinking, and 2,335 ships and 491 steamers among the number reported are classed as not damaged, or results unknown. The proportion of casualties reported in each quarter of the year stands as follows:—First quarter, 3,578; second quarter, 1,927; third quarter, 1,791; and fourth quarter, 4,128. The closing months are usually the most disastrous, but the total for that period of the past year was more serious even than in 1866, the number then having been 3,213. The number of vessels in 1867 abandoned was 455, of which 27 were steamers; the number missing was 100, including 7 steamers; the number burnt or on fire was 138, including 17 steamers; the instances of piracy were 5, all sailing ships, and the cases of collision were 2,062, including 357 steamers. The number of lives ascertained to have been lost was much less than in 1866, the total having been only 1,346 against 2,644—a result attributable, perhaps, partly to increased efficiency of the life-boat service, and partly to the increased care as regards emigrants' ships. The returns relating to lives lost are, it is stated, still most imperfect, the actual number being in excess of that given in the various tables.

A PARLIAMENTARY return prepared by the Metropolitan Board of Works shows that the estimates for the Thames Embankment (north and south) amount to £3,167,515; Mansion House-street, £2,227,837; other approaches, £173,000; total, £5,568,352. The expenditure to the fifth of May, 1868, reached £3,572,013; there was £157,339 available for further expenditure, leaving a further sum of £1,839,000 required.

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THE APPLICATION OF TOWN SEWAGE TO GENERAL FARM CROPS.

By THOMAS CARGILL, C.E., B.A.

(Concluded from page 429).

JUDGING from what has already been accomplished in the application of sewage to general farm crops, there is no question but that hitherto grass, and especially Italian rye-grass, has had the lion's share. This is due to several causes which I shall point out when treating of the selection of crops. One of the principal reasons is that, like all grass crops, it grows much quicker than grain crops, and consequently yields a quicker return for the capital expended. Again, there are difficulties and expenses attending the application of sewage to root and cereal crops from which grass land is free. But although we have not so many examples to draw conclusions from as we could wish, yet there is abundant evidence to demonstrate beyond a doubt that sewage can be successfully and profitably applied to the growth of every description of farm crops. A very extensive and careful series of experiments were carried out at Rugby to test the value of the application to oats, and the results were reported by the commissioners to be of the most satisfactory nature, regarded in a pecuniary sense, and to have afforded a remarkably large money return for the proportion of sewage applied. There is, in fact, no place, with the exception of Lodge Farm, at Barking, where sewage has been extensively applied to root and grain crops, but when it is considered that the soil there is of a poor description, the unprecedented success which has attended the application is a better guarantee for what may be accomplished in other places than if we based our expectations upon the produce of a rich and fertile soil. In applying sewage to cereal and root crops a great deal of care and attention is necessary, both with respect to the quantity applied and the time of its application. It cannot be applied so indiscriminately as in the case of grass. If too large a quantity of it be used at one dose, or if the doses be repeated too frequently, the crop will run to straw, and the ear will suffer for it. The experiments at Rugby, to which I have already alluded, confirmed the truth of this remark with respect to oats. When the supply of sewage was confined to about 140 tons per acre, a money value of 5½d. per ton of sewage was returned, but when that quantity was increased to rather more than 500 tons, the value at once fell to 1½d. per ton, as the grain was seriously diminished in consequence. This is what has to be guarded against in growing cereal and root crops under sewage, especially in the case of wheat. There is scarcely any reliable information at present upon the growing of wheat by the application of sewage, but the experiment I am about to mention, although conducted upon a small scale, is of a most encouraging nature, and ought to stimulate others to imitate it upon a scale more extended, and better calculated to do justice to so valuable a crop. About a couple of roods of land belonging to the farm at Barking were ploughed up, irrigated with sewage, and sown with wheat, and at the same time another couple, closely adjoining the former two, were prepared and sown in a similar manner, but were not irrigated with sewage. The crops having been cut, the yield of the sewaged land was found to be exactly one and a-half times that of the land which was not sewaged, and there is very little doubt but that the proportion of the former to the latter would have been much greater had there been a larger area of land experimented upon. This convincing proof of the superiority of sewaged to unsewaged land is more fully borne out in the case of grass when its value is estimated as milk.

Ammonia is known to be a good manure for wheat, but ammonia accompanied with a large quantity of water may not prove a good manure. No amount of ammonia would compensate for the injury that an excessive and unseasonable application of sewage water would do a wheat crop. But in the time of drought sewage becomes exceedingly valuable for grain crops, not only on account of the ammonia it contains, but also for the absolute water in it. This is a fact that is quite lost sight of by the advocates of the dry manure system, who appear to forget that drought is a terrible, and often incurable, cause of barrenness in a soil. Directing our attention to other crops, we find mangold wurzel to have been grown with excellent results under sewage. At Chelmsford, where, as I have already mentioned, circumstances were of an unfavourable character, thirty tons per acre were produced. At Barking, this quantity was nearly doubled, the average return being over fifty tons. Another instance is afforded by this crop of the superiority of sewaged land over that which has not been sewaged. The yield at Barking of mangolds from ground that had been sewaged was just double that grown upon land which had not been sewaged, although it had received per acre twenty tons of cowhouse manure, together with over a quarter of a ton of guano mixed with superphosphates and common salt. This is a crop which deserves the careful consideration of the farmer in laying out land for the application of sewage. Three dressings are sufficient during the growth. Rye-crop has given most satisfactory results, and is a good crop to put down as a change before the re-sowing of rye-grass. Winter-greens also answer very well as a change crop. Besides these crops, others, such as lucerne—a plant of the same genus as clover—beet, flax, celery, and cabbages, have all been grown upon the farm at Barking, and produced returns beyond all expectations. A crop of cabbages sown in August, and watered with sewage every fortnight, yielded a return of £10 per acre, the distance of the plants apart being about 15in. The soil upon which these unexampled results have been obtained is of a poor gravelly description, and the only manure used was the ordinary London sewage, which is probably more diluted than that of any other town, owing to the large drainage area it embraces.

So far as the farmer is concerned he has not much choice in the selection of the best site for the application of sewage, as is the case with local boards. What the farmer has to do is not to look about for the best land—although upon a large estate there may be a good deal of selection in the matter—but to apply the sewage to the land he may happen to possess, whether it be good or bad. He should, of course, exercise his own judgment and practical experience respecting the manner in which the farm is to be divided, and the various crops allotted to it. While, therefore, it may be fairly stated that there is no soil so utterly barren that it cannot be made productive by the application of sewage, yet, at the same time, the situation of it, the nature and levels of the ground, materially affect the financial part of the question. We have seen that at Edinburgh, pure sea sand by sewage irrigation was converted from a state of utter sterility into that of a teeming and prolific soil, and it may, therefore, be reasonably imagined that by a similar course of operations the same results might be obtained in other neighbourhoods. There was for some time a difference of opinion upon this important point, many asserting that certain descriptions of sand could not be rendered fruitful by the use of sewage. Baron Liebig held this opinion, and maintained that all the sewage in the world would never make crops grow upon the Maplin Sands. A short time ago a company was started to irrigate the sands, and as the opinion of so eminent an authority as Baron Liebig was deserving of consideration, it was determined to set the matter at rest, and an experiment was carried out which decided it in the most conclusive manner. As the sewage could not be conveyed to the sands in this early stage of the proceedings it was determined to bring the sands to the sewage. Accordingly, about 3,000 tons were taken up in barges, and spread over an acre of ground, levelled and prepared for its reception. The depth of sand was about 2ft. 6in. During the year four cuttings of grass were obtained from it, one crop yielding twenty tons per acre. Smaller plots of the same made ground were equally productive with respect to mangold and other crops.

Admitting the practicability of applying sewage to every possible description of soil, with nearly equally good results, it is still evident that the management must be varied to suit the particular nature of it. A much larger quantity of sewage may be applied in the case of light, porous, gravelly soils than upon stiff clays, particularly during the first year of the application. It would appear that gravelly soils require a certain time to become thoroughly saturated with the sewage, and absorb it greedily while the operation is in progress. This fact is corroborated by the experience acquired at Barking. When the sewage was first brought on to the land an enormous quantity of it went to waste in the carriers, which, being cut in the gravelly soil, absorbed it with extreme rapidity. The settling tank was, in consequence, not used for a long time, in order to allow the sewage to carry as much mud along with it as possible, and, by depositing it in the carriers, render them ultimately water-tight, which appears now to be the case. The practical lesson to be learnt from this is that if the supply of sewage was very limited, and the ground of an exceedingly porous nature, it might be worth while to make the carriers water-tight by puddling them, or by other means. During the winter time, when the crops are stationary, stiff soils probably retain the fertilizing constituents of the sewage better than the lighter descriptions of land. With all crops of a rapid growth, as grass, which quickly assimilate the elements they require from the soil, the character of it is not of much consequence. Three different descriptions of soil are sewaged at Croydon with much success. One is a sandy, gravelly soil; another gravelly, mixed with loam; and the other a stiff, clayey one.

The question of the proportion of land to be sewaged by a given population, however interesting it may be to local boards, does not much concern the farmer, but it may be generally accepted as a good practical estimate that one acre of ground will require the sewage of 100 persons to yield annually forty tons of grass. The application annually of 5,000 tons of sewage per acre is calculated to give a certain average return of thirty tons of grass. This quantity is sufficient to supply all the potash needed by the plant, without taking any from the soil, but if the latter be rich in potash a less amount of sewage will suffice. It is impossible to state, with respect to grass crops, the exact limit at which the application of sewage ceases to give a productive return. Between 5,000 aud 6,000 tons is the most profitable quantity under all circumstances to apply annually per acre, but at Edinburgh over 8,000 tons is the usual allowance. One point is very certain, that is, that after a given quantity of sewage has been applied the applicatipn of more is not attended with a proportionate increase in the result.

There are three principal methods of actually applying the sewage to the land, known respectively as the hose and jet system, the method of sub-irrigation, and the method of surface channels. There is a fourth plan of irrigation by total submersion, or literally laying the land for a certain time under water. This is practised in Piedmont and other continental districts, but as it is not applicable as a rule to sewage, I need not discuss it. In describing these different methods the sewage is supposed to be brought upon the farm ready to be distributed. The means of conveying it, whether by pumping or by gravitation, are connected with questions of engineering works and estimates which would be out of place for me now to allude to. To commence with the hose and jet system. Small pipes are first laid down, through which the sewage must be forced. To accomplish this it is necessary to have a certain head of water, not less than about 10ft., which entails a great waste of power, consumed in not only overcoming the friction of the pipes, but also in imparting the requisite momentum to the jet. By this system the sewage must always be raised a few feet higher than the level of the land, a disadvantage not occurring in either of the other two methods. The hose and jet plan can be applied to land of any form of surface without the necessity of any especial preparation or laying out in beds. But as a balance against this advantage must be set the cost of the piping, hydrants, and other appliances, which will exceed that of the preparation of the ground for the application of the other principle. On the farms of Alderman Mechi, and Mr. Nielson, the hose and jet system has had a partial success, but then it must be remembered that town sewage is not used, but liquid manure, which is a much stronger and more concentrated fertilizer than the former. Moreover, at these two places, ordinary farm manuring is carried on as well. The dragging of a long length of hose among crops is a troublesome and tedious operation, to call it nothing worse, and grass could not well be sewaged in this manner, except during the early stages of its growth, which would not suffice to produce the splendid annual crops which have been obtained at Edinburgh and Barking. In the best seasons at Edinburgh so much as 80 tons of meadow grass have been got off one acre, which was sold for £35. The utility of this method is very much impaired by the restrictions imposed upon it with respect of time, since one of the most important features of the application of sewage is that it should be able to be applied at any and at all times, in the day-time as well as the night-time, and at any stage of the growth of the crop. Objections have been taken to the fact that the distributing of the sewage over the crop, instead of applying it direct to the roots is wrong in principle, and that a deposit is thereby left upon the leaves and those portions of the plant above ground, exceedingly injurious to its growth.

At Rugby, Alnwick, Watford, and other locali-

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ties, the hose and jet method has totally failed. Mr. Rawlinson, the well-known commissioner of sewers, has stated that it would cost more to distribute 500 tons of sewage per acre by means of this method than to apply 5,000 tons by the system of surface channels.

The second method, namely, that of sub-irrigation, has not been practically tried except on a very small scale, as it is not only a very expensive plan, but also promises little hope of being successful. It consists in laying down below the top soil porous or perforated pipes, the ends of which can be closed when required, and the sewage forced through the pipes into the soil. Now it will be at once apparent that as the pipes must be laid at such a depth as to be out of the reach of the plough and other tillage implements, the plants scarcely derive the full benefit that they ought to do from the sewage, more particularly as it is distributed very slowly, and is in some danger of complete stagnation in the interior of the pipes, owing to the stopping up of the holes by solid deposits. It is not by any means clearly established how these underground pipes act, or whether a portion of the sewage does not drain away from them instead of rising to the level of the roots of the plant, in which case the waste might be very great. Under certain conditions the pipes used for ordinary subsoil drainage may be made to answer the purpose of this system, by merely stopping up their outlets during the season of irrigation. This plan has been adopted in Switzerland and a few other places.

Of the three methods, that of surface channels is the only one which has been attended with undoubted success, and as it is the one I should recommend to be adopted I shall describe it more in detail. It is the only principle applicable upon a large scale to sewage irrigation, and fitted to contend with the difficulties that have to be encountered. It may be subdivided into three distinct kinds, namely, the catch-water, or catch-work plan, the pane and gutter, and the ridge and furrow. All of these are distinguished by their simplicity and efficiency, and the adoption of one or other depends upon the physical features of the ground. The catch-work plan is best adapted in the case of steep or even hilly grounds, and is the cheapest mode of applying sewage. The ground having been first carefully levelled over, or contoured, as it is technically termed, gutters or carriers are cut along the contour lines at convenient distances from the top to the bottom of the field. These carriers are cut transversely to the slope of the ground, and are perfectly level in the direction of their length. The sewage being brought into the uppermost carrier fills it, and then flows over the edges on to the land into the lower carrier, and so on until it reaches the lowest one, which conveys it away to the outlet.

It is not absolutely necessary for the sewage to be brought first into the top carrier; it can be brought into any one, as it is sometimes advantageous to give a portion of a field an extra dose. According to the slope of the ground, so must the distance between the carriers be regulated; about 35ft. may be considered an average distance. As to the slope itself, 1 in 12 will be found a good limit, although 1 in 4 or 5 has not been considered too steep. When the ground, however, has a slope of this steepness, there is danger of the sewage passing off so rapidly as not to benefit the land to the proper degree. The cost of preparing the ground and cutting the carriers for the application of sewage upon this principle will not exceed about £2 per acre.

When the ground has a gentle inclination the pane and gutter system is generally adopted, and the ground is prepared in the following manner. Main carriers are cut right across the field, or in the direction of its least fall, and another series of smaller gutters are cut radiating from them in the direction of the greatest slope of the ground. The land between these secondary or distributing carriers is laid out perfectly level, and stops made of oak or elm boards placed at intervals across them. In addition to the distributing carriers, discharging gutters are cut parallel to them, and the manner in which they act is as follows:—The sewage flows from the main into the secondary carriers, where, by the proper use of the stops, it is dammed back, and made to flow over the land until it reaches the discharging gutter which conveys it away. This principle has been extensively employed with the greatest success at Croydon and Norwood, its management being both simple and satisfactory. The cost of forming the ground and cutting the carriers for the pane and gutter system at Craigentenny was about £12 10s. per acre, which is a high price, and the annual expense of maintaining the fields in working order is a little over £3.

The third method to be described is that known as the ridge and furrow, or bed method, which is applicable to land perfectly level, and necessitates a good deal of preliminary formation of the ground. As the name signifies, a ridge is formed by raising the earth, which is taken from the slide slopes running down to the furrows, which lie in the hollow between two adjacent sides. The operation can hardly be called excavating: it is rather a transference of the soil from one spot to another. Carriers are constructed in the artificially-formed ridges and furrows, and the sewage, after entering and filling those on the ridges, flows over the side slopes into the drains in the furrows, and runs into the nearest watercourse. The sides of the slopes are the panes, as they are sometimes called (which is a badly chosen term, as it confuses this system with the pane and gutter), are carefully levelled and dressed to an inclination of about 1 in 120, and the ridges may be placed at any average distance apart of from 25ft. to 75ft., according to the crop put into the ground. It is difficult to estimate what the cost of forming the ground upon this system would come to, without knowing the particulars of each case. £5 per acre may be stated as the lowest, and £20 as the highest price. A large area of land at Barking has been laid out upon this method for the growing of grain crops during the present year.

All these subdivisions of the "surface channels" principle possess the great advantage of being able to deliver the sewage upon the land at all times, and during all stages of the growth of the crop, even up to the time of cutting it, should it be grass. Any stagnation of the sewage upon the land must be prevented by levelling all irregularities, and filling up all holes and hollows, so as to maintain the flow as uniform as possible. In artificially forming the ground the best soil should be kept on the surface. The general principles that ought to guide a farmer in the laying out of his farm for the application of town sewage are not difficult to arrive at, although they must always be modified by the peculiar circumstances of the locality, the nature of the soil, the shape of the ground, and a number of minor points belonging to every individual instance. A certain amount of grass, whether meadow or rye-grass, must be grown, in order to dispose of the sewage at all times, and to form an outlet, as it were, for it, whenever the condition of the other crops does not allow it to be applied to them. A farm composed entirely of arable land would be unsuited to the application of sewage, provided it were required to dispose of the sewage at all times, which would be generally the case. Green crops are the only ones which can stand, and, in fact, benefit, by the application of excessive quantities of sewage. Other crops cannot be stimulated or forced to the same extent, and are only injured by doses of sewage too often repeated. When sewage farming is better understood, and reduced to scientific principles, it will be found more economical to devote a much larger area of land to the production of root and cereal crops than is done at present. The truth is, that there is a mania just now for growing grass, particularly Italian rye-grass, which is no doubt the great sewage crop. This is partly owing to the fact that at Croydon and the few other places where sewage is profitably applied, grass is the best paying crop, a ready market being found for it, owing to the situation. Milk is one of the most essential articles of food, and brings a high price in every large town. Consequently the crop which contributes most to its production is certain to find a ready sale, whether it be cut for garden or grazed off the land. At the same time it would be a most short-sighted policy to imagine that the application of sewage is to begin and end with green crops. In fact, the true value of it will never be appreciated until it is extensively applied to roots and cereals. At present it is wasted; there is too much of it to be had for nothing; then, it will be properly economized and estimated as it ought to be. From the facts I have laid before you it is manifest that the future system of sewage farming will be a combined one, and will consist in so proportioning the relative amounts of grass and arable land as to dispose of the sewage in the most effectual manner. The farmer will also be relieved from a great difficulty. Although he will have a choice, he will not be able to say, as at present, "I cannot grow such and such a crop, the ground is too poor;" for the real value of sewage is that by its means the poorer soils are raised to an equality with the richer, and made to be equally productive. Bearing in mind that grass will stand a very large quantity of sewage, there is not the slightest fear of not being able to dispose of it, provided a judicious selection be made in the choice of the crops grown. While any crops may be grown to great perfection, yet the most profitable ones will, of course, depend upon local circumstances, of which the farmer himself is the best judge. It may be stated that while sewage is a valuable fertilizer for all descriptions of soil, it is a perfect regenerator for the poorer kinds. It may be expedient in the one case, but it is absolutely essential in the other. An objection has been taken to the application of sewage to rye-grass, that it caused the crop to be very rank. This is not the fault of the sewage, but of the farmer. If rye-grass be cut immediately before it begins to form seed, it will never be either coarse or rank. It should be ploughed up every second year, a root crop taken out of the ground, and then it may be resown. One acre of Italian rye-grass irrigated with 5,000 tons of sewage will yield 1,000 gallons of milk per annum, equal to a money value of over £33. There is an advantage in applying sewage to cereal crops which is not always taken account of, more particularly if the land be tolerably fertile. After applying the sewage in large doses for two or three years on grass lands, intermediate grain crops may be grown in great perfection from the manure or residue of sewage constituents left in the land. Clayey soils in particular possess a remarkable power of retaining or storing up food for plants. Were rye-grass to be cut every two years, or even every eighteen months, it would allow of a very judicious and profitable combination of sewage farming, as intermediate crops of mangolds, potatoes, and cabbages could be got out of the land with great success. Viewing the question of the application of sewage to crops upon a broad basis, there is but little doubt that through its means land which is now impoverished and exhausted, or rendered barren by natural or artificial causes, will be restored to its original fertility. Not by simply applying sewage to grass crops, or by continuing the application for two or three years, but by a regular scientific, systematic course of sewage farming and sewage engineering for the future Can it be expected that a period of a few years can repay the evils which it has taken ages to create, or that a brief application of the remedy can cure a disease that has been aggravated by the lapse of centuries? Most fortunately at the present time, by one of those coincidences which invariably attend cause and effect, land is wanted for the application of sewage, and sewage is needed—urgently needed—by the land. It is from the union of the two that national wealth and prosperity will result, but we shall never carry out the union in its integrity, never avail ourselves to the full degree of the advantages at our disposal, or do justice to the resources in our power, until sewage pipes are laid on to the land for the use of the farmer and agriculturist in the same manner as water and gas pipes are laid on for the supply of our cities and towns.

MANCHESTER BOILER ASSOCIATION.

THE last ordinary monthly meeting of the Executive Committee of this association was held in Manchester on Tuesday, May 26, 1868, Charles F. Beyer, Esq., C.E., in the chair, when Mr. L. E. Fletcher, chief engineer, presented his report, of which the following is an abstract:—"During the past month 276 visits of inspection have been made, and 698 boilers examined, 532 externally, 11 internally, 6 in the flues, and 149 entirely; while, in addition, 3 have been tested by hydraulic pressure. In these boilers 102 defects have been discovered, 4 of them being dangerous, thus:—Furnaces out of shape, 4; fractures, 15—2 dangerous; blistered plates, 5; internal corrosion, 27; external ditto, 6; internal grooving, 8; water gauges out of order, 5; blow-out apparatus ditto, 8; fusible plugs ditto, 1; safety valves ditto, 1; pressure gauges ditto, 14—2 dangerous; boilers without pressure gauges, 2; without feed back pressure valves, 5; cases of deficiency of water, 1." Mr. Fletcher presents a long list of explosions, six having occurred during the past month, resulting in the death of six persons and injury to seven others. In addition to these, reference is made to an explosion which ranks as No. 11, and occurred during April, but particulars of which were not received in time to be included in the last report. Not one of the exploded boilers was under the inspection of this Association. No. 11 explosion, by which one person was injured, occurred at a paper mill, at a quarter before two o'clock, on the after-

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noon of Wednesday, April 15. The boiler was No. 3 in a series of four, set side by side, all of them being internally-fired, and of plain single-flued Cornish construction, while the one in question was 15ft. long, by 4ft. 7in. in diameter in the shell, and 2ft. 8in. in the furnace tube, the thickness of the plates in the latter being a quarter of an inch, and the steam pressure 60lb. The boiler failed through collapse of the furnace tube, the crown of which came down and rent near the firebridge, when the rush of steam and water blew up the brick flue at the back of the boiler and severely scalded one of the workmen, but did not disturb the boiler from its seat.

The cause of the collapse has been attributed to shortness of water through the neglect of the attendant. As the furnace tube was removed at the time of examination, Mr. Fletcher is not prepared to offer a positive opinion on this point, but he was assured at the works that the glass gauge showed an ample supply of water at the time, while it may be pointed out that the furnace tube being made of plates only a quarter of an inch thick was quite unfit for a pressure of 60lb. on the square inch, constructed as this one was without any strengthening rings or other appliances, while, further, there was no feed back pressure valve, so that there was nothing to prevent the water's being vomited from one boiler to the other, which would have laid bare the furnace crowns in a few minutes. Whether, therefore, the attendant had been neglectful or not, the furnace tube was weak, and the complement of fittings defective, and, however convenient it may be to throw the blame on the attendant, the boiler makers cannot be exonerated in the present instance, and the explosion affords an additional illustration of the necessity of competent periodical inspection to check the construction and equipment of boilers, as well as their condition.

The following explosions occurred from April 25, 1868, to May 22, 1868, inclusive:—April 30, plain cylindrical, egg-ended, externally-fired—1 killed, 3 injured; May 1, single flue, or Cornish, internally-fired—1 killed; May 9, single-flue, or Cornish, internally-fired; May 11, plain cylindrical, camber-ended, externally-fired—1 killed, 1 injured; May 11, multitubular marine, internally-fired—1 killed; May 12, plain cylindrical, camber-ended, externally-fired—2 killed, 3 injured; total—6 killed, 7 injured.

ON SOME EFFECTS OF THE HEAT OF THE OXY-HYDROGEN FLAME.*

By Mr. William Odling, F.R.S.

CHEMICAL changes, whether of combination or decomposition, result in the production of new bodies which, under the conditions of the change, have for the most part a greater stability than the original bodies. One evidence of this greater stability is afforded by the development of a quantity of heat—the heat of chemical action—from the produced bodies having a smaller potential heat than the original ones. It results, both from reason and experiment, that in order to undo or reverse any definite chemical action, just so much heat must be directly or indirectly expended as was evolved by the original action. For the same quantity of heat evolved, the resulting temperature varies with the mass and kind of matter heated, and with the rapid or gradual evolution of the heat. When the evolution of heat is instantaneous, the resulting temperature may be calculated from the quantity of heat evolved, and the mass and specific heat, &c., of the matter heated. By a unit of heat is meant the quantity of heat necessary to raise the temperature of one kilogramme of water one degree Centigrade, or more accurately from 0deg. to 1deg.

Every 18 grammes of water is a combination of two 1-gramme proportions of hydrogen H, with one 16-gramme proportion of oxygen O; and, by the combination of 2 grammes of hydrogen with 16 grammes of oxygen, there are developed 68 units of heat. Of these 68 units of heat, however, little more than 57 units are really due to the chemical action—nearly 11 units of heat being evolved by the contraction of the original mixed gas into two-thirds its volume of steam, and by the further condensation of the resulting steam into 18 cubic centimetres of water. While the quantity of heat evolved by the combination of a given quantity of oxygen and hydrogen is invariable, the intensity of the heat may vary from a scarcely recognisable rise of temperature up to the highest temperature of the oxy-hydrogen blow-pipe flame, capable of fusing platinum and silica. A most remarkable effect of the intense temperature resulting from the combination of oxygen and hydrogen into water, is the partial decomposition of water into oxygen and hydrogen, discovered by Mr. Grove in 1846. At this high temperature, hydrochloric acid and carbonic anhydride gases also undergo partial decomposition into hydrogen and chlorine, and into carbonous oxide and oxygen respectively. Upon what do these singular decompositions by heat, of bodies formed with great evolution of heat, depend; or with what class of chemical phenomena may they be associated?

Under certain familiar conditions, chemical action seemingly takes place to its utmost possible extent in a single direction only, with production of a maximum amount of the substance that is formed with maximum evolution of heat. For example, taking atomic proportions in grammes, the heat of formation of chloride of zinc, $ZnCl_2$, is 101 units, and the heat of formation of chloride of copper, $CuCl_2$, is 60·5 units. Hence, with chlorine in solution and excess of both copper and zinc, there is finally produced the maximum possible amount of chloride of zinc and no chloride of copper. Again, an addition of sufficient zinc to solution of chloride of copper, there is complete combination of chlorine with zinc and complete separation of chlorine from copper, *i.e.*, complete burning of the one metal and complete unburning of the other.

But under simpler though less familiar conditions, chemical action habitually takes place in more than one direction simultaneously, with production of correlative products in varying proportions. Thus, with hydrogen and excess of both chlorine and oxygen, although the heat of formation of oxide of hydrogen H_2O is 57 units, and the heat of formation of chloride of hydrogen, 2 HCl, is only 47·5 units, yet, in this case, the hydrogen does not combine with the oxygen to the exclusion of the chlorine, but divides itself between the oxygen and the chlorine in proportions which vary with the conditions of the experiment. In accordance with this result it is found that, at the same red heat, excess of chlorine will effect the partial decomposition of water with extrusion of oxygen; and, conversely, that excess of oxygen will effect the partial decomposition of hydrochloric acid with extrusion of chlorine. So that, beginning with the two chemical substances, water and chlorine, or beginning with the two chemical substances, hydrochloric and oxygen, or beginning with the three chemical substances, hydrogen, chlorine, and oxygen, there exist, at a full red heat, the four chemical substances, water, hydrochloric acid, chlorine, and oxygen; the proportions of the four substances depending certainly upon the relative quantities present of the elements concerned, and most probably also upon the temperature of the experiment. Similarly, beginning with the one chemical substance water (Grove), or beginning with the two chemical substances, oxygen and hydrogen (Bunsen), there always exist, at a sufficiently high temperature, the three chemical substances, water, oxygen, and hydrogen. Although, by exposure to a red heat, the electrolytic mixture of oxygen and hydrogen gases becomes completely combined, or transformed into water, yet, as recently shown by Bunsen, at the high temperature of 2,024deg., only one-half, and at the still higher temperature of 2,844deg., only one-third of the mixture undergoes combination, the other one-half or two-thirds remaining in the state of mixed gas.

Chemists are acquainted with many reciprocal actions comparable with those of chlorine upon water, and of oxygen upon hydrochloric acid, the most familiar instance being probably the decomposition of ignited oxide of iron by hydrogen with extrusion of iron, and the converse decomposition of oxide of hydrogen by ignited iron with extrusion of hydrogen. Similarly, sodium will decompose the oxides of carbon, while carbon will decompose oxide of sodium; and just as a sufficient excess of chlorine may be made to effect the almost complete decomposition of a given quantity of water, so may a sufficient excess of carbon (or carbonous oxide) be made to effect the almost complete decomposition of a given quantity of sodium-oxide or zinc-oxide, as in the ordinary processes for obtaining the two metals; notwithstanding that, for an equal consumption of oxygen, the respective combination heats of sodium and zinc exceed by far the combination heat of carbon or carbonous oxide. Again, although the combination heat of oxygen and carbonous oxide is 68 units, while that of oxygen and hydrogen is only 57 units, yet, as was shown by Bunsen many years ago, upon exploding a mixture of oxygen with a joint excess of carbonous oxide and hydrogen, the oxygen does not attach itself exclusively to the carbonous oxide, but divides itself between the carbonous oxide and hydrogen in a ratio determined by their relative proportions.

* Read before the Royal Institution of Great Britain.

STEAM FIRE ENGINES.

THE corporation of the borough of Wigan have recently purchased of Messrs. Merryweather and Sons, of London, the large-size double cylinder steam fire engine "L'Empereur," one of the engines which the firm exhibited at the Paris Exhibition of last year, where, it will be remembered, the first prize, and only gold medal, was awarded to them. The trials made with this engine at Wigan have shown that the engine is quite capable of projecting and maintaining a stream 1¾in. diameter to a height of over 200ft., and of raising 100lb. pressure of steam from cold water in from ten to eleven minutes. By way of experiment, jets of 2in., 2¼in., 2½in., also four of 1in. and eight of ¾in. were delivered by this powerful machine; whilst doing this great amount of work the engine remained perfectly steady. It has two steam cylinders, each 8¾in. diameter, and two horizontal double-acting pumps, each 7in. diameter, with 24in. stroke of steam and water pistons. Engines of similar size have been supplied by these makers to five of our Royal dockyards.

Correspondence.

MAGNETIC PHENOMENON.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—If your correspondent, "A. de B.," of Delft, will duly reflect on the experiment he has described at page 435 in your journal, June 5, he will see there is nothing remarkable in the north pole of the magnet attracting the suspended needle at C. It should do so. He has forgotten that in magnetizing the point of the needle (which was thrust through the cork) with the north pole of the magnet, he communicated to it a south polarity. The south pole of the magnet of course communicated a north polarity to the point of the suspended needle, the lower end of which would of necessity be a south pole, and, therefore, attracted by the north pole of the magnet, when presented to it. As regards the oscillations of the needle, if he will place the bottle on a support free from tremor, the suspended needle will soon attain a state of rest.—I am, Sir, yours, &c.,

J. B. DANCER.

Manchester, June 9.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—W. K.—F. W. B.—R. H.—Messrs. W. and C.—H. D. F.—Messrs. C. G. and Co.—H. J.—R. S.—R. H. N.—R. W.—S. F. M.—W. R.—M. J.—C. P. C.—C. W.—R. I.—S. K. M.—G. S. K.—J. P. F.—R. B.—G. E. P.—I. B. D.—E. M.—G. L.—S. E.—T. R.—W. H. H.—L. S.—J. T.—G. J. G.—W. F.—R. M. O.—W. T. C.—E. F.—J. T.—H. R. S.—P. W.—W. M.—T. P. J.—F. F.

Meetings for the Week.

MON. — Royal United Service Institution. — Major Palliser, unattached, late 18th Hussars, on "The Construction of Heavy Rifled Ordnance," at 8.30 p.m.

THURS. — Royal Institution.—Sir J. Lubbock on "Savages," at 3 p.m.

FRI.—Royal United Service Institution.—Colonel W. F. D. Jervois, C.B., R.E., Deputy-Director of Works for Fortifications, on "Coast Defences, and Application of Iron to Fortification," at 3 p.m.

SAT.—Royal Institution.—Sir J. Lubbock on "Savages," at 3 p.m.

DURING the past week 34 wrecks were reported, making for the present year a total of 989.

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Naval, Military, and Gunnery Items.

A PANORAMA of the Isthmus of Suez, representing the works executed by the company of M. F. de Lesseps, has been brought out in Paris. Before the public were admitted, M. de Lesseps invited the members of the press to the panorama, and intimated to them that "it was but the beginning of the voyage which the company was going to organise next year."

THE "Monster Tower Drums" were originally manufactured for the Great Handel Festival, held in Westminster Abbey, A.D. 1784. They were called "Tower" drums, owing to the fact that the heads were made from the skins of the celebrated lions exhibited at the Tower of London about that period—a circumstance now almost forgotten.

THE Duke of Northumberland will distribute the prizes to the cadets, on board the "Worcester" training-ship lying off Erith on the 23rd inst. The Queen's prizes, which in future will be annual, will this year be given for the first time. These consist of a gold medal, to encourage the boys to acquire and maintain the qualities which will make the finest sailor, and a binocular glass, with a suitable inscription, and a sum of £35 to the boy who shall have obtained the naval cadetship given by the Admiralty.

ANTWERP is not only the principal port of Belgium, but also the emporium, for the greater part of Germany. Since the peace of 1815, the trade of Antwerp has continually increased. In 1824, the number of ships that arrived at this port was 681; in 1825 the arrivals amounted to 800; in 1836 to 1,426; in 1861 to 2,786; and in 1866, the number of arrivals amounted to not less than 3,085 ships, of the aggregate tonnage of 885,052, and the departures to 3,031 ships, of 885,052 tons.

ARRANGEMENTS are in progress with the view of placing several heavy Palliser guns on the forts at Pembroke Dock and Milford Haven. The first five have been shipped at Woolwich, and are expected to arrive in the course of a few days, when they will be removed and placed in position, at Popton on fortress. The next five will be placed at Hubberston, and the other forts will receive their complement in due time. These formidable pieces of artillery are of very large calibre, and weigh about 12½ tons each.

THE "Pallas" has been placed in dock at Portsmouth, to cleanse her hull below the water-line, preparatory to making her ordered experimental trials at sea. Fifty tons of coals will be taken out of her coal bunkers, and 50 tons of ballast fixed on her upper deck, the purpose in this change in the disposition of her weights being to raise, so far as these means will effect it, the centre of gravity of the hull, and ascertain in the forthcoming trials its effect upon her tendency to roll at sea.

CAPTAIN ROBERTSON, R.N., of the Board of Trade, has just completed his annual inspection of the Volunteer Life Brigades, on the north-eastern coast, established for the rescue of shipwrecked seamen. The corps are composed of young men of all classes of the community, and have been found in a high state of efficiency. The Tynemouth, South Shields, and Cullercoats Life Brigades have club-houses admirably fitted up, and complete arrangements are made for the reception and restoration of shipwrecked men immediately after they are landed from wrecks. The movement was commenced at Tynemouth a few years ago, and is gradually extending to other large seaports and fishing villages. It has the hearty support and co-operation of the Board of Trade.

ON Tuesday the River Wear Commissioners opened the new docks at Sunderland of eleven acres area. The long depression in the shipping trade has so reduced the funds at the disposal of the commissioners that economy necessitated the avoidance of any costly ceremony. Flags were hoisted at the masts of nearly all the ships in port, and thousands of the inhabitants assembled to witness the commissioners run a fine steamer of 2,000 tons burden, and other large vessels, into the dock shortly after low water, showing what deep-water accommodation would be afforded at high water.

AT a recent meeting of the Cork Harbour Board a communication was read from the Board of Trade containing a proposal with reference to the blasting of Daunt's Rock, providing that whatever sum of money might be paid out of the Mercantile Marine Board for the purpose, an equivalent should be paid by a special toll levied off the trade of Cork, so as to indemnify the Mercantile Marine Fund. The board unanimously rejected the proposal on the ground that it was an imperial rather than a local measure, and that the trade of Cork had no right to be called on to contribute at all.

ADVICES from San Francisco state that the monthly service of the Pacific Mail Steamship Company to Japan and China commenced on June 3. The "Great Republic," which left San Francisco on March 4, when within about 2,000 miles of Yokohama, became partially disabled, and proceeded under sail and one wheel to that port. The remaining part of the voyage to Hong Kong and back to San Francisco was completed by the company's steamer "New York," which was then at Yokohama, and the round, it is said, exceeded by only two days the contract time.

Miscellanea.

A MONUMENT from the hand of the sculptor Molin is to be erected at Stockholm to the memory of King Charles XII. The inauguration is to take place on November 30 next, the 150th anniversary of the monarch's death.

THE Parliamentary session commenced on the 19th of November, and the result up to the present period has been 30 public and 31 local Acts, making 61 in nearly seven months.

THE Bath and West of England Agricultural Society, which is now amalgamated with the Southern Counties Adult Education Association, has decided to hold its exhibition for 1869 at Southampton, subject to the site being approved of by the council, and other conditions.

FORTY-FIVE miles of steel rails are laid on the Lehigh and Susquehanna Railway, connected with the North Pennsylvania at Bethlehem. There was not one broken rail caused by the trains during the past winter.

ADVICES in relation to the volcanic eruption in the Sandwich Islands state that at Kakuka, on April 7, the lava again burst forth through a fissure nearly three miles long, and run, in a few hours, twelve miles, from a height of 3,800ft. to the sea, forming a solid projection half a mile in length.

IN Paris, for some days past, a number of cabs have been seen with the new kilometrical meter for measuring the distance traversed. The apparatus is fixed to the seat, at the left of the coachman; and resembles a small timepiece. The comparison is so much the more exact that near the traveller is a dial which marks the hour.

AN official statement relative to the cost of the Thames Embankment has been issued. The receipts to May 5 last amounted to £3,729,352, and the payments to £3,572,013, and the sum required to complete the work is £1,839,000. The original estimate was £4,935,320, but (according to the foregoing figures) the present estimated cost will be £5,568,353.

THE amount of capital accumulated in the Post Office Savings Banks at the close of 1867 was £9,230,229; at the close of 1866 the corresponding total was £7,719,981; at the close of 1865, £6,161,488; at the close of 1864, £4,687,893; and at the close of 1863, £3,131,535. Thus, in four years the aggregate balance at the credit of depositors in the Post Office Savings Banks increased to the extent of £6,098,694.

AT the last meeting of the Royal Geographical Society the following gentlemen were elected Fellows of the society:—W. A. Bell, Esq.; A. T. Bowser, Esq.; W. Clark, Esq.; Hon. G. S. Gough; T. C. Graham, Esq.; Sir George P. Lee, Bart.; his Excellency Lieutenant-General Sir Robert Napier, G.C.B.; G. F. Plumberg, Esq.; C. J. Smith, Esq.; Captain the Hon. W. J. Ward, R.N.; M. Williams, Esq.

DURING the year 1866 there were produced from mines in the United Kingdom 101,630,544 tons of coals, valued at the place of production at £25,407,635; 4,523,897 tons of pig iron, valued at £11,309,742; 11,153 tons of fine copper, valued at £1,019,168; 67,390 tons of metallic lead, valued at £1,381,509; 9,990 tons of white tin, valued at £885,368; 3,192 tons of zinc, valued at £69,916; 636,188 tons of silver from lead, valued at £174,951, and other metals, valued at £95,000, so that the total value of coal and metals taken from British mines in the year above referred to was £40,345,945, including 743oz. of gold, valued at £2,656.

THE exhibition of rhododendrons, azaleas, &c., generally called "American plants," which opened in the Royal Botanic Gardens, Regent's-park, last Monday, has now attained its maximum beauty. The extraordinarily fine spring has been so much in favour of this as well as nearly all classes of plants that the display is considered finer than on any former year. Much also is due to the energy of Mr. John Waterer, the cultivator of the plants, for the great variety of colour of the flowers, which ranges from pure white and delicate rose to deep purple and vivid crimson. A very curious effect is produced by the large mass of bright colour within the marquee, which is filled with a glow of peculiar light.

THE amount of Customs revenue collected at Glasgow in May was £74,818, as compared with £90,009 in May, 1867, and £68,994 in May, 1866. At Greenock, Customs revenue was collected in May to the extent of £105,708, as compared with £101,068 in May, 1867, and £132,322 in May, 1866. The imports of sugar into the Clyde in the first five months of this year amounted to 66,389 tons, against 78,587 tons in the corresponding period of 1867; the deliveries for home consumption in the Clyde during the last five months amounted to 69,613 tons, against 70,788 tons in the corresponding period of 1867. The stock in bond in the Clyde at the close of May was 12,757 tons, against 26,785 tons the close of May, 1867.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending June 6, was 6,842; total number since the opening of the museum, free daily (May 12, 1858), 1,309,653.

THERE are two specimens of the mocking bird now in England. They are to be seen in the aviary at the Crystal Palace, near the crystal fountain. They are in full song, and warble the notes of the thrush, blackbird, nightingale, mock the railway whistle, the sawing of wood, and whistle some English songs.

THE visitors to the South Kensington Museum during the week ending June 6, were—On Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m.; on Wednesday, Thursday, and Friday (free), from 10 a.m. till 6 p.m., 25,152, National Portrait Exhibition, by payment, 2,439; total—27,591. Average of corresponding week in former years, 20,948; total from the opening of the Museum—7,437,548.

THE sale of fungi in Milan is under great restriction, and is only allowed in the public markets, so as to be under the immediate eye of the market inspectors. The sale of all fungi prejudicial to health, as also of those but little known, even if not poisonous, is strictly prohibited. The following, says the "Society of Arts' Journal," are the only varieties of fungi which are permitted to be sold in the Milanese markets:—

Names in Milanese Dialect.	Italian names.	Botanical names.
Funsg ferree	...Fungo porcino...	Boletus edulis.
Funsg cocch	...Uovolo	...Agaricus cæsareus.
Spongignœura...	Spugnuola	...Phallus esculentus.
Trifola	...Tartufo	...Lycoperdon tuber.

Any infringement of these regulations is punished by fines and imprisonment.

AT the earthenware manufactory of Messrs. Powell and Bishop, Hanley, Staffordshire, a fortnight ago, it was noticed that the walls of a portion of the building, called the "saggar" house, were gradually falling out of the perpendicular, but several days elapsed before it was found to be due to a seam of coal, technically known as a "smut," which crops up under that part of the building, having become ignited by one of the flues of the "saggar" house, and the fire had in all probability been smouldering for a considerable time. A mining engineer was consulted, and he advised that a shaft six yards deep should be sunk near the seam, and the fire cut off by driving lateral galleries.

TWO volumes have been issued among the Parliamentary papers, an instalment of a series of six volumes of reports on the Paris Universal Exhibition of 1867. One volume will contain the general report, the statistical tables; four volumes will be occupied by reports on the various classes; and the sixth volume is devoted to returns relating to the new order of reward for success in the development of a spirit of harmony among those co-operating in the same work, and in making provision for the material moral and intellectual well-being of the workmen. The reports on the various classes were prepared for the Science and Art Department in accordance with the direction of the Committee of Council on Education. The two volumes first issued are Vol. II. and Vol. VI.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3319, 3321, 3343, 3348, 3350
BUILDINGS AND BUILDING MATERIALS—3377
CHEMISTRY AND PHOTOGRAPHY—3358, 3360, 3389
CULTIVATION, OF THE SOIL, including agricultural implements and machines—None.
ELECTRICAL APPARATUS—3317, 3346, 3390
FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—3329, 3338, 3347, 3351, 3357, 3371, 3372 3384, 3385
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—3323, 3359
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—3303, 3383
GENERAL MACHINERY—3310, 3312, 3314, 3315, 3316, 3322, 3330, 3332, 3337, 3354, 3366, 3367, 3369, 3373, 3375, 3381, 3386, 3387, 3388
LIGHTING, HEATING, AND VENTILATING—3318, 3353, 3361 3376
METALS, including apparatus for their manufacture—3340, 3352, 3355, 3360
MISCELLANEOUS—3311, 3313, 3326, 3327, 3328, 3335, 3336, 3339, 3341, 3342, 3344, 3349, 3364, 3370, 3374, 3378, 3380, 3382

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ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3325, 3356, 3362, 3363, 3368
SHIPS AND BOATS, including their fittings—3391
STEAM ENGINES—3309, 3320, 3334, 3379
WARFARE—3308, 3324, 3345

3309 J. G. TONGUE. *Improvements in gibs applicable to the crossheads and other parts of engines and other machinery, also in the means employed for lubricating the same and other sliding or frictional surfaces.* (A communication.) Dated November 22, 1867.

The first part of this invention relates to a peculiar construction of "gibs" such as are used in the cross-heads of steam and other engines, and in other mechanical devices having a sliding character or action, and in which the gibs form bearings against guides during the sliding or reciprocating action of the cross-head or other mechanical device which carries them, and is equally applicable to gibs having a fixed or stationary character on or against which the moving parts of machinery bear or slide over. This part of the invention consists in making the gib in sections consisting of a loose or detachable friction plate of superior metal as regards wear and anti-friction properties, the same covering the one side or face of the gib to form the rubbing surface or bearing and main portion or body of the gib of inferior metal constructed or arranged to carry the friction plate, and constituting a back or support to the main portion readily removed, and a new one supplied to the main portion or body of the gib which is exempt from wear. The second part of the invention relates to the lubrication of gibs of a working or movable character, or the surfaces against which they bear or slide.—Patent abandoned.

3310 T. G. F. DOLBY. *The hot water food warmer.* Dated November 22, 1867.

An extension of time for filing the final specification of this invention having been petitioned for, the documents relating to the invention cannot at present be seen.

3311 A. MUNRO. *Improvements in boring or cutting rocks or other substances, and in the means employed therefor.* Dated November 22, 1867.

This invention relates to an improved tool to be used for cutting rocks or other similar substances in mining and engineering operations, and in hewing or cutting stone for building and other structural purposes, and it consists in the application of chilled cast iron, or iron compounded with other substances as the material of which the tools themselves are made. The tool consists of flat discs, with the edge bevelled, or of a bell-mouth shape, so that a sharp or cutting side is left all round them; the tools are retained in holders fixed to the boring head of a boring or cutting machine, and they are manufactured by running cast iron into properly shaped drills in the ordinary manner. In place of forming the tools of a disc shape, they may be made oblong with round or semicircular ends. They may also be made of an elliptical, angular, or other form, a dovetail or other-shaped projection being formed on the back for retaining them in the holder.—Patent completed.

3312 G. WELCH. *An improved mode of, and apparatus or means for, killing whales.* Dated November 22, 1867.

The patentee claims, first, the use of shells filled with gunpowder or other suitable explosive material fixed on the front points of the harpoon and whaling lances, as described. Second, the method of exploding such shells by means of a fuze, which is ignited by pressure and percussion of the opening of the barbs after the harpoon has entered the whale, as described. Third, the method of exploding shells attached to whaling licences by means of a waterproof time fuze contained in a perforated tube inserted in the hollow shaft of the lance, the said fuze being ignited when the lance is fired from the harpoon, gun, or other suitable instrument.—Patent completed.

3313 J. H. BROWN. *A new game called "The queen and her court," to be played with balls and cues or other media for propelling the said balls, and also for the peculiar construction of the table on which the same is played, together with the several mechanical appliances and figures.* Dated November 22, 1867.

These improvements consist in a new game denominated the "Queen and her Court," which game is played with balls and cues, or other propelling media, on a table formed with any required number of holes, somewhat after the construction of a bagatelle board, only that the balls falls completely through into a chamber underneath upon an inclined plane.—Patent abandoned.

3314 G. D. HUGHES. *Improvements in the means of, and apparatus for, consuming smoke and economizing fuel in furnaces of steam boilers and other furnaces.* Dated November 23, 1867.

The patentee claims the peculiar arrangement and application of vertical wires or rods in the door, or box, or respirator, and the projections on the underside of the firebars, and also the combination of diverging and deflecting plates. He does not claim any of the other mechanical arrangements separately, but he claims the combined means, apparatus, and general arrangement of parts as applied to the doors or other parts of furnaces for the purpose of consuming smoke and economizing fuel.—Patent completed.

3315 W. NEEDHAM and J. KITE. *Improvements in apparatus for depurating or changing the condition of fluids in process of decantation.* Dated November 23, 1867.

The object of this invention is to intercept all substances held in suspension, and to purify fluids of every kind in their passage from one vessel to another by means of a portable filtering apparatus adapted between them. The filtering apparatus consists, essentially, of a chamber containing one or more filtering cloths, and having on its exterior connecting tubes and cocks by which it is placed in connection with the casks or other vessels, and through which the fluid is admitted to, and withdrawn from, its interior.—Patent abandoned.

3316 G. H. and E. BOLTON, W. WHITTHREAD, and T. ROBINSON. *Improvements in obtaining motive power, and in apparatus employed therein.* Dated November 23, 1867.

This invention consists, first, in obtaining motive power by igniting and exploding within any suitable engine a mixture of the vapour of a hydrocarbon liquid with atmospheric air or oxygen, when admixture of the air or oxygen with the said vapour, or only a part of the air or oxygen with the said vapour, or only a part of the air or oxygen required, is effected or allowed to take place within a vessel or space outside the cylinder or cylinders, or other part of the engine within which the explosion is caused. Any gas or vacuum engine now in use can be employed, but the inventors prefer those of the improved construction hereinafter described. The said vapour and air or oxygen, mixed as aforesaid, are supplied to the engine by either of the well-known methods of inhalation, or injection; they prefer the former, however, as by it the mixing of the said gases is effected in a simple and efficient manner within the same vessel in which the hydrocarbon liquid is vaporized. Second, the invention consists in employing with engines in which hydrocarbon vapour and air or oxygen are employed an apparatus devised by the patentees, and called "the vaporizer." This consists of a rectangular or other suitably shaped vessel; it contains the hydrocarbon liquid, and is so fitted that heat can be applied to vaporize the said liquid should the atmospheric temperature be insufficient for that purpose. Internally it is divided by partitions, or it is partly filled with a spongy, fibrous, or porous material, which will suck up by capillary attraction the hydrocarbon liquid. The supply pipe of the engine, that is to say, the pipe which conveys the mixed gases to the engine, is connected into the said vaporizer, which is fitted with a pipe so arranged that it can be opened to the air or to a supply of oxygen. When the engine is at work, acting by inhalation, the said pipe is opened, and at each stroke air or oxygen is inhaled through the opening which passes through the vaporizer and supply pipe into the engine. The air or oxygen so sucked in mixes with and takes up in its passage through the vaporizer a quantity of the hydrocarbon vapour, sufficient to form an explosive mixture; or the further quantity of air or oxygen required is added on the engine in any convenient manner. When the engine is worked by injection, a pump is employed to force or suck air through the vaporizer and deliver it thence into the engine. Third, the invention consists in placing between engines in which hydrocarbon vapour mixed with air or oxygen is exploded and the vaporizer described above an interceptor to prevent the flame of explosion (should the valves not be tight from any cause) from travelling backwards into the vaporizer. This consists of a box fitted with wire gauze or small tubes. In practice they prefer to place it in the supply pipe near to the engine. The invention comprises other features.—Patent abandoned.

3317 E. T. HUGHES. *Improvements in telegraphic apparatus.* (A communication.) Dated November 23, 1867.

This invention is not described apart from the drawings.—Patent abandoned.

3318 P. SALMON. *Improvements in the manufacture of gas, combined with its application as a motive power in engines previous to its being burned or consumed, and in generating steam in boilers for the same.* Dated November 23, 1867.

The patentee claims, first, the manner of fitting the tubes in the gas generator, the novel self-acting shut-off valves, scrubbers, and drivers, and the use in combination with these of the feed injector, as set forth. Second, the combined apparatus used for the application or treatment of gas in the manner described for lighting, cooking, warming, generating steam or other purposes, as set forth.—Patent completed.

3319 W. BOULTON. *An improved method of transmitting motive power to potters' wheels, lathes, and other similar machinery for the manufacture of pottery.* Dated November 23, 1867.

This invention consists, principally, in an endless band (made of cotton, hemp, india-rubber, or any other suitable material), to be driven from a grooved or other pulley in either a horizontal, vertical, or oblique position, as may be best suited for the machine to be driven, and to be direct-acting without the aid of discs or long shafting, and to have a number of potters' wheels, lathes, jiggers, or other machines in connection with the making of pottery at one and the same time, and so that the speed of any or all of them can be varied at pleasure or reversed, and, in order to accomplish this, the patentee takes the belt from the first driving pulley in the most convenient manner, and passes it near to a grooved pulley in connection with the machine to be driven. He then fixes a small friction pulley attached to a lever or treadle, or any other convenient appliance, and, when the machine is required to move or revolve, the friction pulley is caused to bring the belt in contact with the driving pulley, and, when the speed is required to be reduced, the belt is partially removed from the driving pulley in order to allow a little slipping, or a hand-wheel or brake may be attached, in order to vary the speed, or the belt may be removed to another pulley of a larger size by a lever, treadle, or other convenient arrangement. If the motion is required to be reversed he moves the belt to the contrary side of the pulley, or brings the return belt in contact with another pulley on the same shaft or spindle. By this means the reversed motion can be varied in speed according to the size of the second pulley. In order to keep the belt at an uniform tension he introduces a balance or tightening weight that will move with the variation of the belt.—Patent completed.

3320 W. MACNAB. *Improvements in marine steam engines.* Dated November 23, 1867.

This invention relates to a previous patent dated February 11, 1862 (No. 354), and consists in disposing the low-pressure cylinders which have trunks, and the high-pressure cylinders which have solid piston rods, horizontally and vertically respectively, or otherwise at right angles, or other convenient angles, to each other, but with both low-pressure and high-pressure cylinders of each pair acting on one crank pin. These improved engines may be used in single pairs, but engines comprising two pairs, or in all four cylinders with the crank of one pair at right angles to that of the other pair, form a very good and steadily working arrangement for large powers—Patent completed.

3321 C. E. BROOMAN. *Improvements in steam generators.* (A communication.) Dated November 23, 1867.

The objects of this invention are to increase the heating surface and the evaporating power of the fuel in tubular steam generators, and the improvements consist, first, in a tubular partition which the patentee fits between the grate bars and the top of the fireplace; and, second, in an independent tubular apparatus which fits in the firebox above the tubular partition, to serve, as required, either as a heater of the feed water, or as a superheater of the steam produced by the generator.—Patent completed.

3322 S. AMPHLET and J. B. FENBY. *Improvements in machinery for ruling ornamental patterns or devices.* Dated November 23, 1867.

The details of this invention are two voluminous to be quoted here. The patentees claim, first, the construction and arrangement of the compound table described, the lower or principal table having a longitudinal motion from end to end of the machine, and the other a transverse motion upon the first or principal table. Second, the construction and arrangement of the parts of mechanism for giving an intermittent sliding motion to the transverse table for the purpose of spacing the pattern. Third, the construction and arrangement of the parts for reversing the spacing mechanism, and for returning the transverse table to its original position on the principal table, substantially as described and illustrated in the drawings. Also the construction and arrangement of parts for determining the position at which the spacing mechanism should be reversed. Fourth, the construction and arrangement of parts for raising and lowering the whole of the pens at each double traverse of the principal table, and for lifting any particular pen or pens on the advance stroke of the said table, as the pattern being ruled may require. Fifth, the construction and arrangement of the parts for shifting any row of pens without disturbing the spaces of the pens, with respect to each other. Sixth, the construction and arrangement of parts for raising and lowering the pen carriage, substantially as described. Seventh, the general arrangement or combination described of the parts of machinery for ruling ornamental patterns or devices. Lastly, constructing the pens of machinery for ruling ornamental patterns or devices with a long bearing surface or edge, as described.—Patent completed.

3323 W. MORT. *Improvements in preserving meat, and in apparatus employed therein.* (A communication.) Dated November 23, 1867.

This invention is not described apart from the drawings.—Patent completed.

3324 J. H. JOHNSON. *Improvements in breech-loading fire-arms, and in cartridges for the same.* (A communication.) Dated November 23, 1867.

This invention is not described apart from the drawings.—Patent completed.

3325 M. A. HAMILTON. *Improvements in the manufacture of railway rails.* Dated November 25, 1867.

This invention relates, chiefly, to the construction of rails of iron and steel, the two metals being combined in such a manner that the head of the rail is covered on the top and sides with steel, the head, neck, or web and base of the rail being of iron. The whole rail is rolled or drawn from a pile or faggot consisting of bars of iron and steel, the steel and iron being welded together during the process of rolling. The invention also relates partly to the production of an iron railway rail formed partly of old rails having the top and sides of its head wrapped around with the steel, the whole being welded together during the rolling process.—Patent completed.

3326 T. BARTON. *An improved cribbage board.* Dated November 25, 1867.

This invention consists in forming within the top of the board two sets of numerical indicators and a trump card register (making in all five indicators), as also a register at each end denoting the number of games scored; the register denoting the "ace" in each suite, or trump card turned up or cut at each dealing, and the numerical indicators (singly or combined) registering the progress of the game, which are both to be seen at one glance.—Patent completed.

3327 F. BROWN. *Improvements in kitchen ranges.* Dated November 25, 1867.

This invention is more particularly applicable to what are known as close fire ranges when the range is made with an oven on one side of the fire and a boiler at the back; or when made without any boiler the patentee heats the oven or ovens by two distinct flues from the fire. First, the top of the oven is heated by a flue from the fire passing over it; this flue has an outlet into the chimney, and the draught is regulated by a damper in the usual manner. Second, the bottom, back, and side of the oven furthest from the fire are heated by a flue passing, by preference, from the bottom of the fire, or from the side of the fire close to the bottom; this flue passes under the oven, and rises at the back or side, or both, and then up the same outlet to the chimney as the flue which passes over the top of the oven; or it may have a separate outlet or outlets to the chimney, and the draft may be regulated by an independent damper or dampers. The side of the oven next the fire is heated in the ordinary manner by its close proximity to the fire, and is protected as usual with a firebrick or iron shield to prevent its becoming overheated.—Patent completed.

3328 G. TURNER. *Improvements in the construction of packing cases, and in the mode of locking the same to secure them against clandestine opening.* Dated November 25, 1867.

This invention is not described apart from the drawings.—Patent completed.

3329 T. L. GREENWOOD. *Improved means or apparatus for dyeing piece goods indigo blue.* Dated November 25, 1867.

This invention consists in the application and use of a pair of rollers submerged a suitable depth in the dye liquor, and placed at any convenient distance apart, and parallel to each other, so arranged and operated by chain and wheels, or other suitable gearing, that the fabric to be dyed may be first wound upon one of these rollers, then unwound therefrom and wound upon the other roller, and so on, thus traversing the fabric alternately from one roller to the other in the dye liquor until the desired effect is produced.—Patent abandoned.

3330 T. J. MAYALL. *Improvements in means or apparatus for accumulating and delivering sheets of paper or other fabrics.* Dated November 25, 1867.

The object of this invention is that sheets of paper, or other fabric, as received from a printing press or other supply may, be accumulated in regulated quantities, and that when the desired number have been accumulated they may be delivered on to a table or other receiver. For this purpose the separate sheets are received between pairs of endless tapes which are kept distended by rollers. These receiving tapes conduct the sheets to the surface of a cylinder, which may be called the accumulating cylinder, and to which the sheets are borne by other endless tapes formed of india-rubber web or other elastic material. These elastic endless tapes are kept extended by means of extending rollers, by which, aided by guide rollers, they are caused to bear against a considerable portion of the surface of the accumulating cylinder. One of these extending rollers is supported on arms capable of being actuated so that at one time the portions of tapes passing over it may, aided by other arms, act to facilitate the accumulation of sheets on to the accumulating cylinder, and then,

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when desired, be moved to cause the accumulated sheets, aided by other arms or guides, to pass between delivery rollers, by which they are delivered to a table or other receiver.—Patent abandoned.

3331 G. B. GALLOWAY. *Improvements in merchants' ships and other vessels and appliances connected therewith.* Dated November 25, 1867.

Provisional protection has not been granted for this invention.

3332 R. WARD. *Improvements in machinery for spinning or twisting tobacco.* Dated November 25, 1867.

The patentee claims the use of an arm running down the whole length of the table, or as nearly so as circumstances require, to enable the spinner to operate upon the mechanism the use of cones to regulate the speed, and the use of loose shears in connection with one of the cones to withdraw the motive power from the reel. He also claims the arranging machinery for spinning or twisting tobacco, substantially as described.—Patent completed.

3333 T. CHALMERS. *Improvements in machinery for producing seamless tubes.* (A communication.) Dated November 25, 1867.

This invention is not described apart from the drawings. —Patent completed.

3334 A. V. NEWTON. *An improved construction of rotary steam engine.* (A communication.) Dated November 25, 1867.

This invention relates to a novel construction of rotary engine, which admits of being driven in opposite directions at the will of the attendant. The engine consists of a cylinder through the end plates of which passes a driving shaft carrying a cam or block mounted concentric with the cylinder. This block is made to work steam-tight against the end plates. It is formed with recesses in its periphery to receive hinged pistons which fit closely in their respective recesses, except when forced out by the impelling power of the steam. In one position of the cylinder metallic packing with tapering ends are provided, which forms a steam top between the inner periphery of the cylinder and the periphery of the block or cam, and it serves to press down the pistons (as they are brought round by the rotation of the block) into their respective recesses. Two sets of pistons are provided, one set to act in one and the other in the opposite direction. Each set may consist of two or more pistons. At opposite sides of the cylinder are ports or openings for the admission of steam from the boiler. These parts are opened or closed according to the direction of rotation required for the engine. From each of these ports the steam passes to one of two annular steam chests made in the end of the rotating cam or block. These steam chests are divided into two equal parts, from each of which a passage leads off to the back of a piston. The steam, therefore, is caused to act on the back of the pistons, and thereby impart the required propelling power to the engine.—Patent completed.

3335 W. F. STANLEY. *A new instrument to be called a meteorometer.* Dated November 25, 1867.

This invention refers to an instrument which the inventor calls a meteorometer, the purpose of which is to predict the probable weather. The construction of this will combine in one instrument the following indications:—The specific weight, the direction, the force, the temperature, the hydrometric and the electric state of the atmosphere; also will indicate whether the mercurial column is rising or falling; also the combined action of weight and direction of the atmosphere acting together, giving the meteorological effects of their combined action by indication on one dial; also the amount of rainfall in a given time. A compensating clock will be generally placed upon the face of the instrument. The details of the invention are voluminous.—Patent abandoned.

3336 R. M. LETCHFORD. *Improvements in the manufacture of cigar and other lights.* Dated November 26, 1867.

The first part of this invention has reference to the composition for burning at the end of the stem. This part of the invention consists in forming a paste of amorphous phosphorus, with a small quantity of powdered glass and dissolved gum, and a proportion of water. He applies this paste to the end of stems of suitable material, and finishes in the way that Vesuvian cigar lights are now finished. The proportions of the materials he uses are:—Amorphous phosphorus, 4oz.; powdered glass, 8lb.; gum arabic, 3lb.; and water, 4 pints. The second part of the invention relates to the stems of cigar and other lights. Stems of cigar and other lights have hitherto been made of wood or glass. Now, according to this invention, he makes them of bone.—Patent completed.

3337 W. SIM. *Improvements in arrangements or apparatus for watering and cleansing streets and roads, and for speedily removing snow.* Dated November 26, 1867.

The features of novelty comprised in this invention are, first, the using of permanently fixed perforated pipes, supplied from the water mains, and controlled by valves or hydrants for watering and cleansing streets and roads, and also for removing snow therefrom, when not accompanied by too intense a frost; and, second, the using of travelling furnaces for liquefying snow when accompanied by hard frost, or when it may be inconvenient to use water for removing it.—Patent completed.

3338 H. GREENHALGH. *Certain improvements in mechanism or apparatus employed for preparing cotton or other fibrous substances.* Dated November 26, 1867.

This invention relates to that portion of apparatus employed for preparing cotton and other fibrous substances termed "drawing frames," and to that part of drawing frames known as the "sliver-stop motion," used for stopping the particular "head" of the machine when any particular sliver breaks, which has hitherto been effected by means of the balanced "spoon-stop motion" as a substitute for which the present invention is designed. The improvements consist in the novel application and use of a balanced lever, having at one end a vertical rod with curved guides at the upper end, the opposite end of the lever being provided with a weight adjustable on a screw, so as to adjust the balance of the lever. The sliver passes from the delivery rollers through a tension eye or guide, also adjustable, and over the aforesaid curved guide, and thence through a "trumpet mouth" into the ordinary can or receiver, and so long as the sliver remains united, the lever is balanced by its weight, but when disconnected the weighted end of the lever falls, and the end thereof comes in contact with the ordinary rocking bar which actuates the ordinary stop motion of the machine.—Patent abandoned.

3339 J. P. SMITH. *Improvements in the manufacture of cutting tools, and in the construction of tool holders.* Dated November 26, 1867.

The patentee claims, first, manufacturing cutting tools by casting them of the form required in chill moulds, the said tools being cast from molten steel, or from molten alloys of steel or iron, or of steel and iron with tin or with copper, or with both tin and copper, or with other metals, substantially as set forth. Second, the sheath cutting tool holder, constructed substantially as described and shown in the drawings. Third, the several constructions of cutting tool holders shown on the drawings, in which a cam, or wedge, or both a cam and wedge, is or are employed to secure and adjust the cutting tools, substantially as set forth.—Patent completed.

3340 J. P. SMITH. *An improved mode of coating and uniting metals with metals.* Dated November 26, 1867.

The patentee claims coating or uniting one kind or quality of hard metal with another kind or quality of hard metal by superimposing or bringing them into contact with each other when both are in the molten state.—Patent completed.

3341 E. TOWNSHEND. *Improvements in tobacco pouches.* Dated November 26, 1867.

This invention consists in forming the bottom and ends of such pouches with a corrugation or corrugations along them, so that they may be capable of expanding or opening out in a similar manner to the sides and end of a bellows. —Patent completed.

3342 C. E. PENNY. *Improvements in envelopes.* Dated November 26, 1867.

This invention applies especially to that class of envelopes known in the trade as "pocket envelopes," wherein the letters or contents are introduced at one end, which is left open for that purpose, and which is then closed by a flap which is gummed or otherwise fastened down. The two sides are first folded over somewhat in the usual manner, and gummed or pasted, but the patentee makes this joint by forming one side somewhat in a half lozenge shape, so that when folded over the obtuse angle slightly overlaps the centre and other side like a right-angled triangle, the base of which is about equal to the width of the envelope, so that, when the sides are folded over, they overlap only at one end, forming a joint diagonally from one corner of the envelope to about the central point of the same. The two end flaps are in the form of Isosceles' triangle, whereof the base is equal to the width of the envelope, and the height (with the apex rounded or cut off) such that, when folded over, they overlap in the centre in such a manner that the lower flap when folded up completes the form of the pocket, and the upper flap when folded down overlaps the former, and is gummed on to both side flaps and the lower end flap at the same time, so that, whether the envelope is further secured by sealing wax or not, it is impossible to open the same and abstract any of the contents without detection.—Patent completed.

3343 J. A. and J. HOPKINSON. *Improvements in steam boilers.* Dated November 26, 1867.

The patentee claims, first, the adaptation and application to boilers of a steam chamber or chambers formed or inserted below the surface of the water, such chamber or chambers being in communication with the upper steam space and the steam pipe, as described. Second, the use of such steam chamber or chambers as a means of strengthening the boiler, as described.—Patent completed.

3344 J. and J. HINKS. *Improvements in safety cans or vessels for containing, measuring, or storing petroleum, oil, and other volatile inflammable liquids.* Dated November 26, 1867.

In the axis of the nozzle or neck of the can or vessel is a rod working in bearings in the shoulder of the can immediately below the neck or nozzle. The said rod carries a disc or valve fitting against the bottom of the neck or nozzle. By raising the said rod the valve is closed, and by depressing the rod the valve is opened. The top of the rod is screwed, and the cap or cover of the nozzle or neck has a screwed hole in it which takes upon the screw on the top of the rod. By screwing the cap or cover on to the top of the rod it screws down upon the top of the nozzle or neck, and at the same time raises the valve, pressing the valve against the bottom of the nozzle or neck. On the valve is a conical metallic tube, the upper part of which fits accurately in the nozzle or neck of the can, the said conical tube being perforated with small holes. As the valve rises or falls the conical tube slides up or down the nozzle or neck of the can. When the valve is depressed liquid can be poured into the can, or be removed therefrom, the liquid passing through the fine holes or perforations in the conical tube. The holes or perforations in the conical tube are so fine that flame will not pass through them, and if the liquid in the neck or nozzle accidentally takes fire the flame will not pass through the said fine holes or perforations into the can or vessel.—Patent abandoned.

3345 W. R. LAKE. *Improvements in breech-loading fire-arms, and in cartridges for the same.* (A communication.) Dated November 26, 1867.

This invention is not described apart from the drawings. —Patent completed.

3346 W. R. LAKE. *Improvements in electric telegraph apparatus.* (A communication.) Dated November 26, 1867.

This invention consists, partly, in a mode, and instruments for, operating and working long submarine cable lines of telegraph by the sound, or printing instead of the "galvanometer reflector" system, and also in devices for protecting such instruments and cables from any injurious effects of lightning or atmospheric electricity.—Patent completed.

3347 J. HUDSON. *Improvements in machinery for the manufacture of paper.* Dated November 26, 1867.

Here the inventor covers the couching rolls, and first and second pairs of press rolls, with stout india-rubber jackets, by which means he is able to dispense with the woollen jackets and endless felts, as at present arranged in this description of machinery, but the endless wet felt may be employed for carrying the sheet of paper to the rolls, and then, by passing under, may take it up again to the second press rolls, or, where no second press rolls are used, then on to the drying cylinders. A felt is worked with the first press roll as well as being covered with india-rubber. The second press roll will not require any felt, nor will the coucher require any felt jacket, as at present. —Patent abandoned.

3348 C. T. HIGGINBOTHAM. *An improved arrangement or construction of furnaces to be used for preventing smoke and effecting economy of fuel.* Dated November 26, 1867.

This invention consists in using firebars having a hollow web, or partly hollow and partly tubular web, which bars may or may not also have in addition to the hollow or tubular web certain lateral openings through which air may pass into the overlying stratum of fuel. Across the inner end or side of the furnace a hollow bridge or chamber is formed, the ends of the bars passing into the hollow bridge or chamber through its front wall or side, the bars thereby constituting air passages into the chamber. As the air passes through the bars, its temperature is raised, and it consequently passes as hot air into the chamber, from which it escapes through one or more suitably formed openings, and, mixing with the gases escaping over the bridge from the incandescent fuel, causes their complete combustion, and therefore prevention of escape as smoke. —Patent completed.

3349 J. H. JOHNSON. *Improvements in the treatment of rabbit, hare, and other skins.* (A communication.) Dated November 26, 1867.

This invention consists in substituting for the preparation of mercury hitherto employed in the process known as "carrotting" of any hydrocarbonated or other substance capable of decomposing nitric acid into nitrous acid. As examples of those hydrocarbonated substances from which good results have been obtained, raw or refined sugar, gum, and starch, may be mentioned.—Patent completed.

3350 A. V. NEWTON. *An improved steam injector for supplying water to steam boilers or tanks.* (A communication.) Dated November 26, 1867.

The steam injector, when applied as a boiler feed, consists of a steam-tight cylinder or box, made of boiler iron or other metal, which is connected by a pipe with a well, cistern, or other reservoir of water, the bottom of the cylinder being placed at the height to which the water is required to rise in the boiler. The cylinder is also connected with the boiler by two pipes, one of which is used for the passage of steam from the boiler into the cylinder, the other for the passage of water from the cylinder into the boiler. These pipes are governed by taps or valves, so that the communication between the boiler and the cylinder, and cylinder and boiler, may be shut off or opened, as required. The pipe connecting the cylinder with the well, cistern, or reservoir is also governed in like manner by a tap or valve. The cylinder being empty, and all communication with it being shut off, by opening communication between the boiler and cylinder by means of the pipe used for the passage of steam, a jet of steam from the boiler fills the cylinder. When the cylinder is full of steam, the communication between the boiler and the cylinder is shut off, and the communication between the cylinder and the well, cistern, or reservoir of water is opened. The steam rushes from the cylinder into the water, and, condensing in contact therewith, creates a vacuum in the cylinder, when the water immediately rises up and fills the cylinder. The communication between the cylinder, and well, cistern, or reservoir of water, is then shut off, and the communications between the boiler and the cylinder, by means of the pipe used for the passage of steam and between the cylinder and boiler, by means of the pipe used for the passage of water are opened, and the steam forces the water from the cylinder into the boiler, entering the cylinder and imparting heat to the water, keeping the water in the boiler on a level with the bottom of the cylinder, and making it cover the entrance of steam pipe into the boiler. This entrance being thus covered by the water, the action of the steam on the water in the cylinder ceases until the end of the steam pipe leading to the boiler is again uncovered by the sinking of the water in the boiler. When this takes place, the steam will again act on the water in the cylinder, forcing the water into the boiler, and up to the same level, and covering again the entrance of steam pipe into the boiler. It follows that so long as there is any water in the cylinder, the water in the boiler will stand on a level with the bottom of the cylinder. A water gauge put on the cylinder will indicate the depth of water therein.—Patent completed.

3351 A. V. NEWTON. *Improved apparatus for preparing paper pulp.* (A communication.) Dated November 26, 1867.

This invention relates to the use of a circulating pump in combination with a wood or straw pulp digester, whereby the digesting liquor is forced to circulate continuously through the vegetable fibrous mass to be pulped. In combination with such a digester and pump it is also proposed to employ a coil or other means of heating the circulating liquor on its passage to and from the digester.—Patent abandoned.

3352 E. H. BENTALL. *An improvement in the conversion of iron into blooms.* Dated November 26, 1867.

This invention relates to the utilization of the cuttings of iron produced in workshops where boring, turning, planing, and other cutting or fashioning tools are used by the conversion of those cuttings which have hitherto possessed little commercial value into blooms at a cost considerably below the cost of manufacturing ordinary wrought iron. In order to attain this end the patentee forms cases of sheet iron of any approved capacity, say of a size equal to receiving one hundredweight of the cuttings, and in these cases he packs as much of the waste material or turnings, borings, planings, and filings of iron as they will contain. The packed cases he submits to the heat of a reverberatory furnace, and when brought to a white heat, or thereabouts, he removes them from the furnace and subjects them to the action of stampers, or other severe pressure, which, owing to the highly heated and partially softened state of the metal, will convert them into solid plastic masses or blooms possessing a fair grain, and capable of being employed for a variety of purposes. —Patent completed.

3353 M. A. HAMILTON. *Improvements in lamp burners.* Dated November 26, 1867.

This invention relates to lamp burners for burning mineral oils, and the nature of the invention consists in the novel construction of the burners, whereby the wick can be lighted without removing the globe or chimney An aperture is formed in the side of the body of the burner, which aperture is closed by a sliding valve acted on by a spring which keeps the valve closed, except when held open by the hand during the act of lighting the wick. —Patent abandoned.

3354 C. COATES. *Improvements in machinery for cutting or dressing stone, and in apparatus connected therewith.* Dated November 27, 1867.

This invention consists in improved machinery for cutting and dressing stone by means of circular discs or tools, or their equivalents, the discs being mounted and

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working in the manner described, and shown in the drawings, and constituting a dressing tool or instrument of a new character. The stone intended to be dressed is placed on a movable table to which a reciprocating motion is given, so as to bring the stone under the operation of the dressing tool. In some cases the stone may be supported upon a table, and a reciprocating motion is given to the dressing tool in the manner described. The invention also relates to apparatus for sharpening the operating edges of the discs forming the dressing tool by grinding them in the manner described. The invention is not fully described apart from the drawings.—Patent completed.

3355 J. H. JOHNSON. *Improvements in the construction or arrangement of piles or faggots for wrought-iron beams, girders, or bars of different forms.* (A communication.) Dated November 27, 1867.

The patentee claims, first, the construction and use of a pile or faggot composed of one or more bars for the web, and any appropriate number of bars for the flange or flanges, the said bars being arranged and permanently secured together by rivets or bolts, substantially as described and illustrated in the drawings. Second, the construction and use of a pile or faggot composed of one or more bars for the web for each flange, the whole being held together by rivets or bolts, substantially as described and illustrated in the drawings. Third, the construction and use of a pile or faggot composed of one or more bars for the web, and any desired number of bars for the flange or flanges, the said bars being arranged and permanently secured together by rivets or bolts, substantially as described and illustrated in the drawings. Fourth, the construction and use of a pile or faggot (for cruciform and other shaped beams or girders) composed of bars arranged and secured together by clamps, substantially as described and illustrated in the drawings. Fifth, the construction and use of a pile or faggot composed in part of a solid bar or bars with a rib or ribs, and in part of bars riveted together and wedged to the said ribs or ribs, substantially as described and illustrated in the drawings. Sixth, the construction and use of a pile or faggot consisting of a solid bar or bar having a rib or ribs confined between bars by riveting the same to any desired number of intervening bars whose aggregate thickness is less than the said rib or ribs, all substantially as set forth in the specification and drawings.—Patent completed.

3356 W. FOWLER and J. GRIFFITHS. *Improvements in the manufacture of the tyres of railway and other wheels.* Dated November 27, 1867.

This invention is particularly applicable to the manufacture of the tyres of railway and other wheels from Bessemer steel scrap. The patentees heat the steel scrap in a furnace, and hammer and roll it to the section or size required. They afterwards coil or bend pieces of suitable length into a circular figure, and in this way form rings. They prefer to roll the bar of a taper figure in cross section. When the bar is coiled into a ring, the narrow edge being made the inner or concave side of the ring, the metal thickness on the said concave side and the ring becomes of uniform thickness. The ring may be made of segmental pieces instead of from a single piece. They take a series of rings made in the manner described and build or place them upon one another, so as to form a pile, the rings being so arranged that they break joint with one another. The pile of rings is placed in a heating furnace, and when raised to a welding heat is taken to a hammer and placed upon or in the anvil or bed of the said hammer. The said anvil or bed is of a dish shape, so that the external part of the pile of rings is surrounded by the projecting sides of the said bed or anvil. The hammer is provided with a mandril or punch which corresponds in size with the hole in the pile of rings. The mandril or punch may also be made to increase the size of the holes in the rings if necessary. By the operation of the hammer the pile of rings is welded into an annular bloom or blank, the bloom or blank being turned over and heated from time to time for effecting a uniform weld, the external and internal diameters being preserved by the dish-shaped bed or anvil and mandril of the hammer. The bloom or blank thus made is taken by the weldless tyre mill and rolled into a tyre having the required section.—Patent completed.

3357 A. M. CLARK. *Improvements in ornamenting gauze and other fabrics.* (A communication.) Dated November 27, 1867.

This invention relates to the production of designs of all kinds and colours presenting either a bright or dull appearance or mall on light and other fabrics, this ornamentation being especially applicable to gauze, tarlatan, tulle, and other light fabrics. The following is the mode in which the inventor carries out the invention. He takes coloured resin or sealing-wax, reduces it to powder, and spreads it on a table. He then places the fabric to be ornamented on the pulverized matter, and impresses any suitable design thereon by the aid of an adhesive mordant, which causes the pulverized wax to adhere at all points, where the mordant is absorbed after the fabric is dry. He brushes off the surplus wax, and subjects it to the action of heat in a stove or otherwise, by which means the particles of resinous matter become fixed and assume a brilliant coloured effect. He may also employ transparent wax in grains, which he sprinkles or otherwise applies on the fabric to be ornamented; these grains or powder are then melted by the application of heat, and form a transparent bead.—Patent completed.

3358 A. V. NEWTON. *Improved apparatus for making extracts.* (A communication.) Dated November 27, 1867.

This invention consists in an improved arrangement of apparatus for extracting tannin from bark, or the strength from any other substance from which extracts are made or obtained, by means of which upward hydraulic pressure is applied to the substance under treatment. Reference to the drawings is essential for a full description of the invention.—Patent completed.

3359 E. BELKNAP. *Improvements in the treatment of the solution of malt for brewing.* Dated November 27, 1867.

This invention consists, first, in cleansing or purifying the wort after washing and before fermentation by means of the alkalies, alkaline earths, alkaline hydrates, and alkaline silicates, or any or all of them, either separate or mixed, and thereby causing a more complete coagulation and separation of the albuminous elements held in solution than can be effected by boiling only, as now generally practised. Second, in effecting the precipitation of albuminous and other matters from the wort by the addition to the same of an insoluble ponderable body in a finely pulverized state, capable of being mechanically diffused through the wort, together with alkalies, alkaline earths, alkaline hydrates, and alkaline silicates, as described.—Patent completed.

3360 H. F. GARDNER. *Improvements in the means of, and apparatus for, treating metals and minerials, in order to produce their oxides or other chemical or mechanical combinations, and to separate metals from their ores or from their alloys.* (A communication.) Dated November 27, 1867.

This invention relates to certain improvements in the means of and apparatus for treating metals and minerals for the purpose of producing various chemical or mechanical combinations or changes, such as the production of their oxides, carbonates, or other salts; also for the purpose of separating metals from their ores, or from their alloys, and of effecting these objects by a continuous operation if required. This mode of operation consists, first, in melting the metal or mineral to be treated or acted upon in a suitable crucible, and raising its temperature to the degree necessary for subsequent operations. From the bottom of this crucible or melting pot the metal is allowed to flow in one or more fine jets or streams. Immediately after the stream of melted metal leaves the orifice of the crucible it encounters a jet or blast of atmospheric air, or other gas or vapour, which is projected directly across the jet of metal with considerable force. The effect of this blast is, first, to subdivide the metal into a metallic dust of exceeding fineness, and, if the metal is of a character that has its melting point below that of oxidation, and its temperature is but just above that, the metal will be deposited in the form of an impalpable powder. In the second place, if the temperature of the melted metal is sufficiently high to produce a chemical combination with the blast, the metal being in a state of minute subdivision, is instantaneously acted upon chemically by the blast, and converted into an oxide or a salt, according to the nature of the blast employed. If atmospheric air be injected, oxides will generally be produced, but if the blast be composed of some other gas, some other chemical reaction will be produced corresponding to the chemical character of the blast, or some other chemical reaction may be thereby prevented.—Patent completed.

3361 J. S. SMITH. *Certain improvements in apparatus for ventilating buildings and other similar purposes.* Dated November 27, 1867.

The patentee claims the use and application of a movable cap, cover, plate, or equivalent for opening and closing the upper end of air shafts used as ventilators, for the purpose of excluding dust, dirt, and extraneous matters, irrespective of the form thereof, or of the mechanical means employed to effect their rise or fall. Second, the general construction, arrangement, and combination of the apparatus for the purpose, as described.—Patent completed.

3362 J. M'FARLANE and G. BARKER. *Improvements in the permanent way of railways.* Dated November 27, 1867.

Here the inventors cast longitudinal sleepers or bearing plates in one piece with a rail, the upper or wearing surface of which is "chilled" to produce a good wearing surface. They prefer to make the cast sleeper or bearer of an arched form, or hollow on its under side, so that it may rest on the ballast without shifting, and to form along the centre of its upper surface a vertical web or rib, having a head upon it which is to form the rail, the upper surface of the head being chilled to produce a good wearing surface. The vertical web or rib is strengthened by flanges which connect it with the top of the sleeper or bearer. In order to connect together such combined rails and sleepers end to end, a piece of T or other iron may be employed, the T-iron being placed on the under side of the sleepers so as to overlap their ends, and being affixed thereto by bolts. Lugs or flanges may also be cast on the under side of the sleepers or bearers to hold the fish plates from moving laterally. The rails may be kept to gauge by wrought iron tie bars at intervals, the tie bars being passed through slots in the web of the rail, and fixed with gibs and cotters. The foregoing are the main features of the invention.—Patent abandoned.

3363 S. A. CHASE. *Certain new and useful improvements in the running mechanism of car and carriage trucks of any nature.* Dated November 27, 1867.

The object here is to obtain an increase in power for propelling a railway or other carriage, as well as to reduce the friction upon the bearings of the rolling portion of such car. The invention also has for its object to start the carriage for a short distance with the application of very little power, its value for this purpose being chiefly applicable to horse railway cars. The invention consists in the employment of two sets of axles and wheels, one disposed over the other, and with the load resting upon and sustained by the upper axles, the rollers of which rest and roll upon the lower axles, or upon small hubs applied to the lower wheels, the journals of such lower axles being upheld in vertically sliding boxes, substantially as explained. The invention further consists in a mode of applying the journals of the upper axles to their boxes or bearings so as to allow such to roll along forward within such box a short distance, until the vis inertia of the weight of the carriage is overcome, and impetus created upon such carriage by the employment of very little power, as well as to keep the journals well lubricated, substantially as explained.—Patent completed.

3364 W. R. LAKE. *An improved spring hinge.* (A communication.) Dated November 27, 1867.

This invention relates to a simple device which is well adapted to take the place of ordinary door and other hinges, or may be used in connection with the same simply as a spring. The invention consists, chiefly, in constructing and arranging the two parts or leaves of the hinge in such a manner that one part, or a portion of the same, forms the spring to act upon the other part.—Patent completed.

3365 M. A. HAMILTON. *An improved cutting implement, more especially designed for opening cases or cans formed of sheet metal.* Dated November 27, 1867.

This implement is provided with a point at one end which is forced through the sheet of metal to be cut, and forms a centre or fulcrum around which the implement is turned to force its cutting blade through the metal. The blade is made adjustable, and its distance from the fulcrum point can be varied according to the required size of the aperture to be formed. The blade is secured in any position by an eccentric at the back of the implement.—Patent abandoned.

3366 A. MACKIE. *Improvements in apparatus for composing and distributing type.* Dated November 28, 1867.

This invention consists in the use of paper, or other suitable material, previously and specially perforated or slotted, to control or regulate the selection of type by self-acting mechanism in connection therewith, both for setting and distributing printers' type.—Patent completed.

3367 R. H. BENTHAM. *Improvements in the method of, and apparatus for, facilitating the flow of liquids from barrels or other closed vessels.* Dated November 28, 1867.

This invention consists in the novel application and use of an elastic or compressible bag, bladder, or vessel, which may be made of caoutchouc, gutta-percha, membrane, or other material, and such bag is to be enclosed within the barrel, and communicate with the atmosphere, by means of a tube passing through the bung or stopper closing the opening to the barrel. When the barrel or vessel is full of liquid the air is expelled, and the bag is compressed thereby, but as the liquid is withdrawn the air passes down the tube and expands the bag, exerting pressure on the liquid, and facilitating the flow without direct contact therewith.—Patent abandoned.

3368 W. PALMER. *Improvements in the shape and manufacture of horses' shoes.* Dated November 28, 1867.

Instead of taking a plain flat bar of iron as the foundation for horse shoes, the patentee takes a bar of a sort of angle iron, which has been formed into the proper shape by means of rollers, or by other suitable and proper apparatus. The section of the bars of iron which he uses is in the form of a wedge with the point downwards, and with the upper face or surface of the wedge prolonged in one direction, so as to form a projection on one side of the upper face of the wedge. The wedge point of the bar forms the under or downward portion of the shoe and the flat side of the bar the upper portion.—Patent completed.

3369 M. H. and L. H. LARMUTH. *Improvements in water meters and water-power engines.* Dated November 28, 1867.

This invention relates, generally, to those water meters and water-power engines which have reciprocating pistons, and in the first place more particularly to those meters or engines having pistons, the movements of which are controlled by rotating shafts through cranks or their equivalents. The object of this portion of the improvements is to give a certain amount of elasticity to the piston, or to each end of the cylinder, or to parts in connection with each end of the cylinder. This may be effected by forming a portion of the surface of the piston of caoutchouc, or other suitable flexible material, the water acting on the said flexible material from either side of the said piston; or the said flexible material may be fitted to the ends of the cylinder, or be connected therewith, the water having access in all cases to the flexible material, the flexible material being at liberty to yield to a certain extent in either direction, so as temporarily to increase or diminish the capacity of the cylinder, or the portion of the cylinder contained between the piston and either end of the cylinder. The second portion of the invention consists in fitting the cylinders of water meters with linings of glass, earthenware, pottery ware, porcelain, or other similar material, or with metallic linings glazed, enamelled, or coated with a vitrified substance, or with vitrified substances.—Patent abandoned.

3370 E. T. HUGHES. *Improvements in tea and coffee pots.* (A communication.) Dated November 28, 1867.

This invention consists in constructing an area around the upper and the inside portion of the pot, and providing or forming upon the lid of the pot one or more projecting rims extending downward therefrom, nearly to the bottom of the said area, and also providing a tube or nozzle, or a portion thereof, conducting from the area into the nozzle proper, which nozzle has a cap fitted closely thereto, all being so constructed that, when the coffee or tea is put to steeping or boiling in the usual way (having supplied the area with water), the fragrance and full substance is retained within the body of the pot until desired for use.—Patent completed.

3371 T. and B. CARTER and J. LISLE. *Improvements in machinery or apparatus employed in the preparation of wool or other fibrous substances technically known as condensers.* Dated November 28, 1867.

This invention relates to means of working the rubbing rollers employed in these machines, and the improvements consist in the application and use of a cam or skew wheel for producing the usual traverse motion, or for giving reciprocatory motion to the rubbing rollers. This cam is mounted on a horizontal rotary shaft, placed in bearings opposite to one end of each pair of rubbers, about centrally with the two surfaces which are in contact, and a swivelling hook is attached to each rubber, which hook clips on the cam or skew wheel (one on each side), so that one cam gives motion to both top and bottom rubber, each moving in opposite directions.—Patent completed.

3372 W. COTTON. *Improvements in machinery or apparatus for cutting woollen and cotton, corduroy, or other similar fabrics.* Dated November 28, 1867.

The patentee claims, first, the giving or producing reciprocatory motion to the cutting knives while the fabric to be cut has continuous motion. Second, having the knife guide points round and to project at least one inch beyond the points of the knives.—Patent completed.

3373 T. ROSE and R. E. GIBSON. *Improvements in machinery or apparatus for separating and cleaning seeds.* Dated November 28, 1867.

This apparatus consists, essentially, of two rotating separating screens, of cylindrical or other suitable shape, placed in a sloping or angular position the one within the other. These screens are constructed of wirework, or of perforated metal, or other material, the inner one having elongated openings, and the outer one circular or nearly circular openings; they are supported on suitable framework, and are made to rotate by power applied in any convenient manner. The seeds (linseed and rape seed) are fed through a hopper or pipe into the inner screen; as the screen rotates, the linseed, it being of a flat rounded shape, passes through the elongated openings into the annular space between the screens, but the rape seed, it being larger in diameter than the width of the elongated openings, is retained within the inner screen. At the lower end of the screens the seeds fall into separate spouts or chambers. During the separation of the seeds, as described, the earthy and other foreign substances, as well as the very small and inferior seeds, pass through both screens, and are collected in a casing which partly surrounds the screens, and are delivered in a third spout or vessel.—Patent abandoned.

3374 E. T. HUGHES. *An improved sprinkler for powdered substances.* (A communication.) Dated November 28, 1867.

This invention consists, principally, in a novel construction or formation of the interior of the cup or vessel,

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whereby the material or substance contained in it is made to always move or fall toward an opening made at or near the centre of its under side or base, in combination with a valve so arranged in such opening that it can be opened or closed at pleasure, and thus, when opened, enable the material with which the vessel is filled, or partially so, to be discharged and sprinkled through it upon the article of food which it is desired to season.—Patent completed.

3375 E. T. HUGHES. *Improved machinery for folding and pressing the edges of elastics used in boots and shoes.* (A communication.) Dated November 28, 1867.

This invention is carried out as follows:—On a table there are two apparati, each connected by a rod to a treadle underneath the table, in such manner that the rods are raised or lowered by the foot at pleasure. A guide is introduced into an opening or recess for each elastic, then the stuff is placed in its proper position, and the stuff-holder fixed, after which the guides are removed, and two plates are employed for enabling the edges of the elastic to be plied or folded. There are two irons fixed to one of the said rods, and they are heated on a stove placed at the back, a rotary motion being given to the rod for that purpose, and when the irons are heated, they are returned to the openings for the elastics, after which the treadle is acted upon, and the two irons brought to the level of the plates which rest on the said table for enabling the edges of the elastics to be plied or folded, At the same time that a transverse handle fixed to the irons is acted upon by the hand, a lever, working on a cross rod, also fixed to the said irons, is brought forward, carrying the irons forward with it over the stuff. The plates are now drawn back, and the treadle slightly lowered, so as to balance the weight of the two irons, and then the irons are drawn backwards and forwards several times for pressing the folds, after which they are returned to the stove. The elastics are now placed in the other apparatus, and a stamp caused to act by means of an eccentric and handle on a heated plate of iron, so as to press the folds together. In order to cement the elastics between the folds they are taken to the other apparatus, so that there is no time lost, for while the heating is being performed at one side, the apparatus is at work at the other side.—Patent abandoned.

3376 T. S. HORN. *Improvements in miners' safety lamps.* Dated November 28, 1867.

Here the base of the lamp forms the receptacle for the oil, having a tube in the centre for the insertion of the wick or lamp cotton, and for feeding or supplying the lamp with oil. Above this receptacle, and permanently attached to it, there is an air chamber perforated round the circumference for the admission of air horizontally at a point below the point of combustion. The top plate of this air chamber is also perforated with very fine holes for the admission of the air to a combustion chamber which surrounds the wick, and is formed of metal of a dome or other shape, having an aperture at the summit through which the wick can pass. This metal dome is fitted by a bayonet joint, screw, or other means into a metal ring or flange, which flange has formed on its outer or upper surface an annular groove for the reception of a glass chimney which is cemented therein. By the use of the dome the air for supporting combustion passing through the air chamber from below impinges on the flame at the point of combustion, rendering such combustion more complete, and therefore affording increased light. The dome also acts as an extinguisher should the lamp be either overturned by accident or otherwise, the light in that case immediately dying out. The products of combustion pass up the glass chimney through a contracted aperture in a metal cone fitted thereon, and becomes diffused by escaping through small perforations in a copper cap fitting on the glass chimney.—Patent abandoned.

3377 J. H. JOHNSON. *An improved hollow brick or block to be used for the floors, ceilings, and other parts of buildings, and apparatus for moulding or manufacturing the same.* (A communication.) Dated November 28, 1867.

According to this invention it is proposed to construct, in suitable moulds, hollow bricks or tiles of plaster cement, or other suitable material, of a square, rectangular, or other form. These blocks are perfectly closed up on all sides, although made cellular or hollow internally; consequently, the plaster employed in setting them in their place between the joints cannot possibly obtain access to the interior of the blocks. Ribs or projections are moulded along the several sides or edges of these closed hollow blocks, in order to afford a better hold to the plaster or cement, which is introduced between them when setting the same, and the top and bottom faces of the blocks are roughened or made uneven to form a key or holding surface for the adhesion of the coating or plaster employed in furnishing the floor or ceiling.—Patent abandoned.

3378 J. M. NAPIER. *Improvements in vessels and apparatus for the preserving and more convenient use of unguents.* Dated November 28, 1867.

The patentee claims arranging vessels, for the preserving and more convenient use of unguents, with a piston-like cover, and with an orifice with a wiping surface around it. He also claims combining with such vessels, either permanently or when required for use, apparatus by means of which the piston-like cover may be progressively forced into such vessel, so as to expel the unguent through the orifice as it is required for use. He also claims the general arrangements of the vessels and apparatus, substantially as described.—Patent completed.

3379 E. WOOD. *Certain improvements in steam engines.* Dated November 28, 1867.

The patentee claims, first, the combination of a gridiron slide valve with an arrangement of mechanism called or used as a "trippet motion," the valve moving in a direction at right angles to the length of the steam cylinder. Second, the novel arrangement and construction of "gridiron valves" and cylinders for steam engines wherein part of the cylinder constitutes the seating or surface upon which the valves work or slide, by which means movable valve seatings and side pipes are dispensed with. Third, the combination of a gridiron slide valve with the well-known mechanical contrivance called a "dash pot," whether the parts so combined be used with or without a "trippet motion." Last, the addition and combination of steam or air buffers to pistons for closing valves, the said buffers being of greater area than the pistons used for such purpose, as described, set forth, and fully illustrated in the drawings.—Patent completed.

3380 J. R. PRATT. *Improvements in the construction of articles of earthenware.* Dated November 28, 1867.

This invention relates to an improved method of joining together the separate parts of articles of earthenware by forming on them male and female screw threads while the clay or plastic material from which the articles are made is in a soft state.—Patent completed.

3381 E. H. BENTALL. *Improvements in the manufacture of nuts and bolts.* Dated November 28, 1867.

This invention is not described apart from the drawings. —Patent completed.

3382 J. SCHOLEFIELD. *Improvements in cases or covers for umbrellas, and in the umbrellas to which such cases or covers are to be applied.* Dated November 28, 1867.

The patentee claims, first, the manufacture of cases or covers for umbrellas of curved india rubber, or other suitable material possessing sufficient elasticity, the cases being normally considerably shorter than the umbrellas to which they are to be applied, so that when applied they compress the umbrellas into a small compass, as described with reference to the drawings. Second, providing the handles of umbrellas with studs or appliances, substantially as described.—Patent completed.

3383 J. R. TOWERS. *Improvements in bedsteads, which improvements are also applicable to other purposes.* Dated November 28, 1867.

This invention relates to an improvement in that part of a bedstead by which the sides and ends are secured to the posts, and consist in mortising or recessing the ends of the side and end bars into the posts, there being no projecting parts thereon to be knocked off or otherwise damaged. The side bar the inventor provides with a recess at its end through which the end bar passes at right angles when adjusted in place in the post. A screw bolt passes through both these ends, firmly securing them in the post in which a screw thread is tapped for securing the bolt passing up therein. The post he forms in two parts, the screw bolt above mentioned forming the end of the lower part or leg, which passes up through the ends of the bars, as before described, into the upper part of the post.—Patent abandoned.

3384 J. BAYLIS. *Panoline dye.* Dated November 28, 1867.

This invention consists of a compound chemical substance possessing the property of imparting a disposition to receive a fast colour of equal shade simultaneously upon animal and vegetable fibres; thus a mixed textile fabric of cotton, wool, or silk, or any of them, may be dyed into various colours by one process, instead of a separate process for each fibre, as in the practice generally in use. The inventor produces this substance by the chemical reduction of cuperiferous arsenic.—Patent abandoned.

3385 W. R. LAKE. *An improved apparatus for boiling and washing textile fabrics and fibres.* (A communication.) Dated November 29, 1867.

This invention relates to means for producing the circulation of water or other cleansing liquid or steam through a boiler for washing textile fabrics and fibres, and for other like purposes, and consists, chiefly, in dividing the said boiler into an upper and lower chamber, separated by a perforated partition, and communicating with each other by means of tubes which extend from the lower chamber nearly to the top of the upper chamber in which the articles to be washed are placed. The boiler must be closed and strong enough to bear a slight pressure of steam, which causes the circulation of the liquid or vapour through the tubes and chambers.—Patent abandoned.

3386 J. B. JORDAN and J. DARLINGTON. *Improvements in machinery for boring rocks, and in apparatus for driving, rock boring, tunnelling, coal cutting, and other machinery employed in mines, collieries, and quarries.* Dated November 29, 1867.

This invention is not fully described apart from the drawings.—Patent completed.

3387 J. FRASER and G. DUNCAN. *Improved combined machinery for printing.* Dated November 29, 1867.

The patentee claims combining or arranging printing and consecutive numbering machines whereby to imprint at the same time, or in a conjoined operation, on continuous webs or rolls, or on a continuous supply of paper, the desired letterpress and consecutive numbers for the purpose set forth.—Patent completed.

3388 T. ROSE and R. E. GIBSON. *An improved mode of treating cotton seed to obtain oil therefrom, and in machinery employed therein.* Dated November 29, 1867.

The patentees claim, first, subjecting cotton seed to a rubbing, grinding, stamping, or pulverizing action, and thereafter sifting out or separating the meal, such meal being the product employed to yield oil, substantially as described. Second, the employment of rotating rolls with serrated surfaces operating substantially in the manner and for the purpose set forth. Third, in combination with the said rotating serrated rolls the vibrating screens operating substantially in the manner and for the purpose set forth. Fourth, the employment of rotating arms or beaters in a perforated cylinder for the purpose set forth.—Patent completed.

3389 C. ALBISSER. *Improvements in the preparation of sulphate of magnesia, applicable to the treatment of the crude potash, salts of Stassfurt, and the refuse from the manufacture of chloride of potassium.* (A communication.) Dated November 29, 1867.

A patent, dated the 23rd of September last, was granted to A. Ziegele for the manufacture of Epsom salts from these crude salts. The kiesecrit which the crude salts contain may, however, be separated and manufactured into a form in which it is commercially useful without hydrating the sulphate of magnesia, so as to bring it to the state in which it is commonly known as Epsom salts. The preparation of such sulphate of magnesia from crude salts containing kiesecrit is the object of the present invention. —Patent completed.

3390 M. F. MAURY. *An improved mode for protecting submarine cables when placed on board ship from injury by design or from damage by accident, and for facilitating the paying of them out.* Dated November 29, 1867.

Here the cable is not furnished with the usual outside covering of wire, but it is insulated in the usual manner. It is packed in hogsheads or casks which are filled with water, both ends of the cable being left outside the hogsheads or casks for the purpose of testing, &c. The inventor states that, as there is no running water at the bottom of deep seas, a cable which is heavy enough to sink will be found sufficiently strong. By dispensing with the outside covering of wire and non-insulating coating the cost of the cable is lessened, and the laying thereof facilitated.—Patent abandoned.

3391 H. S. COWAN. *Improvements in apparatus for signalling at sea.* Dated November 29, 1867.

The object of this invention is to enable one vessel to indicate to others the exact course she is steering, and the invention consists, mainly, in the use of two lights or lamps of different colours, the relative position of one of which as regards the other indicates the course the vessel is steering.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated February 1, 1868.

356 J. Jameson, Catherine-terrace, Gateshead, engineer. Improvements in the preparation of postage and other stamps, and in the obliteration of the same.

Dated February 8, 1868.

431 W. Richardson, Oldham, mechanical engineer. Improvements in machinery or apparatus for the manufacture of combs to be used in carding engines as doffer or other such combs, or in wool burring, cotton cleaning, or other machines used in the treatment of fibrous materials in which combs of like character are required.

Dated February 25, 1868.

636 R. Kerr, Paisley, Renfrewshire, manufacturer. Improvements in the method of, and apparatus for, heating conservatories and other similar houses or structures.

Dated March 18, 1868.

921 C. J. Appleby, Emerson-street, Southwark, Surrey, and I. Riley, Freeling Cottage, Freeling-street, Caledonian-road, Middlesex, engineers. Improvements in cranes or other machinery for lifting, lowering, and hauling by means of steam, gas, heated air, or other fluid pressure, and in the boilers or furnaces for generating the power for the same, such improvements being applicable in part for other purposes.

Dated April 21, 1868.

1298 S. Dreyfous, Paris. An improved apparatus for removing the cotton from cotton pods. (A communication.)

Dated May 1, 1868.

1426 A. Munro, Arbroath, Forfarshire. Improvements in machinery, tools, and tool holders to be used for cutting stone, slate, marble, and other materials.

1430 P. Marlin and A. Tack, civil engineers, Brussels, Belgium. An improved process for transforming hydrocarbon oils into gas for illuminating and heating purposes.

Dated May 5, 1868.

1470 D. R. Macgregor and P. Taysen, merchants, Leith, Edinburgh. Improvements in the manufacture of paint for the protection of iron and other metals from the destructive influence of sea water, and for the prevention of fouling. (A communication.)

Dated May 6, 1868.

1481 J. Young, Aspull, Lancashire. Certain improvements in the construction of ovens to be employed in the manufacture of fuel termed coke, oil, and gas.

Dated May 7, 1868.

1497 B. Pickering, Kingston-upon-Hull, seed crusher. Improvements in apparatus used in expressing oils and fatty matters from seeds and from substances in which such matters are contained.

Dated May 8, 1868.

1513 C. E. Brooman, Fleet-street, City, patent agent. Improvements in preparing zirconia, and the employment of the same to develope the light of oxyhydrogen flame. (A communication.)

1515 W. Seck, Richmond-terrace, Clapham-road, Surrey, mechanical engineer. Improvements in machinery or apparatus for hulling and winnowing grain.

Dated May 9, 1868.

1522 S. Moulton, Bradford, Wiltshire, india-rubber manufacturer. Improvements in the treatment of vulcanized or cured india-rubber for obtaining a substance of a mossy nature, suitable for printers' inking rollers, cushions, and other articles.

1524 A. M. Clark, Chancery-lane. Improvements in breech-loading firearms. (A communication.)

1529 J. H. W. Biggs, Manchester. Improvements in apparatus for selecting warp threads, and for drawing them through the eyes of harness and through reeds.

Dated May 13, 1868.

1551 J. Slater, engineer, Catherine-terrace, Lansdowne-road, S.W., Surrey. An improved method of breaking up macadamized roads and other surfaces, and apparatus or machinery therefor.

Dated May 14, 1868.

1579 J. E. Piper, Wilson-street, Finsbury, Middlesex. A new improved oil for lubricating machinery.

Dated May 16, 1868.

1604 J. G. Tongue, Southampton-buildings, Chancery-lane. Improvements in apparatus for sewing or stitching together the numbers or separate parts of a volume in the operation of book binding. (A communication.)

1605 W. Rule, jun., Dolcoath Mine, Camborne, Cornwall, tin dresser. An improved machine or apparatus for dressing metallic ores.

1610 A. M. Clark, Chancery-lane. Improvements in lamps for burning mineral oils and essences. (A communication.)

1618 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in apparatus employed in the manufacture of iron and steel. (A communication.)

Dated May 18, 1868.

1622 W. Manwaring, Britannia Works, Banbury, Oxfordshire, engineer. Improvements in lawn mowing machines.

1624 W. Needham and J. Kite, Vauxhall, Surrey, engineers. Improvements in preparing filtering surfaces for the depuration of fluids.

1625 L. Goldstein, Bradford, Yorkshire, merchant. Improvements in umbrella and parasol cloths.

1626 J. F. Spencer, Sunderland, Durham. Improvements in working the valves of steam and other engines.

1628 J. Mitchell, Sheffield, spring manufacturer. Improvements in railway and other carriage springs, and in the machinery or apparatus for manufacturing the same.

1629 J. Grantham, King's Arms-yard, City, civil engineer. Improvements in the construction of iron and steel-built ships, and in rudders.

Dated April 19, 1868.

1630 E. P. H. Vaughan, Chancery-lane. Improvements in the preparation of anhydrous chlorides by means of sulphides or their elements. (A communication.)

1631 E. P. H. Vaughan, Chancery-lane. Improvements in the construction of pipes for smoking. (A communication.)

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1632 R. Pearce, Swansea, Glamorganshire. Improvements in the separation of copper and other metals from silver.

1633 J. Flachfeld, Basinghall-street, City, merchant. A new manufacture of cases for pipes and tubes used in smoking. (A communication.)

1635 J. Steel, Glasgow, brewer. Improvements in cask washing apparatus.

1636 J. Elce, Manchester. Improvements in temples employed in looms for weaving.

1637 D. A. Cooper, Worcestershire, goldsmith. Improvements in solitaires or fastenings for gloves and other articles of dress.

1638 J. Pollock, Birmingham, accountant clerk. Improvements in instruments or apparatus for drawing corks from bottles.

1639 T. Griffen, Guilford-street, Russell-square, Middlesex. Improved apparatus for bleaching and cleansing fabrics.

Dated May 20, 1868.

1640 W. Jones, engineer, and J. Hetherington, machinist, Manchester. Improvements in machinery for stretching woven fabrics.

1641 H. H. Johnson, Cannon-street, City, wine merchant. An improved mode of advertising in railway tunnels and cuttings.

1642 J. Kennett, Alma-place, Eastbourne, Sussex. An improved method of ventilating sewers.

1643 J. Fry, perambulator manufacturer, Stephen-street, Lisson-grove, Marylebone, Middlesex. Improving the construction of folding perambulators in order to contract them into a smaller compass.

1644 R. Froehlich, South-grove East, Mildmay Park, Middlesex. Improvements in means or apparatus for opening sardine and other sheet metal cases or receptacles, which improvements are also applicable to cutting sheet metals and other materials. (A communication.)

1645 C. L. Tavernon, Boulevart de Strasbourg, Paris, practical engineer, and J. Moret, Sevres, near Paris, merchant. An improved lift and force double-action pump, giving a continuous and regular supply of liquid.

1647 F. D. Nuttall, St. Helen's, Lancashire. Improvements in reverberatory furnaces for wasting and smelting purposes.

1648 J. B. Whitely, Prospect Iron Works, Lockwood, near Huddersfield. Improvements in machinery for stretching, drying, and producing the elastic finish on woven fabrics.

1649 A. Bell, Alfred-road, Middlesex, engineer. Improvements in the valves of steam engines.

1650 W. F. Batho, Birmingham. Improvements in machinery for planing or shaping metals, wood, or other materials.

1651 H. D. Hoskold, Cinderford, Gloucestershire, J. Davis, St. Whites, Gloucestershire, mining engineers, and G. P. Wheeler, Abinghall, Gloucestershire, engineer. Improvements in the manufacture of artificial fuel.

1652 Z. Poirier, The Grove, South Lambeth, Surrey, merchant. A new or improved safety stopper for bottles and other vessels.

1653 A. Leslie, Turriff, Aberdeen, bank agent. Improvements in machinery or apparatus for steam cultivation.

1654 D. Jones, Cambridge Heath, Hackney-road, and J. Jackson, Ann-street, Ratcliffe, Middlesex. Improvements in apparatus for imparting heat to the feet and body whilst travelling or otherwise.

1655 W. Tijou, Great George-street, Westminster, engineer. Improvements in steam pumps.

1656 C. R. Havell, Reading, Berkshire, artist. Improvements in the means or apparatus for heating water for baths, and other purposes.

1657 W. England, Bristol, commercial traveller. Improved apparatus for measuring liquids.

1658 A. V. Newton, Chancery-lane. Improvements in sewing machines. (A communication.)

1659 W. Inglis, Manchester, engineer. Improvements in steam engines and boilers.

1660 W. Sim, Glasgow, contractor. Improvements in arrangements or apparatus for watering and cleansing streets and roads, and in the application of apparatus for removing snow, and to other purposes.

1661 G. T. Bousfield, Loughborough Park, Brixton, Surrey. Improvements in power looms. (A communication.)

1662 C. Barnard, Norfolk Iron Works, Norwich. Improvements in chairs and other articles of furniture to sit or recline upon.

1663 J. Convers, Rue de la Paix, Paris, naval engineer. Improvements in cranks and crank shafts and axles.

1664 W. R. Lake, Southampton-buildings, Chancery-lane. An improved device for marking and creasing tucks in cloth or other material upon a sewing machine. A communication.)

Dated May 21, 1868.

1667 W. Palliser, Army and Navy Club, Pall Mall, major unattached, and F. J. Bolton, Rochester, Kent, captain in the army. Improvements in ordnance, and in wads to be used therewith.

1668 E. A. Chameroy, Rue Faubourg St. Martin, Paris, manufacturer. An improved liquid or gas meter.

1669 W. Hadfield, Manchester, manufacturer. Certain improvements in looms for weaving.

1670 J. E. Poynter, Glasgow, manufacturing chemist. Improvements in the manufacture of soap.

1671 J. Booth, Birmingham, printer and stationer. Improvements in fastenings for bags of paper, linen, or other flexible materials.

1672 J. Crofts, R. Dawson, and J. King, Hunslet-lane, Leeds. Improvements in means or apparatus for combing wool or other fibres.

1673 E. E. Allen, Parliament-street, Westminster. Improvements in the mode of packing, covering, or making up materials wound upon spools, or in the form of bundles or skeins.

1675 T. G. Messenger, Loughborough, Leicestershire, hydraulic engineer. Improvements in fire engines or double-action pumps.

1677 R. Fryer, Manchester, railway inspector, and J. Fryer, St. John's Wood, London. Improvements in machinery or apparatus for tilling land.

1678 J. Starley, Coventry, Warwickshire. Improvements in sewing machinery.

1679 J. R. Batty, Leeds, machinist. Improvements in saddles for frames used in the spinning of flax or other fibrous substances.

1681 H. Hall and J. A. Mason, Burton-on-Trent. Improvements in apparatus for propelling vessels.

1682 F. E. B. Beaumont, The Garrick Club, London, and C. J. Appleby, engineer, Emerson-street, Southwark. Improvements in apparatus for drilling rock and stone for blasting and other purposes.

1683 J. W. Whittaker, Carlisle Villa, Great Lever, near Bolton-le-Moors, Lancashire, cotton spinner. Improvements in carding engines.

1684 R. Rayner, Lower Clapton, Middlesex. Improvements in frictional gearing. (A communication.)

Dated May 22, 1868.

1686 C. Fu-not, Curighem-lez-Bruxelles, Belgium, manufacturer. Improvements in central-fire cartridges.

1687 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the means and apparatus for drawing cop and other threads through shuttle holes and eyes. (A communication.)

1688 C. Mole, Farringdon-road, City, boot maker. Improvements in the manufacture of boots.

1689 W. E. Newton, Chancery-lane. Improvements in grate bars. (A communication.)

1691 A. M. Clark, Chancery-lane. Improvements in rotary steam engines. (A communication.)

1694 R. K. Bowley, Rockhills, Upper Sydenham, Kent. Improvements in the construction and arrangement of floral devices, and in the apparatus employed therein. (A communication.)

Dated May 23, 1868.

1697 J. Higgins, Salford, Lancashire, machine maker. Improvements in machinery for spinning and doubling cotton and other fibrous materials.

1698 J. Fletcher, Bow, Middlesex, engineer. Improvements in revolving retorts for the manufacture and reburning of animal charcoal.

1699 E. W. de Rusett, Lewisham, Kent, civil engineer. Improvements in engines worked by steam or other motive fluid, specially applicable to steam pumps.

1700 T. Ashford, Birmingham, nail cutter. Improvements in machinery for the manufacture of gas tube hooks or fastenings.

1701 W. Seck, Richmond-terrace, Clapham-road, Surrey, engineer. Improvements in kilns or apparatus applicable to the drying or treating of grain for the manufacture of malt.

1703 F. Wirth, Frankfort-on-the-Maine, Germany. An improved apparatus for causing the circulation of water in steam boilers. (A communication.)

Dated May 25, 1868.

1705 T. J. Baker, Farndon, near Newark, Nottinghamshire, miller. Improvements in the manufacture of wheat and other grain into flour, and in the machinery connected therewith, part of which improvements are applicable to grinding gypsum and similar substances.

1707 E. Hunt, Glasgow. Improvements in obtaining motive power, and in apparatus therefor.

1709 P. Cameron, Glasgow. Improvements in ships' compasses.

1711 S. A. Smith, Walton-le-Dale, Lancashire, cotton spinner. Certain improvements applicable to carding engines.

1715 W. H. Kent, St. George's-place, Knightsbridge, Middlesex. Improvements in machinery for fluting, crimping, and pulling fabrics. (A communication.)

1717 J. Scoffern, New North-street, Finsbury, Middlesex, M. B. Improvements in treating paper and woven fabrics to produce therefrom waterproof sheets and slabs.

1719 H. L. A. Lippens, Southampton-buildings, Chancery-lane. Improvements in looms for weaving.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated May 28, 1868.

1767 H. Haines, Southampton-buildings, Chancery-lane. Improvements in the manufacture of lead pipe and lead pipe lined or cased with tin or other metal. (A communication.)

Dated May 29, 1868.

1777 G. T. Bousfield, Loughborough Park, Brixton, Surrey. Improvements in plating spoons and other articles with a coating of metal. (A communication.)

Dated June 2, 1868.

1803 T. Christy, New York, U.S. Improvements in paper satining machines.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," June 9, 1868.

276 J. J. Hicks. Backs and handles for hand mirrors.

280 W. E. Newton. Machinery for grinding and polishing concave surfaces. (A communication.)

289 W. A. Gibbs. Mechanism for drying wheat in the sheaf.

290 W. H. Crispin. Anti-scorbutic biscuits.

297 J. Pearson and J. W. Young. Apparatus for purifying oils.

298 J. Brown. Machinery for cutting wood.

309 S. B. Ardrey and S. Beckett. Velocipedes.

310 W. Tasker. Machine for cleaning cotton. (A communication.)

314 C. Riley. Combined threshing machine frame.

317 W. E. Newton. Breech-loading firearms. (A communication.)

319 W. R. Lake. Furnaces for roasting ores. (A communication.)

324 M. A. Hamilton. Apparatus for cutting bread.

327 T. Rowan. Removing impurities from iron ores.

328 B. Hayne. Connecting beer engine pipes with their taps.

340 H. Chapman. Bolts and nuts.

341 J. Mitchell and G. T. Graham. Apparatus for cutting fabrics into lengths.

343 G. L. Scott. Apparatus for steering ships.

344 S. E. Howell. Suspension bridges.

346 J. Frame. Transmitting motive power.

348 G. Clarke. Fire-escapes.

349 G. Moulton. Pentograph engraving machines.

352 H. Aitken. Treating iron ores.

353 A. Clark and A. V. Winkle. Apparatus for manufacturing aerated waters. (Partly a communication.)

356 J. Jameson. Preparation of postage stamps.

361 M. A. Wilson. Spring mattresses.

366 C. Richardson. Looms for weaving.

367 W. R. Lake. Leggings. (A communication.)

374 J. Lewis and R. and E. Alston. Movable firebars.

382 T. Scott and R. Mowat. Lamps for burning paraffin oils.

394 W. E. Newton. Mowing and reaping machines. (A communication.)

395 W. E. Newton. Buttons. (A communication.)

398 J. Hay. Method of roughing horses.

408 G. F. Bradbury and T. Chadwick. Sewing machines. (A communication.)

410 C. Brakell. Apparatus for measuring fluids.

423 J. B. Wilson. Forging steel.

426 T. Walker. Construction of sewers.

427 P. Rothwell. Regulating valve for the delivery of specific quantities of gas.

465 A. Brin. Apparatus for generating and applying gas from air and hydrocarbon fluids.

494 W. R. Lake. Whip holder. (A communication.)

553 W. R. Lake. Process of seasoning wood. (A communication.)

611 W. E. Newton. Manufacture of illuminating gas (A communication.)

655 J. R. Cooper. Breech-loading firearms.

683 J. F. Low. Apparatus for preparing jute.

691 H. B. Wilder. Magnetic electric telegraphic apparatus.

855 B. Britten. Manufacture of manure.

927 S. Wenkheim. Method of combining a shirt and waistcoat, or portions thereof, so as to be worn either as a waistcoat and shirt, or as a shirt only.

1265 G. Lister. Machinery for feeding slivers of wool to carding engines.

1276 T. A. Warrington. Candlesticks.

1297 L. Bing. Apparatus for ascertaining the actinic power of light.

1363 R. Cocker. Purifying and preserving wood. (A communication.)

1481 J. Young. Construction of ovens.

1541 S. Buxton. Pens.

1552 S. B. Boulton. Loading timber in timber yards.

1613 W. Allday. Forge bellows.

1614 A. Parkes. Manufacture of parkesine.

1615 G. Price. Pianos.

1619 M. A. Hamilton. Churns.

1622 W. Manwaring. Lawn mowing machines.

1721 W. R. Lake. Horses' harness. (A communication.)

1767 H. Haines. Manufacture of lead pipe. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed June 5, 1868.

3472 J. W. Kenyon and R. A. Armitstead	3499 L. Rose
3477 F. Roper	3506 W. H. Barlow
3483 R. B. Jones and W. Powell	3519 J. M. Napier
3484 J. B. Morrison	3535 E. R. Sintzenich
3485 O. Barrett and H. Leggott	3540 J. Robinson
3486 J. Blakey and H. B. Fox	3550 J. G. Settle
3492 R. Warry	3571 J., J., and J. Booth
3497 W. Clapperton	3640 J. Rowe
	8 H. Milward
	158 R. Heathfield
	886 H. A. Bonneville

Sealed June 9, 1868.

3503 W. B. Leachman	3551 T. Pebardy
3510 J. W. Burton	3560 R. Tinkler
3516 A. M. Clark	3577 W. H. Kerr
3522 T. A. Weston	3581 W. Huskisson
3527 J. Ward	3583 T. V. Mackintosh
3528 R. Roberts and P. Williams	3584 A. Shrimpton
3532 W. G. Hanning, G. B. Knott, and L. C. F. Clerc	3600 J. Cockshoot
	3609 L. M. Becker
	3714 H. Bessemer
	2 W. R. Lake
3533 J. Collingham and T. E. Smith	44 F. Chamberlain
	79 W. E. Newton
3534 P. Bawden	684 T. Trotman
3547 W. M'Ilwraith and J. Bonner	731 T. Johnson
	755 F. T. Baker
3549 A. Bullough	841 P. Lennox

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1530 W. Townend	1557 W. Tongue
1535 P. Coombes	1574 J. de Hemptinne
1541 W. E. Newton	1626 H. A. Bonneville
1547 D. Barker	1646 G. Smith
1552 G. Haseltine	1778 G. Low

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1400 W. F. Floyd	1518 J. Knowles

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending June 6, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2621	0 4	2888	4 2	2918	1 0	2962	0 10	3032	0 4	3072	0 4
2839	1 2	2889	1 10	2923	1 4	2968	0 8	3039	0 4	3073	0 4
2840	0 8	2894	3 6	2924	0 10	2969	1 6	3040	0 4	3074	0 4
2847	0 8	2895	0 10	2927	0 10	2972	0 10	3043	0 4	3077	0 4
2859	0 6	2901	0 6	2929	0 8	2973	1 4	3046	0 4	3078	0 4
2860	0 6	2903	0 8	2931	0 8	2990	1 4	3048	0 4	3080	0 4
2861	0 8	2906	1 10	2934	1 4	2992	0 8	3051	0 4	3082	0 4
2867	0 10	2908	1 0	2939	0 10	3001	0 4	3053	0 4	3084	0 4
2870	2 0	2910	0 6	2943	1 0	3013	0 10	3057	0 4	3086	0 4
2877	1 10	2912	0 8	2944	0 8	3015	0 8	3058	0 4	3087	0 4
2879	1 4	2913	0 8	2948	0 10	3027	0 10	3059	0 4	3088	0 4
2882	0 8	2915	0 8	2949	1 4	3028	0 4	3064	0 4	3108	0 4
2883	0 8	2916	1 2	2957	0 10	3031	0 10	3068	0 4	3129	0 8
2887	1 0	2917	0 8								

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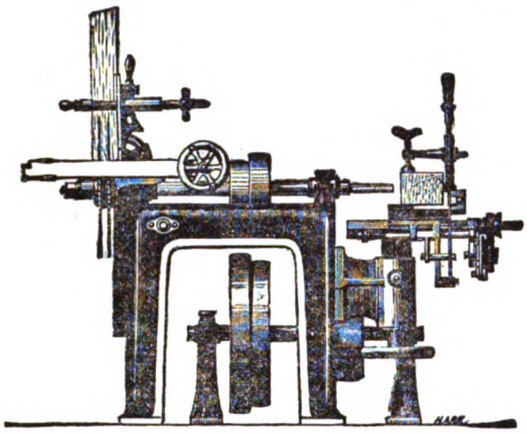

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Printed by ROBERT SMILES, and Published by him at the Office of ROBERTSON, BROOMAN, and CO., 166, Fleet-street, in the Parish of St. Dunstan-in-the-West, in the City of London.—Friday, June 12, 1868.

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JUNE 19, 1868.

RECENT GUNNERY EXPERIMENTS AT SHOEBURYNESS.

DURING the past few days Shoeburyness has presented unusual attractions to artillerists and military engineers, owing to the trials of iron structures, applicable to land fortifications. The experiments commenced on Tuesday last, and were under the direction of the Ordnance Select Committee and Associated Members. The executive duties devolved upon Colonel F. Eardley Wilmot, R.A., commandant of Shoeburyness, who was assisted by Captain Alderson, R.A., and an excellent staff of working officers. The first day's work consisted principally in a trial of the Plymouth shield, against which eight rounds were fired, five of which were directed against a point to the right of the porthole, which had been strengthened by a 5-inch plate in place of some of the 5-inch bars. The other three shots were fired at the built-up side of the shield. The gun used upon the occasion was a 23-ton 12-inch rifled gun, which was fired with battering charges of 76lb. of powder and 600lb. Palliser projectiles. The heavy charges were determined upon in order to test the strength of the shield with the full power of the gun. Two rounds were also fired from the American 15-inch gun. The guns were placed at a range of 200yds. from the targets. The first shot struck the armour-plated target about 3ft. from the ground, and 15in. from the right-hand edge, and tore open the strip of iron outside the shot. The shot penetrated to the depth of about a foot, and then broke up, a bolt being driven inwards, and the inside plates being slightly bulged. A shell with a bursting charge of 14½lb. of powder was next fired, and struck just above the port. The shell did not penetrate the target very deeply, bursting in the rear. Its effect was to break the horizontal iron plank over the porthole in two, on the right-hand side of the port, and to thrust it backwards, the damage showing only at the back of the shield. The third shot was fired from the Rodman 15-inch gun, with a powder charge of 83½lb. of powder, equal to 100lb. of American powder, and a 450lb. spherical projectile. This shot struck not far from the shot of the first round. It cracked the front plate, started another bolt, and bent the inside layer of iron, doing, however, but little damage. The shot, which was of American make, and appeared to be of excellent iron, rebounded, and fell, much flattened, a few feet in front of the target. As this shot was a graze, a second shot was fired from the same gun, striking at a point 5ft. from the ground and 18in. from the left edge. The result was an indent about 9in. in depth, the plate being cracked through to the edge and the right-hand corner, which had been previously struck, being knocked off by the shock. The inner planks near the porthole were distorted, and an upright standard was slightly bent. The shot struck on a spot where the plates were supported by one of these standards, and which was, therefore, a strong place. The effect, however, of both these rounds appeared very small for the large charge of powder, and gave but an indifferent opinion of the power of the great American weapon as compared with that of our own rifled guns.

The fifth shot was fired at the target from the 12-inch rifled gun, penetrating about 13in., breaking a bolt, and doing considerable damage at the back of the target. It pushed out the middle layer of iron, and broke one of the horizontal planks of the internal layer, a piece of which, weighing between 200lb. and 300lb., was violently projected about 100ft. to the rear of the target. The projection to the rear of this large mass of iron would have been a serious thing in actual warfare, although this is provided against by a thick rope mantlet hung immediately in the rear of the shield. The sixth round was directed against the weaker part of the target, which represented the actual construction of the Plymouth fort, and was 15in. thick. This and the two following shots were intended to strike a part between the upright standards, where the plates were unbacked. This, however, was not accomplished, each shot striking a place immediately in front of the upright standards. This was perhaps to be accounted for by the circumstance that the charges were very different from those ordinarily used, and the calculations made for laying the guns may, therefore, have been affected. The sixth round was a solid shot, which penetrated about 10in., breaking two bolts, and causing a bulge in both the back plates and the standards. The seventh round was a shell, which burst outside, and did little further mischief. The eighth and last round for the day was a solid shot, which caused a considerable bulge in the rear of the shield, which opened with a radiating crack, the standards also being much bent. An inspection after the firing showed that although the Plymouth shield had received eight rounds from the largest guns with full battering charges, it had stood very well, although, of course, it showed signs of having been punished.

The experiments on Tuesday concluded with a shot from the large rifled gun at each of two single unbacked 15-inch plates. The first of these was a rolled plate 13ft. 6in. long, 3ft. 5in. wide, and 15in. thick, prepared by John Brown and Co. It was simply resting against standards representing those of the Plymouth target. The second plate was of hammered iron, 9ft. long, 4ft. 6in. wide, and 15in. thick, and was supplied by the Thames Iron Company at their own expense. The shot fired at Sir John Brown's plate was aimed centrally between the two supports, and it struck the middle of the plate fairly. The point penetrated about 12in. into the solid metal, throwing up a bulge of about 3in. at the back, with a slight radiating crack. The shot fired at the Thames Iron Company's plate was a failure, as it struck the edge, carrying away a large piece of iron. The object of firing at these plates was to compare the results, not only of one with the other, but of the solid 15-inch plates as against a shield made up of three 5-inch layers. This object, however, so far, was frustrated by the shield not having been struck upon an unsupported part.

On Wednesday the experiments commenced by another attack upon the Plymouth shield, the Rodman gun having first fire. The powder charge and the projectile were similar to those on the previous day. The shot was directed against the built-up portion of the shield, and struck in front of an upright standard, making an indent of 7in., but doing very little further damage behind, although it hit a place which had been much punished already. The rifled gun then put in a shot with a 76lb. charge, which struck under the left-hand corner of the porthole. The result was a penetration of about a foot and a considerable cracking of the plate in front. In the rear much damage was visible, the inner layer of 5in. iron being bulged out 8in., and torn open with wide rents, and three bolts were strained. The place where the shot struck had not previously been damaged, and, as it consisted of three wide plates superposed, it afforded a comparison with the effect of the same gun on the solid 15-inch plate, which was highly favourable to the latter, according to final results. A shell was next fired from the same gun at the built-up side of the shield, and struck fairly between the standards. It penetrated the plates and broke the inner plank, turning it against the pier behind. The shell exploded within the structure, the fragments mixing with pieces of the plate. The 18-ton 10-inch gun was next tried with 60lb. of powder and a shell, the bursting charge of which was 10lb. It was aimed at the same part of the target as the previous shots, and struck between the standards about 2ft. to the left of the Rodman shot. It broke off the intervening piece of the front plate and passed into the shield, where it exploded. These two shots did considerable damage, but it is to be observed that the strength of the shield at this point had been much reduced by four previous shots.

The fifth round was fired from the same gun as the last one, and with the same weight of powder. The shell struck nearly under the centre of the port, penetrating 17in. and sticking in the plate, the bursting charge exploding outside. Not much damage was done in front, but in the rear a piece of the inner plate, about 2ft. 6in. long by 15in. wide, extending horizontally between this and a former shot, and weighing 5cwt. or 6cwt., was broken off and projected behind the rope mantlet, which had been placed in position and hung down 5ft. away, and which was struck by the piece of plate and proved its power to resist large fragments and to prevent them passing into the gun chamber. The fragment of iron did no material damage to the rope curtain, but rebounded from it, and fell on the ground near the place from which it had originally been detached. A fragment of the hind part of the shell entered the porthole, and also struck the mantlet, but did not pass through. The next round was a shell from the 10-inch gun, which was thrown by a charge to equal a striking force at 1,000 yards range. It was aimed at the curved top plate of the target, forming the bend over from the face to the concrete roof. It made a hole 2ft. 4in. in the head of the shell remaining in the concrete. This was followed by a shell from the 12-inch gun, with a powder charge to equal a striking force at a range of 1,000 yards. The shell struck the top corner of the structure and carried it away in one piece—4ft. 4in. by 3ft. 3in., and weighing 13cwt.—a distance of 147ft., with a large 3-inch bolt attached. All the strengthening rails, brackets, and other securing positions twisted violently, and the top of one 12-inch vertical support bent back 6in. A crack opened in the brickwork, into which the pier giving support at this end is built. This was the last shot fired at this shield on Wednesday, attention being afterwards turned to the 15-inch plates.

The second shot fired at John Brown and Co.'s plate was from the 10-inch gun, and it struck the plate 10in. from proper left edge, and 1ft. 10in. from top. It penetrated 10in., producing a bulge and a star crack in the rear, and a crack from the bottom of the plate extending through the shot-hole. The third round was a 10-inch shell, which made an indent 12·2in. The crack in the front, which was made the day previously, opened, whilst there were diagonal corresponding cracks in the rear. This plate, from the numerous cracks, appears to hold together by only about 6in. of metal, and yet, if properly secured in position, it would undoubtedly prove serviceable as a means of defence. The second shot fired againt the 15-inch hammered plate of the Thames Iron Company was from the 12-inch rifled gun, with a full charge. The shot struck 15in. from the top edge, and broke the plate completely in half, driving the two fragments, weighing about 5 tons each, 20ft. asunder. The fractured surface, which was oblique, and presented a sectional area of 10 square feet, showed a good quality of iron, but was full of large flaws, from imperfect welding. Here for the day the trials ended; they were resumed yesterday, and we shall report further upon them next week.

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Let us now turn to the practical results of these interesting experiments so far as they have gone. They have certainly most effectually settled two questions of the highest importance in a national point of view. In the first place, they have conclusively shown that a single plate of 15in. in thickness is vastly superior in point of resistance to three plates of an average thickness of 5in. each—a point which we theoretically demonstrated long since. In the next place, they have established the fact that hammered plates of a given thickness are incomparably inferior to rolled plates of the same thickness—a fact we have always insisted upon, and which we thought required nothing more than common sense to perceive. As the case stands, we have the well-built Plymouth shield, partly constructed according to Colonel Inglis's design, and consisting of a front 5-inch plate backed by a row of vertical and another row of horizontal 5-inch bars, and partly strengthened by removing some of the bars and placing plates around the port. The original portion was pounded into fragments, whilst the strengthened part stood the test somewhat better, the penetration not being complete by 4in. or so. On the other hand, we have a single plate merely placed against a few 12-inch vertical supports and a few wooden stumps, and upon which the heaviest artillery is brought to bear at close range, the result being indents, cracks, and bulges, but no penetration. Taking into consideration the widely differing conditions under which the shield and the plate were tried, the latter has proved a triumphant success, upon which we congratulate Sir John Brown and his partners. Not the less signal is the victory the rolled plate has gained over the hammered one. It must be a satisfaction to all to have the question thus practically settled, as there are still some who fondly cling to their old but erroneous notions of the value of hammered plates. We think, however, that no one will be in a hurry ever again either to make or use hammered iron plates. The material may be of the best, but the weld can never be depended upon. Of course, with some people, overriding all other considerations, comes the question of cost, but here the 15-inch rolled plate will stand close scrutiny. If a reasonable quantity be required, taking into consideration the rapidity with which erection could proceed, the fewer number of bolts required, and other points of details, the 15-inch plate will be found to be as economical as the veriest grumbler could wish. But if there be any who are disposed to cavil at comparative cost, there are none who can question the fact that three shots have been fired from our heaviest guns at an unsecured 15-inch armour plate, and all that they did was simply to crack it. But then the plate was stamped "John Brown and Co."

IMPERIAL ESTABLISHMENTS ON THE LOIRE.—No. II.

THE action of sea water upon both cast and wrought iron is well known, and there is scarcely any available precaution against the corroding influence it possesses. For this reason many pieces of machinery exposed to its attacks are manufactured of bronze, as in the case of screws for steam vessels. At Indret the castings for some of these weigh 13 tons, and are of great purity and smoothness of surface, the latter feature being the result of a peculiar process adopted in the foundry, which consists in lining the inside of the mould with a description of slaty paste, susceptible of the highest state of polish. The whole of the foundry, forges, and other accessories are included in the western division of the establishment. In the eastern divison, most of the boiler work is carried on, and the adoption of a uniform type of steam generators for the Imperial navy has conduced considerably to render them easier of construction, and more economical in cost. Their size or volume, of course, varies in accordance with the engine power they are required to furnish, but the same form, general arrangement of parts, and disposition of details, are adhered to with undeviating fidelity. The plates are submitted to a strict examination, and undergo a heavy test, before being passed as fit for that duty, and any that are not up to the standard are rejected peremptorily. Their thickness varies from 0·4in. to 0·72in., and, previously to 1865, they were all made with wood fuel at the workshops of Guerigny.

It is unquestionable that at present engineers are not decided respecting the merits of steel. One thing, however, is very plain, that the exaggerated anticipations with regard to its enormous superiority over wrought iron have been effectually dispelled. Bridges of infinite span, and boilers of inexplosible strength, will not be constructed of it any more than of iron. Steel plates and steel bars are in a state of probation, and it will altogether depend upon their future method of manufacture whether they will ever emerge from that condition. A very interesting, although not conclusive, example, is to be found in the boilers of the "Cassabianca," which was paid off after a cruise of only two years. The sides and top of the firebox had been made of cast steel, and the whole portion underneath the bars, with the exception of the points covered by bolts, was found to be corroded as if by an acid. No wrought-iron boiler ever evinced so complete a deterioration in the same short space of time. One of the chief difficulties to be surmounted before steel can obtain that confidence which will ensure its general employment is the production of it of a constant quality. With the view of ascertaining its precise advantages, and particularly when contrasted with iron, the French government have ordered some crucial experiments to be carried out. Steel boilers, the plates of which have been obtained from various establishments, have been supplied to the "Bouvet" and "L'Aigle," while that of the "Hamelin" has been divided into two parts, one constructed of wrought iron, and the other of Jackson's steel, made by the Bessemer process, so that in the comparison the conditions of trial will be common to both. There is not such a wholesale economy, with respect to weight, in the substitution of steel for iron in boilers as might be at first expected. In the boiler of the "Hamelin," the thicknesses of the two metals were in the proportion of four to five, representing the relative resistances of the two metals. The firebox, the shell, and the angle irons, are alone capable of a reduction in weight; the tubes and other parts, either of cast or wrought iron, cannot be altered, and, therefore, their weight may be considered a constant. Selecting the boiler of the "Hamelin" as an example, which is provided with four furnaces and steam chest, and calling its total weight unity, we have the following proportions:—Weight of fireboxes = 0·19; shell = 0·29; angle irons = 0·12. The total equals 0·6; the constant weight being equal to 0·4. We thus see that the diminution of weight by the employment of steel in lieu of iron is enjoyed only by 0·6 of the entire weight of the boiler, and since the ratio is as 4 : 5, the saving effected is one-fifth or 0·12 of the gross weight. This theoretical calculation was confirmed by the actual weight of two boilers, one of steel and one of iron; the former weighed 27 tons, and the latter 32, an approximation in practice sufficiently close to demonstrate the truth of the theory. But granting that the absolute weight and strength are slightly in favour of steel, yet the manufacture and manipulation of the more modern material is attended with risks and difficulties from which its rival is altogether free. If the plates of the former are exposed to a sudden current of air whilst at a high temperature, they invariably become brittle, and remain so, even in spite of annealing. Frequently plates, completely finished and ready to be put together, fracture by falling down; at other times a blow from the riveting hammer will crack them, and occasionally they will split without any apparent cause whatever. When a boiler is once fairly started upon service, it ought not to be subjected to any violent shock or absolute blow, but still there is danger that the incessant variations of temperature may give rise to sudden concussions of dilatation and contraction sufficient to occasion cracks, or even fissures, in a metal so easily assailable by rapid alternations of heat and cold.

At the premises of Indret, the fireboxes, which are all of the same type, are usually made first, inasmuch as they serve to occupy the workmen when business is slack in other parts of the establishment. The plates are marked by templets, the rivet holes being designated by white paint, punched, bent hot in the rolls, or cold under the hammer, as required, care being taken in the latter instance to use wooden hammers, so as not to destroy the rim of the rivet holes. In putting a firebox together, the sides are first temporarily placed in position, and the top adjusted to them; the other portions are then attached, and the position of the connecting rivets being accurately determined, and the places for the holes marked, the box is dismounted, the holes pierced, and any trifling fitting done that may be required. The second trial generally finds everything correctly adjusted, the permanent riveting is effected, and the operation is completed. The shell presents but little difficulty, being composed of plain sheets, cut exactly to the required dimensions, and capable of being pierced for the rivet holes without previous trial. When finished, the machines and boilers are shipped on board transports, and conveyed down the Loire as far as Saint Nazaire. There they are transhipped on board Government vessels, which convey them to the ships for which they are intended. A few words concerning the management of the establishment will bring our article to a close. Similar to French, and, in fact, all continental workshops, the employés receive a far greater amount of care and attention than what is bestowed upon the same class of men in England. Twenty-five years of active service qualify for a retiring pension, which is in proportion to the rank and abilities of the recipient at the time of his retirement. One excellent rule is the separation of the apprentices, who are mere boys from fourteen to seventeen years of age, from the adults. This is an arrangement worthy of all praise, and ought to be universally adhered to. It is in vain to expect that our workmen will mend their language and manners, so long as the youth has for example and pattern those who are careless of self-improvement, who live only for the day, and but too often indulge in practices and habits that must have ruined many of their juniors before they were out of their time. The difference between our education and that of foreigners, and which is beginning to tell so heavily against us now, is that our apprentices are never taught, in the strict sense of the term. They learn by imitation, to a certain degree, and pick up the knowledge of their trade in a parrot-like, imperfect kind of manner, but there is no system, no principle of routine laid down for them, and therefore, as a rule, the best of them are only as good as their predecessors. Contrast this system—or, rather, this want of system—with that adopted at Indret. There the apprentices' workshop is a regular practical school. With the file, the hammer, or other implement in his hand, the lad carries out what his teacher has perhaps the day before orally explained to him. It not unfrequently occurs that private firms pay visits to these workshops for the express purpose of engaging the services of some of the most able and skilful of these youthful workmen.

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Every year a selection of about thirty of the cleverest and most intelligent apprentices takes place, who are sent to a finishing school, as it might be termed, where they remain two years. They leave it, understanding how to read, write, calculate, and draw; possessing a thorough knowledge of mechanics, the theory of the steam engine, and of such other science as will be useful to them, and permit of their taking their place either as draughtsmen or superintendents in the establishment. Had we taken these precautions to ensure the prosperity of our workmen, we should have had fewer disputes, fewer strikes, and would not now be obliged to acknowledge that if we are not actually succumbing to, we are at least resisting with difficulty, foreign competition, and can at best only hope to have a share of that which was once all our own.

METEOROLOGICAL INVESTIGATION.

SCIENCE has been defined to be knowledge reduced to a system; and, if it be so, meteorology is surely not yet a science, for it is under little or no system. It is essentially based upon observation, but its observers have no settled or satisfactory system to proceed upon Different nations adopt different scales of measurement to their instruments, barometers, thermometers, rain gauges, and anemometers, while there is too often much discrepancy between the indications of the same kind of instruments. Even the modes of estimating the wind's direction and force, amount and character of clouds, and of specifying ordinary conditions of weather, are various and perplexing. The hours of observations are equally discordant. As to the records of observations, philosophers confess themselves puzzled what to do with them. The Astronomer Royal, in this year's Report to the Board of Visitors of the Greenwich Observatory, says that he is oppressed with the difficulty of making meteorological observations practically available, and adds that, "with a store of records, extensive, accurate, and rich beyond any other which exists, I yet do not see a probability of physical connections or physical laws sufficiently strong to induce me to enter confidently on an extensive comparison. The want of meteorology, at the present time, is principally in suggestive theory."

Thus the large sums spent on meteorological observations are unattended by any really scientific advance towards a knowledge of cosmical laws, although the end and aim of meteorology, if it is to maintain its claim to a science at all, must be the attainment of such knowledge. This seems to be in some measure attributable to want of concentration and unity of purpose. In this country meteorology is specially provided for by an annual Parliamentary grant of £10,000, and, moreover, is actively pursued, by way of observation, by several Government departments, at additional public expense, as the national observatories, the Army Medical Department, the India Department, the Royal Engineers, and the Royal Navy. Then every merchant ship, of necessity, is a good or bad meteorological observatory, and there are a large number of accurate private observers at home whose labours ought to be brought to a focus, and rendered available when wanted by the meteorological societies, but somehow or other this is not done. The amount thus publicly and privately disbursed annually in the service of meteorology is probably greater than that spent in the prosecution of any other science, while it is certain that no other science is so barren of practical results.

So far as we know, there is no common method, no cohesion of effort, no unity of purpose, between the different branches of the Government, not to say between them and private observers and foreign countries in matters meteorological. Each seems to act according to its own direction and peculiar bias, setting order, nature's first law, at defiance. It all seems to end in mere schedules of figures, of good, bad, and indifferent value, as exponents of climatic variations mainly, which, as they accumulate year by year, become of less and less value even for this small service to physical geography. It would be a Herculean task even to decide how much of existing records ought to be committed to the flames as inaccurate, misleading, and worse than useless, while the task of co-ordinating even on a limited scale is rendered impossible by the material being so scattered.

Since Admiral Fitzroy's method of forecasting weather was suppressed, all hope of obtaining any considerable practical advantages from current observations seems to have fled, and despair has settled in some minds as to the possibility of there being any physical connection between the phenomena observed. That there is a scientific basis for the Fitzroy forecasts has been sufficiently proved by Dr. Ballot, of Utrecht, and clearly explained in a little work, entitled "Principles of Weather Forecasts," which we reviewed in our number for January 17 last. Though a complete theory of weather changes is not yet to be hoped for, the principles established ought to be made to yield their utmost practical utility. They are steps towards it, and bring the proximate impediment clearly to light. Certain it is that if we could predict the ebb and flow of the air, as we can the rise and fall of the sea, our ability to make very valuable forecasts would be great. Here, then, is a subject to be investigated, either proceeding upon "suggestive theory" if you please, or, as we imagine, more hopefully, by careful induction. To work at such a subject with observations made at an isolated observatory, a single point in space, must be utterly hopeless; to group observations made simultaneously over a large country will not be sufficient; nothing short of the entire temperate zone must probably be embraced in such a survey. Observations made by separate offices, societies, and individuals, must be brought together and harmonized for such a purpose, including also those obtainable from all the foreign states comprised. The immense labour of reduction and conversion to the same standard of measurement must, of course, be performed before they are available for marshalling to instants of time. In such investigations the records of self-registering instruments are certainly of the greatest value, since they yield data for any assumed hour of the day, and it would be absolutely necessary to select data for each place of observation synchronous with given instants of Greenwich time, to which time all astronomical phenomena are usually referred.

If for the temperate zone the pressure of the atmosphere and the surface winds could be graphically depicted at instants separated by constant intervals, we should be able to detect the formation, transference, and obliteration of atmospheric troughs and crests; their connection with other physical phenomena could readily be traced; and, finally, the influence of sun, moon, and planets on the atmosphere could be detected by this method, if by any. Hence it seems that something more is needed besides suggestive theory. There is needed unity of design in modes, measures, and purposes—co-operation between individuals, authorities, and nations—in the laborious and intricate pursuits of meteorology.

ARTIFICIAL LIGHT IN PHOTOGRAPHY.—No. I.

THE student upon first beginning the study of photography soon finds that he must get rid of two popular errors, namely, that any bright light will do for photography, and that photographic impressions cannot be taken in perfect darkness. He soon discovers that pure yellow, red, and orange rays of light, however bright they may be, have no effect upon sensitive photographic plates. Also, if he be under the care of a good teacher, the fact will be explained to him that some of the extra-violet rays of the spectrum, quite dark and invisible to the eye, will impress a photographic image, so that it is easy enough, by way of experiment, to print a picture upon a sensitive collodion film without the presence of light. Now, as artificial lights vary very much in the rays they emanate, they vary also in photographic power, it being evident that a very bright light, rich only in yellow rays, and poor in the others, is calculated to deceive the eye as to its practical photographic value. Hence our present summary of the value and method of producing different kinds of artificial light for photography may prove useful. Artificial light is not much used in portraiture, except by way of experiment for purposes of amusement and instruction, but in enlarging processes and in printing of transparencies it is largely used in commerce.

The richest artificial source of photographic rays is the electric light, which contains waves even more refrangible than those in the light of the sun. Glass is opaque to most of these very refrangible rays, cutting them off as effectually as a lump of coal; hence, when it is desired to utilize them photographically, either rock-crystal, or no media at all, must be interposed between the light and the sensitive film. In practice, it is not an economical plan to attempt to utilize these rays, as, in aggregate actinic power, they are infinitely lower than the rays transmitted by all good thin colourless glass. For experimental purposes, however, they may be utilized by interposing only plates, prisms or lenses of colourless rock-crystal, not glass The electric light being so expensive and troublesome to work, and requiring a large preliminary outlay of capital, is not used in photography by amateurs, though public companies, and men in a very large way of business, find its employment to be, photographically, advantageous. The very few who use it discard the Grove's battery as the source of power, and substitute one of the new induction machines driven by a small gas or steam engine. In the Woodbury process, the induction machine turned out by the Alliance Company, of Paris, was, after trial, preferred to all others, and the lamp preferred was one invented by a workman in Mr. Woodbury's employ. Grove's batteries are not only troublesome and costly things to keep in order for the daily production of the electric light, but when they are properly managed, as at the Royal Institution, it is found to be two hours' work to charge and prepare for use a battery of forty or fifty cells. As few of our readers are likely to want to use the electric light in photography, the foregoing information will doubtless be sufficient on this head.

The magnesium light is very rich in actinic rays, and is of great value in photography. When magnesium ribbon was first made, it was burnt by holding a piece of it in the fingers. Next, it was pushed slowly through a piece of tube and permitted to burn as it came out, and then clockwork apparatus was designed to deliver the ribbon with regularity through the tube. A reflector was placed behind the light, and a pan was placed beneath, to catch the ash falling from the flame. This was the earliest magnesium lamp, but it is objectionable for several reasons. First, it is the most costly method of burning magnesium; secondly, the falling ash sometimes breaks off in a lump, close to the metal, and this puts out the light; thirdly, the smoke to a small extent sometimes comes in front of the flame, and diminishes the light.

The lamp invented by Mr. Henry Larkins is a clever little piece of work, and gives a greater amount of light, with the least

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expenditure of magnesium, than any of its competitors. But in photography it has also disadvantages of its own. In this lamp the magnesium, in fine powder, is mixed with fine dry sand. The mixture, placed in a reservoir, in the upper part of the lamp, falls through fine metallic sieves into a descending tube. The lower orifice of this tube is kept in the small flame of a gas jet, or spirit lamp with horizontal neck. A little handle enables the operator to open or plug the tube, so that he can let the powder fall, or stop it at will. When the powder falls through the flame, of course it is ignited, and every atom of magnesium falling is entirely consumed. The brightness of the light depends upon the quantity of magnesium in the powder, the larger the proportion of metal, the longer being the pendant flame. When the proportion of metal is very small, the light resembles a bright flickering star, but as the proportion increases, the flame lengthens downwards, till it may be made to assume the shape of a tongue four, five, or more inches in length. The flickering character of the light, when the flame is small, is one objection to the lamp. Another is, that in photographic enlarging it is necessary that the light should emanate as much as possible from a point, and that the front of the flame should be free from smoke. These requisites may perhaps be obtained in the Larkins' lamp, by using a small flame behind and close to a circular orifice as big as a sixpence, or shilling, supplying the flame with air through that orifice only, so that all smoke formed in front of the flame shall be at once carried away. We are not aware that such a lamp for enlarging has yet been constructed. The ordinary Larkins' lamp is of handsome external appearance and made of copper, tinned and polished inside. Some few lamps have been made by the inventor for public illuminations, and two of these large ones were once exhibited outside the Guildhall, on a festive evening, with such effect that expensive gas devices in the neighbourhood were utterly spoiled and extinguished by the glare from the two lamps made by Mr. Larkins.

The principle of supplying air to the front of the flame only was first adopted in America, and is good in all magnesium lamps where intense light is desired in one direction only. Lamps on this principle were at first furnished with a funnel-shaped opening in front, but then it was impossible to close the larger mouth of the funnel with a lens or sheet of glass, because these solid media would stop the supply of air. This difficulty was overcome by Mr. W. H. Harrison, who substituted a double funnel, the outer larger than the inner, and projecting further from the main body of the lamp. This outer funnel was closed at its larger orifice with a sheet of glass, and a wide tin tube in the side of the outer funnel admitted air, which passed on to the front of the inner funnel, and then rushed through it to the flame. By means of a piece of india-rubber tubing slipped over the outer orifice, other gases than air might be supplied to the flame at the will of the operator, thus making the lamp useful for experimental purposes. This modification is suitable either for powder or ribbon flames.

The best lamp for burning magnesium ribbon was invented in America, and is now obtainable in England, we believe, of the Magnesium Metal Company, at Manchester. In this lamp the ribbon, driven by clockwork, passes vertically down the chimney of the lamp, and is burnt between two pairs of metallic rollers. The upper pair of rollers gently pinch the ribbon and draw it downwards. The lower pair carry a knife edge at one part of the circumference of each, so that every time the two knife edges meet, which is once every revolution, they nip off the heavy ash hanging from the flame. This lamp, which is supplied with air from the front only, is very efficient in action, and the flame is not so liable to go out as in the old form of ribbon lamp.

A very great objection to magnesium is the large quantity of white smoke, or magnesia, which it gives off, necessitating the use of chimneys communicating with the outer air, otherwise the room is soon full of smoke. Another objection is its very high price, which, for many purposes, does not permit it to compete with the lime light.

We note the remarks of our contemporaries about English and French lenses, and shall have more information to give on the subject shortly.

TECHNICAL EDUCATION AT THE POLYTECHNIC INSTITUTION.

THE question of technical education has been now fairly brought under the consideration of the Legislature. And we find that in this, as in other good causes, there have been silent workers whose sole reward is the satisfaction of doing their duty. These have done, and still are doing, much that is praiseworthy on behalf of those who are desirous of helping themselves. We are led to these observations from having before us the last number of the "Society of Arts' Journal," in which there are twenty pages of closely printed matter containing particulars of the prizes and certificates awarded to successful candidates in their recent examinations on science subjects. Amongst them there appear as their instructors, and to the efficacy of whose teaching these students bear silent witness, such names as the "Mechanics' Institute," "Young Men's Christian Association," "Working Men's College," "Workmen's Club," and a score of other such terms that testify in unmistakable language that "Technical Education" is a practicable reality. But there is one institution—the first, in fact, that meets our observation on examining the list referred to in connection with the highest prize—more popular, we may venture to say without offence, than any other we have named, and which, like them, is always ready to furnish instruction to all. But, not content with educating a circle of students, it proceeds beyond—to those who seek amusement. If, by proffering such it imparts one iota of information, it is gratified, but is only satisfied when ultimately that information creates a desire for deeper and more solid instruction. How many students have been enlisted through the medium of this institution into the army of intelligence, let the journal now before us say. There we find that the recipient of the Prince Consort's prize is a student of the Royal Polytechnic Institution. There, too, we find that the Royal Geographical Society's prize has been awarded to another student of the Polytechnic. The "Gardeners' Chronicle" prize has been awarded to a third student of the same institution. In like manner, we find on looking through the list that no less than seven other prizes and forty-five certificates have been awarded in the recent examination to Polytechnic students. Now, this must be truly gratifying to all who have the interests of technical education at heart; and, too, it must be a source of peculiar satisfaction to those who conduct the affairs of the Polytechnic Institution, whilst the general public must acknowledge the benefits it is silently conferring upon mankind. It has been said that there is no royal road to learning; true, but there is a Royal Polytechnic road, and those who travel thereby may hope to realize royal results—as we have just shown has, in one instance, been done. When any of our readers next pay a visit to that cradle of the arts and sciences in Regent-street, and whilst absorbed in the lectures, or smiling at the more mirthful phases of practical science, let them remember that there is a well of truth to be explored within the very same walls. We would have them know, too, that while they are being entertained by Professor Pepper there is yet another friend with whom many have not yet made acquaintance—the Rev. Charles Mackenzie. This gentleman is the founder of the Polytechnic Science Classes, and is always ready to welcome and encourage them in the arduous, yet peaceful, paths of knowledge.

NOTES ON RECENT SCIENTIFIC DISCOVERIES AND THEIR PRACTICAL APPLICATIONS.

CARRE'S PNEUMATIC ICEMAKING MACHINE—PROTECTION FOR THE EYES OF METAL WORKERS—MODE OF OBVIATING DEVIATION OF THE COMPASS IN IRON SHIPS—THE MANUFACTURE OF DIAMONDS.

LAST summer we described a pneumatic ice-making machine, the invention of M. E. Carré, of Moislaus. Our account attracted a good deal of attention, and brought numerous inquiries; and we recur to the subject now, as the machine was exhibited, for the first time in England, by Dr. Roscoe, at the conversazione at the College of Physicians last week, and was found to fulfil all the invention promised. It is, as we explained, a simple air pump, under the receiver of which the carafe, decanter, or vessel of water to be frozen is placed. The action of the pump necessarily causes the rapid evaporation of the water, and consequent reduction of temperature. So far all is very simple; but now comes the most ingenious part of M. Carré's invention. To remove the atmosphere of aqueous vapour resulting from the exhaustion of the air, it is made to pass over the surface of some strong sulphuric acid, kept in agitation by a peculiar contrivance, so that a large surface is presented to the vapour. By this means rapid absorption of the vapour takes place, and, consequently, rapid evaporation and reduction of temperature; so that, in about three minutes, a decanter of water is reduced to the freezing point. An apparatus for congealing one decanter at a time costs only four pounds. There is but one drawback to the very extensive use of this ingenious apparatus, and that a little instruction would quickly remove. The sulphuric acid soon becomes too dilute to absorb the vapour of water. A chemist knows how to deal with this dilute acid, which only requires to be evaporated to be ready for use again. But with ordinary people it will always be a difficulty and a loss.

Another very useful invention to which we drew attention in our number for March 20 last, was Cohn's mica spectacles for the protection of the eyes of metal workers, masons, and stonebreakers. We have recently had an opportunity of trying these instruments. They are extremely light and agreeable to wear, and must afford the most complete protection to the eyes from splinters and scales, while the peculiar non-conducting power of mica for heat makes them especially useful to furnace workers, who are apt to suffer from inflammation of the eyes. To the information we have given before we can only add a statement showing the economy of their use. In one establishment reported on by Dr. Cohn, injuries to the eyes cost the sick fund 1,575 thalers in one year. If the spectacles had been in use and the injuries prevented, a saving of 1,318 thalers would have been made, the difference, 157 thalers, being the cost of supplying all the workmen in the shops with the instruments. Our workmen are, in general, for reasons we need not stop to inquire into, slow to adopt protective measures; still, we hope to see mica spectacles extensively adopted in our workshops.

All difficulties about the deviation of the compass in iron ships have been overcome, according to his own account, by M. Arson, who divides the ship longitudinally into two halves, and interposes throughout the whole length a plate of non-magnetic metal—copper, for example. Thus the ship has four magnetic poles, and by the equal counteracting influences of these, the indications of the needle are made correct. There is an appearance of probability in this idea, but great practical difficulties would be found in the way of completely insulating the two halves of the ship.

Another suggestion for the manufacture of diamonds, about which men will, no doubt occupy themselves until the now prized jewels

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are as common as flint pebbles. The present inventor directs a stream of chlorine gas upon cast iron kept in a state of fusion. The iron is sublimed in the form of perchloride, and the carbon is left behind, but not, we expect, in the shape of a diamond. Carbon is present in cast iron in the graphitoidal form, and all our experimenter could get for his trouble would, we think, be a little blacklead.

PARLIAMENTARY NOTES.

THE House of Commons had a busy time of it on Monday evening, no less than a quarter of a hundred questions having been under discussion, some at considerable length. Of these, of course only a few possess an interest to our readers beyond their political bearing. Scientific instruction abroad has been reported upon by our legations, and we have as yet no published information upon this important point. Mr. Samuelson therefore asked the Vice-President of the Committee of Council on Education what was the cause of the continued delay in the production of this information. Lord R. Montagu said the delay had arisen solely from the immense mass of matter. The translator was proceeding as quickly as possible, and the copy was being forwarded in batches to the Foreign Office, where the reports were addressed. Lord Stanley promised to enquire whether there was any delay at the Foreign Office; he believed a great part of the papers were already in print.

With reference to the case of the "Tornado," Lord Stanley was asked by Mr. Smollett if any authoritative decision had been given by the Spanish tribunals, whether the claims of the crew for compensation for harsh and unjustifiable treatment were still under consideration; and if he was prepared to lay upon the table of the House any further correspondence in the matter of the seizure of the ship and the prolonged detention of the crew of that vessel. His lordship, in reply, said—I regret to say that no authoritative decision has yet been come to on the subject. I have more than once made representations to the Spanish Government, but the answer has always been the same—that the Government could not interfere with the ordinary courts of law. With regard to compensation, that will depend on the amount adjudged to the vessels when the decision shall be given. A few weeks ago I laid upon the table such papers as I had, and since that time nothing of importance has been received.

In the course of the evening, Mr. Goldsmid asked the Secretary to the Treasury whether, in consequence of the opening of the Fell Railway over Mont Cenis, Her Majesty's Government intended to adopt the Brindisi route for the Indian mails; and whether they had made any application to the French Government to put an end to the twelve hours' detention in Paris of letters posted for Italy by the evening mails.

Mr. Sclater-Booth thought it was premature at present to form an opinion as to the necessity of immediately changing the route for the Indian mails. The subject was fully considered by a select committee which sat in 1866, and, anticipating the opening of the Fell Railway, a very elaborate report was presented to the Post-Office by Captain Tyler. On the settlement of the contract with the Peninsular and Oriental Steam Company last November, it was stipulated that the Brindisi route should be adopted in preference to Marseilles if circumstances rendered the change expedient. With regard to the latter part of the hon. member's question, he was informed that although the detention operated inconveniently for letters from London, this was not the case with respect to provincial letters, and that the present arrangement was most convenient for the French service and for all parties interested.

Delay in another matter—that of the Electric Telegraphs return, ordered by the House on April 21 last—was complained of by Mr. Ayrton, who asked the Vice-President of the Board of Trade when the return would be presented; and what was the cause of the delay in preparing it and the annual returns relating to railway companies.

The railway companies themselves appear to be the impediments, as, from Mr. Cave's reply, it appears to be impossible to say when the return relating to electric telegraphs would be presented. Notwithstanding a second circular, the required information has not been received from the London and North-Western, London and South-Western, Midland, Manchester, Sheffield, and Lincolnshire, Great Northern, Great Western, Caledonian, and other railway companies. It is evident that without particulars from these large railway companies the return will be so incomplete as to be entirely useless. A similar answer was given to the second part of Mr. Ayrton's question, Mr. Cave observing that the delay in presenting the compiled annual returns of the railway department was due to the failure of the companies to send in the particulars earlier. These particulars were compiled daily as they arrived at the Board of Trade; so that as soon as the last details were received the compiled return was ready for presentation, allowing a few days for computing the totals. It was generally also in type at the same time ready for printing. Last year the railway companies required no less than five reminders before the whole of the returns were made.

FLOATING WATER-WHEELS FOR SIAM.

THE practice of utilizing the power of the tides and currents of rivers for the working of machinery is of ancient date, and is, in some parts, largely adopted in the present day, as, for instance, on the Danube, where a vast quantity of corn is annually ground by tide power. The principle has just been applied, on a small scale, to pumping purposes for the King of Siam, by Messrs. Owens and Co., the hydraulic engineers, of Whitefriars, who have completed the first of a series of floating water-wheels for supplying water to the King's Palace, at Bangkok. This river water-wheel, which we recently saw at work on the Thames, is fixed on a wrought-iron punt 16ft. long, 5ft. broad, and 2ft. 6in. deep. The wheel is 5ft. diameter, with paddles 2ft. broad, and working treble 2-inch plunger pumps of 9in. stroke, and fitted with india-rubber disc valves. Messrs. Owens were consulted by the King of Siam with reference to supplying the four grand palaces at Siam with water, and finding no fall of water from which to obtain motive power, adopted the present means of accomplishing their object. The velocity of the stream ranges from two and a-half to four miles an hour—about the same flow as on the Thames—and the apparatus will have to force water a considerable distance to an elevation of over 100ft., supplying from 3,000 to 5,000 gallons in the twenty-four hours. This, in the recent trials on the Thames, it proved itself quite capable of doing, working equally well on each change of the tide.

THE WHITWORTH SCHOLARSHIPS.

REPLIES have been received from the following towns and educational institutes intimating the number of exhibitions of £25 they are prepared to accept for the year 1868:—Manchester, Owens College, 8; Manchester Free Grammar School, 2; Oxford University, 3; Cambridge University, 3; London Univerity, 3; Durham University, 1; Dublin Trinity College, 1; Edinburgh University, 1; Edinburgh, Watt's Institution, 1; Glasgow University, 1; Glasgow, Andersonian University, 1; Ireland, Queen's University—Belfast, Queen's College, 1; Cork, ditto, 1; Galway, ditto, 1; London, King's College, 1; London University College, 1; Eton College, 1; Winchester School, 1; London, Charterhouse School, 1; London, Christ's Hospital, 1; London, City of London School, 1; Shrewsbury School, 1; Marlborough College, 1; Cheltenham College, 1; Clifton College, 1; Liverpool College, 1; Derby Grammar School, 1; College of Preceptors, 2; Science and Art Department, 3; Society of Arts, 3; Birmingham, 1; Bristol, 1; Swansea and Cardiff, 1; Halifax, 1; Northampton, 1; Sheffield, 1; Brighton College, 1. Only eight answers remain to be received.

TRIAL TRIP OF THE "TRAVANCORE."

THE "Travancore" is the latest addition to the Peninsular and Oriental Company's magnificent fleet of steamships, which was built and engined by Mr. John Key, of Kircaldy. On Wednesday week, this vessel made her trial trip, leaving Southampton Docks at 11·30 a.m., and proceeding direct to Stokes Bay, where one run was made on the measured mile. She then steamed round the Isle of Wight, returning into Southampton Water at six o'clock. The "Travancore" is a screw steamer of 400-horse power nominal (indicated power duing the run, 1,405); her gross tonnage being 1,899¼, and registered ditto, 1,185; length, 281ft. 6in.; breadth of beam, 35ft. 5in.; and depth of hold, 27ft. 8in. Her true mean speed when on the measured mile, with a strong southerly wind blowing, was 12·245 knots; steam, 24lb.; vacuum, 22in.; revolutions of engines, 59. She had 754 tons weight of coals, water, and stores on board, and her draught was 16ft. 6in. forward and 18ft. 2in. aft, the mean being 17ft. 4in. There was a large party of ladies and gentlemen on board. The "Travancore," which is commanded by Captain R. Methven, one of the oldest officers in the service, has, since her trial trip, left with the outward India, China, and Australian mails, and on her return from this voyage she will be despatched to the other side of the Isthmus of Suez for service on those stations. Two more large screw steamers, of 3,000 tons and 600-horse power each, are now in progress for the company, viz., the "Magdala," constructing by Messrs. W. Denny Brothers, at Dumbarton; and the "Hindostan," by Messrs. Day and Co., at Southampton. The "Magdala" is expected to be ready for sea in about six months, and the "Hindostan" in about thirteen months.

ROYAL BOTANIC SOCIETY.

THE second grand exhibition of plants and fruit for the season was held on Wednesday last in the Society's Gardens, Regent's Park, and was highly successful both as regards visitors, of whom there were between 9,000 and 10,000, and flowers and fruit, which were there in splendid variety. The pelargoniums, roses, azaleas, and orchids were very numerous and well grown and covered with perfect blooms, many of the roses being full 6in. across. There were also many fine heaths, well deserving attention, and many fine specimens of palms, for which a special prize was offered by a member of the society. There were good collections of stove and greenhouse plants, containing plants famous for their fine leaves, and very many rare plants especially to be admired for their fine flowers. Superior fuchsias, double and single, a great variety of rare and curious plants, such as the famous pitcher plant, of which there were many specimens, and for which a special prize was given; new petunias; new and fine gloxinias, Japanese lilies, new ferns, dwarf myrtles; new and fine varieties of scarlet and variegated pelargoniums, and an interesting collection of economic plants, for which a special prize was given. The collection of orchids was very good. A noticeable feature was a bed of "economical plants," comprising tea, coffee, pepper, india-rubber, arrow-root, nux vomica, rice, sugar cane, and other plants of medicinal or general employment.

BOILING DOWN.

A VISIT to the boiling-down establishment at Colbinabbin station, says the "Melbourne Argus," is not without interest. When the sheep have been killed, skinned, and cleaned, and the vat emptied and made ready, a number of hands are employed in chopping them into three or four pieces, and then throwing them into it. The vat is 11ft. high, and tapers from the top to the bottom. The tapering does away with the necessity of employing any person to pack the sheep in the vat, as the pressure above always keeps the carcasses close together; and, as they fall to the bottom when steam is applied, room is left for the fat to swim on the top. Steam is conveyed from an engine of 40-horse power, which is in connection with the patent wool-scouring machine in the adjoining shed. The vat holds 300 wethers or 400 ewes, and 1,000 of those are stewed (for really that is the most expressive term to apply to theprocess) in forty-eight hours. When the fat has been all extracted, it is allowed to flow out of the taps, so placed in the side of the vat as to allow nothing but fat to flow into large 500-gallon coolers. The gravy runs from a tap in the bottom of the vat into a reservoir prepared for it, and is afterwards given as food to pigs, who luxuriate on what would be a great blessing for the poor in some of the large and populous cities in the old country. All the bones and shreds of meat are drawn out and carted away to the same herd of unclean animals. Such is the power of the steam employed that the bones are made so soft as to break in pieces in the hand, the marrow being completely melted out of them. A number of coopers are employed making casks, which are afterwards filled from the coolers, and then headed up and sent to the train for conveyance to Melbourne.

THE Bristol and Exeter Railway Company are about to build a cattle market at Bridgewater, in Somersetshire.

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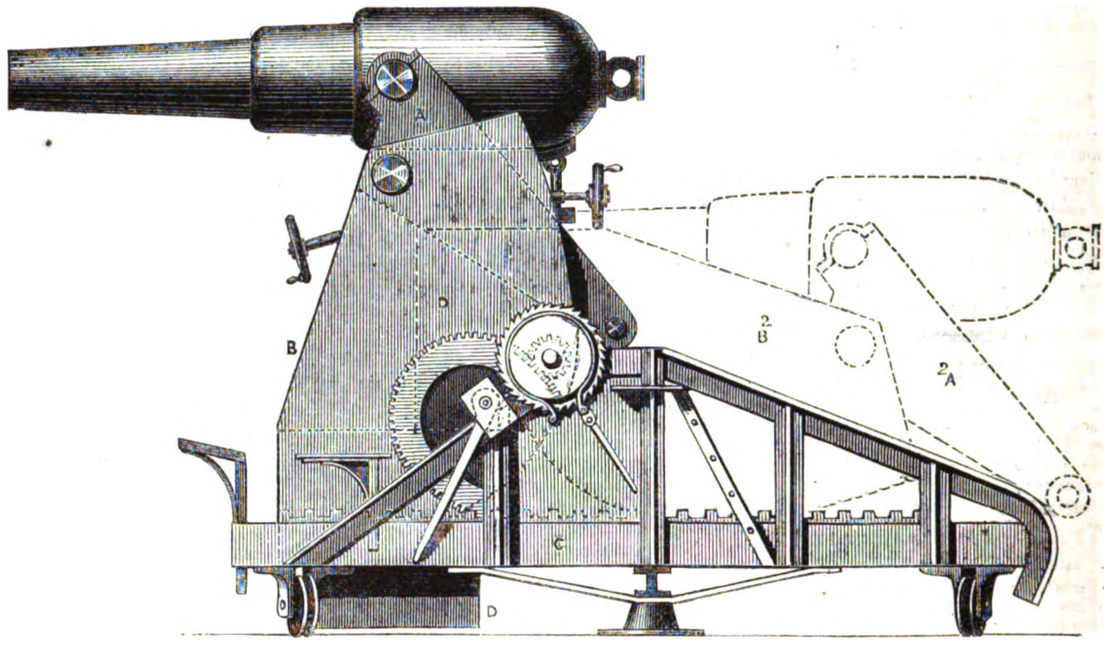
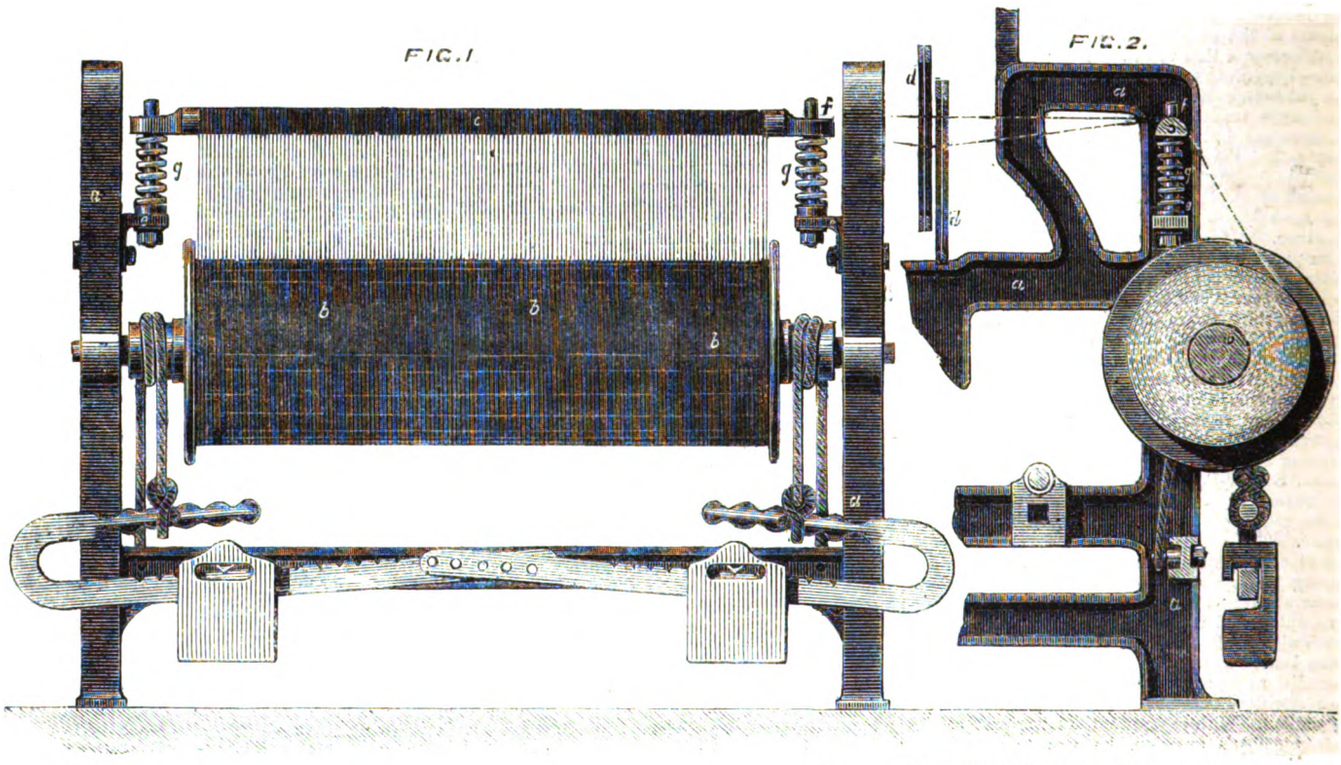
SYSTEM OF WORKING HEAVY GUNS.

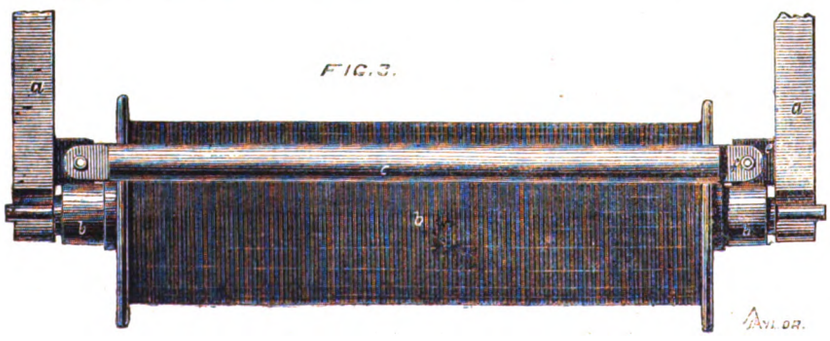
BY CAPTAIN A. MONCRIEFF.



IMPROVED LOOM.

BY MR. R. CARTER.





IMPROVEMENTS IN LOOMS FOR WEAVING

MR. ROBERT CARTER, of Leyland, near Preston, has recently patented some improvements in looms for weaving, the objects of which are to cause the yarn to weave easier by reducing the friction on the healds and reed, and also the friction on the yarn itself, and at the same time to effect a saving in the power necessary for driving. The invention consists in placing the back carrier or rest on spiral springs supported by studs or pins and brackets fixed to the side frames of the loom, so that the springs and carrier or rest will yield to the pressure of the yarn and thus reduce the friction upon the healds and reed as well as upon the yarn itself, and thus cause the yarn to weave easier as well as economize the power required.

Fig. 1 on the annexed engraving is a back view of

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so much of a power loom as is necessary for the illustration of this invention, which is shown as applied thereto; fig. 2 is a cross section, and fig. 3 a ground plan of the same. *a a* are the side frames of the loom; *b b* the yarn beam; and *c c* the back carrier over which the yarn passes from the yarn beam to the healds *d d*. Bolted firmly to the two side frames are two brackets *e e*, in which are fixed vertical studs or pins *f f*; resting on these brackets, and coiled round the studs, are placed helical or spiral springs *g g*, and upon the upper ends of these springs rest loosely the ends of the back carrier *c c*, the ends of the carrier being pierced with holes fitting loosely over the studs or pins for that purpose. By this arrangement and construction of the parts the springs and carrier will yield to any undue pressure on the yarn and thus prevent any breakage, and by reducing the friction cause the yarn to weave easier, as well as economize the power required to drive the loom. The springs also can easily be replaced or renewed when required, and springs of different strengths may be adapted for different kinds of work by merely lifting the back carrier off the studs.

THE MONCRIEFF SYSTEM OF WORKING HEAVY GUNS.

IN our notice of the second soirée of the Royal Society we briefly referred to Captain Moncrieff's system of working guns, promising further particulars and drawings in due course. We now place these before our readers, premising that this protected barbette system promises not only to be one of the greatest improvements ever introduced by a single individual in the art of working heavy ordnance, but to completely revolutionize the construction of fortifications. The records of war prove that there is no defence against shot and shell equal to a simple bank of earth or sand; but heavy guns cannot be well worked behind sand banks in the ordinary way, and, therefore, it is that we have shields of iron and walls of masonry. It is excessively difficult to use sand banks unless the guns are virtually mounted *en barbette*, that is to say, pointing over the parapet instead of through it. Guns so mounted are greatly exposed, and their detachments are, while loading, at least, quite, or nearly quite, unprotected. Captain Moncrieff long since conceived the idea of obtaining a system of firing over a solid parapet, preserving free lateral range—which cannot be done while embrasures are retained—and neither exposing the gun and detachment nor involving the labour of raising and lowering the piece—in a word, of gaining all the advantages without introducing any of the defects of the barbette system. After many experiments, he has produced a gun carriage which has already been tested with great success.

The principles involved are that the gun should be lowered down behind the parapet to be loaded in safety, to be raised above the parapet for a moment only and fired, and then suffered to sink once more to its *cache*. In addition, it was necessary that all this should be done without complex machinery or requiring the expenditure of great power. As regards the last point, Captain Moncrieff was not slow to perceive that much energy is wasted by the recoil of a gun in overcoming the friction of compressors, and this energy he proposed to store up in a heavy weight to be raised by the recoil of the gun down a slope, and by its subsequent fall to elevate the gun once more over the parapet. The details of the invention by which these principles are applied in practice are, as will be seen, extremely ingenious. In the Moncrieff carriage the recoil is stopped without injurious strain by an arrangement of forces analogous to those which stop the rolling of a ship, where the gradual rising of the centre of gravity of the whole structure puts a limit to the movement in one direction. The curve of the elevators can be made to control the metacentre, and express the same movement with nearly the same results.

Captain Moncrieff first submitted his invention to the Government in 1858—ten years since—and he has partly worked out its application to three different classes of artillery, namely, siege artillery, the heaviest class of garrison artillery, and ships' guns and floating batteries. One form of the second application is the one illustrated in our engraving. For this class of guns Captain Moncrieff confines himself to the force of gravity for absorbing recoil. In the other two cases the Captain likewise uses gravity wherever it can conveniently be applied, although he has also matured plans for absorbing and utilizing recoil by means of other forces. Our engraving shows the general arrangement of a Moncrieff carriage for a 7-ton gun. It consists of three principal parts, viz., the carriage proper, A; the elevators, B; and the platform, C. The dotted lines A^2, B^2, show the carriage and elevators near the loading position. It traverses on a central pivot and a single circular racer 14ft. in diameter, and the platform is about 16ft. 6in. in length. A counterweight D, sufficient to balance the gravity of the gun, is placed between the two elevators. In the firing position the centre of gravity of counterweight and the fulcrum on which the elevators rest are nearly coincident, and are both in nearly the same vertical plane as the trunnions of the gun. On the discharge of the piece the elevators roll backwards on the platform, causing the gun to descend in a cycloidal curve, while at the same time the counterweight rises, at first with an increasing velocity. The centre of gravity of both the gun and the counterweight together is also the centre of the circular part of the periphery of the elevators; this being the portion on which the elevators first roll, after firing, it follows that the common centre of gravity of the gun and counterweight travels backwards in a horizontal plane. And as this circular part is about a quadrant the detachment is enabled to work the gun for drill purposes or to place it under cover from the firing position with ease, the whole structure being in a state approaching to stable equilibrium. As soon, however, as the elevators pass off the circular arc on to the greater curve, the leverage in favour of the counterweight goes on in an increasing progression until it becomes sufficient to meet the utmost force of the recoil; thus the recoil is absorbed without necessarily using friction, and it will be observed how this arrangement takes off that shock and vibration which proves so destructive to pivots and masonry in the ordinary carriage, and which has led to so much expense lately in making foundations strong enough for the platforms of heavy guns. When the gun has recoiled as far as it will go it is held in that position by a self-acting pawl, and then loaded under cover. The elevation can also be given to it in this position if desired, as there is a trunnion pointer with segmental scale on the cheek of the carriage. If the pawl is lifted the energy of the recoil stored in the counterweight raises the gun into the firing position, its movement upwards being regulated by one gunner holding the handle of the friction band.

A careful examination of Captain Moncrieff's system discloses many and important advantages. Its adoption will probably enable us to dispense with our present costly and inefficient system of coast defences. The fact, however, cannot be disguised that Captain Moncrieff has not yet quite perfected his system, but he has in view several modifications and improvements. Besides, practical trials must be made in order to ascertain defects with a view to their remedy. But even taken as it stands the system undoubtedly possesses great merits and is a valuable improvement upon all previous methods of working heavy guns. Not the least important part of the system is the arrangement advocated by Captain Moncrieff of arming positions by means of small detached works in which guns mounted in Moncrieff gun pits or batteries support each other by their fire. The lateral range of the guns instead of being limited, as at present, to a maximum angle of 70deg., extends through the whole circle if required. Hence, in detached works, the value of each gun is increased by the increased lateral range it controls. In conclusion, we may observe that Captain Moncrieff has introduced a very ingenious reflecting sight, by the aid of which aim can be taken without exposing a man.

ELASTICITY IN RAILWAY STOCK AND THE TRACK.

NO one familiar with railway operations will deny the importance of applying some degree of elasticity to the track, and so applying it that the effects can be secured in the depth of winter as well as when the frost is absent. A well ballasted road bed with properly adjusted superstructure, will in the milder season of the year give what is popularly supposed to be about the requisite degree of elasticity, but how far this popular supposition is correct, the rapid depreciation of even the best specimens of this track will show, even in the most favourable weather, where the traffic on the road is heavy. All experience shows that the character or the amount of elasticity obtained by ballast and wooden crossties does not fulfil the requisition, as the large amounts annually expended for track repairs, and repairs of rolling stock, sufficiently show. What is really required is something more permanent, and a material not so subject to climatic influences. A rain storm will so saturate even the best ballasted road that the blows of the driving wheel at the rail-joints will rapidly cause depression and displacement of the ballast, and this displacement once commenced, becomes a source of expense and destruction in the rail, road bed, and every part and portion of the rolling stock. It has been demonstrated that the driving wheel of a locomotive passing a depressed rail-joint, say at a speed of twenty-five or thirty miles to the hour, will jump some fifteen or more inches over the depression, and strike with crushing weight upon the opposite side. How much of a disturbing and destructive force this jumping process is, any one will easily comprehend who has ridden on the footboard of an engine running over a rough road, and they will comprehend likewise how little gravel ballast iron rails or wooden cross-ties can resist the force of many of these blows. The common "permanent" way is the most unpermanent thing on earth; it is never in plane, and often out of line, enough to cause a useless expenditure of power. If broken stone is substituted for gravel for ballast an advantage is gained, but not enough to pay for the extra expense, unless the facilities for supplying and applying it are extremely favourable. What is needed is some material that is in a measure independent of climatic influences. If blocks of stone were sunk in the road-bed deep enough to resist the action of the frost, and the rails laid in chairs upon an elastic cushion of rubber, then the problem is solved, so far as permanence of material and independence of climatic effects. Then comes the mechanical problem of securely fastening the chairs to the stone blocks; that mastered, it would seem that a really "permanent way" is secured, and a firm, even and elastic track secured. The interposition of an elastic bearing for rails, and a solid immovable foundation, would be a vast advance upon present practice; it would double the life of rails and exercise a corresponding beneficial effect upon the rolling stock.

We hear a great deal of broken tyres, axles and other parts of the locomotive and the car, a vast majority of which we have not the least doubt could be prevented by a really elastic truck. Once secure this permanence of foundation and elasticity of superstructure, corresponding improvements would be made in the rolling stock, although in the latter a great comparative advance has been made. The whole tribe of rigid long wheel base engines should be given up, and flexible devices, such as Bissel's pony truck and Hudson's equalizer, substituted for the present stiff and unyielding running gear. The same reform should be made in tenders, and the trucks so arranged that the wheels can pass through curves without that hard abrasion and strain between the rail and wheel which is so destructive to both.

The modern tender, with its innumerable wheels, castings, springs, and other accompaniments, is a prolific cause of trouble and expense. It needs to be simplified instead of complicated. Bissel's tender truck is an improvement in the right direction. It does away with one set of wheels on the forward truck and has a single centre bearing spring immediately over the axle, which is a decided improvement over side springs, which on an uneven load throws the whole load first upon one side and then rebounds upon the other. The forward axle is connected with the back truck by a lever which swivels in the centre between the bearings, and thus enables the tender to pass curves of short radius with the greatest ease. The centre bearing and nearly straight spring likewise equalizes the weight upon the forward wheels, and gives a very easy movement to the tender, entirely different from the short thumping up-and-down motion so observable in most tenders. This improvement, and those alluded to in the engine, give an amount of flexibility to the whole machine favourable to the track. A common mistake is using springs with too sharp a curve; the nearer they approach the form of an arch, the stiffer and harder they are in their action. When they are nearly straight under the full load they give an easy vibratory movement entirely different from the hard jerky motion so noticeable in some engines and tenders. It is a mistake to suppose that merely putting more springs upon a machine will give it the requisite elasticity: we rather want better and more philosophical application of them. Springs should be so applied that they will take up the shock of opposing forces controlling them to a given end. It is possible to have too much as too little elasticity both in the running gear and in the truck. A fine adaptation of electricity, so as to produce the best effects at the least expense, is a triumph for the mechanical engineer, and we know no place where this study can be pursued with such good effects and where the field of enquiry is so broad as in railway machinery. The really practical engineer, who, in addition to his daily experience, is willing to take the experience of others and compare results with the truly catholic desire of arriving at the truth, will hardly fail of finding that great improvements are possible in the construction of the track as well as the rolling stock. —American "Railway Times."

THE SCIENTIFIC WONDER.—Have you seen it? It magnifies 32,000 times. Price thirty-two stamps (post free), with book of full instructions. To be had only from A. McCulloch, Philosophical Instrument Maker, 18, Blucher-street, Birmingham.

N.B.—For further particulars, see Advertisement in this paper, page 1, column 2, headed "Scientific Wonder."—[ADVT.]

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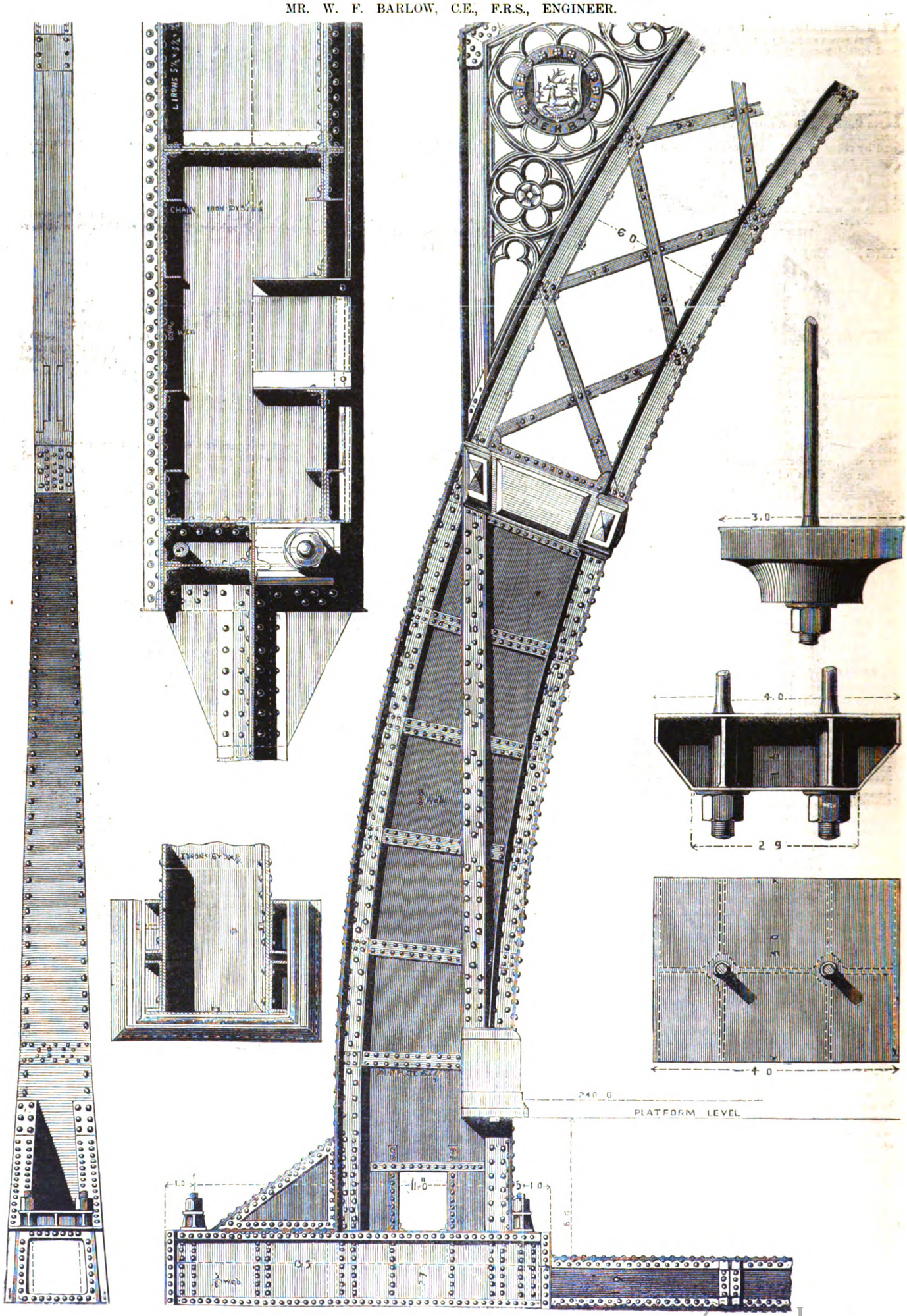
MIDLAND RAILWAY EXTENSION—ST. PANCRAS STATION—DETAILS OF MAIN GIRDERS.

MR. W. F. BARLOW, C.E., F.R.S., ENGINEER.



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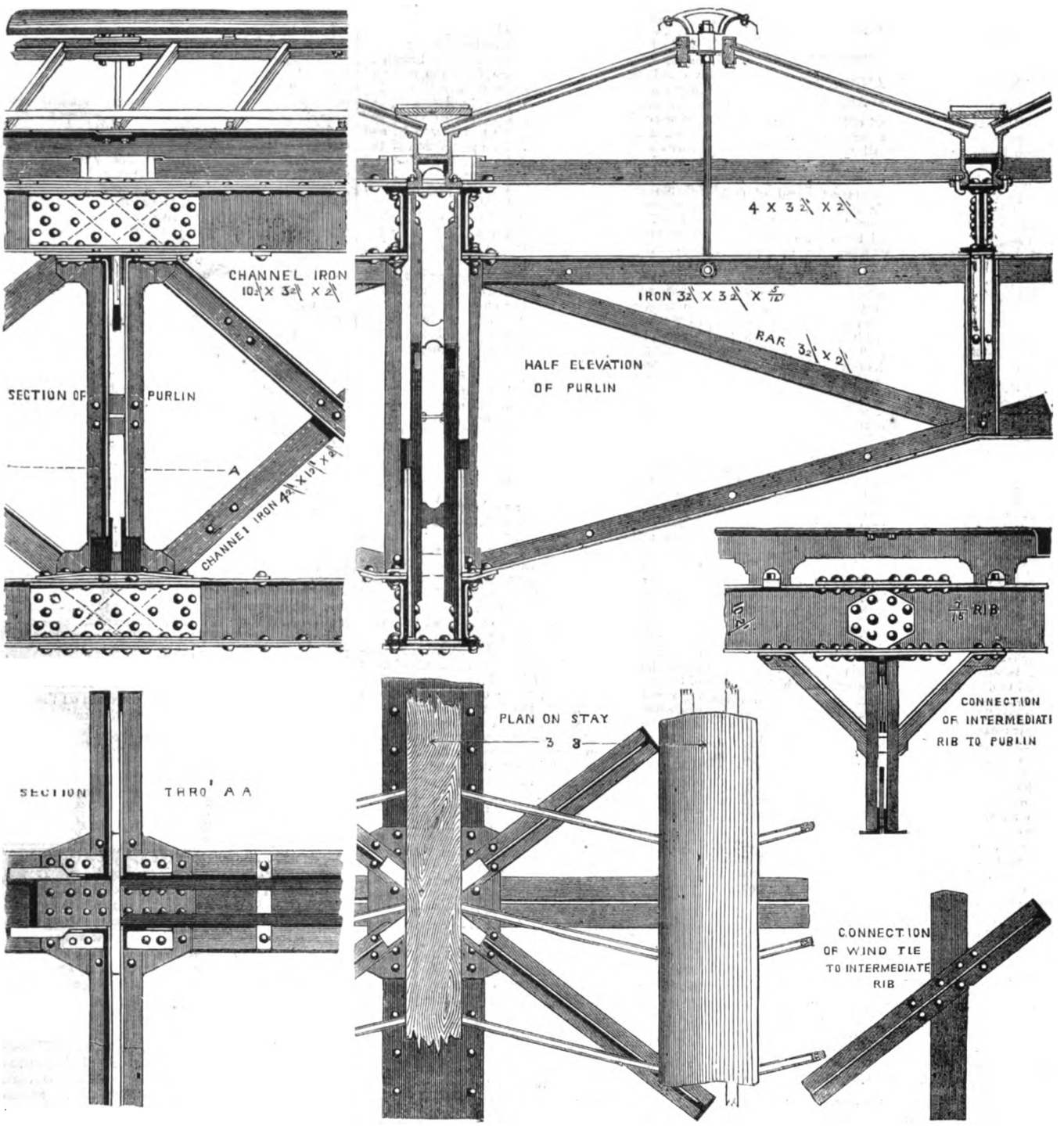
THE ST. PANCRAS STATION, MIDLAND RAILWAY EXTENSION.



THE SAINT PANCRAS STATION, MIDLAND RAILWAY EXTENSION.

WE last week gave the general particulars and drawings of the St. Pancras Terminus of the Midland Railway. According to promise, we now place before our readers some enlarged details of the structure, leaving, however, a few for illustration next week. The springing of each arched rib is composed of plate sides, channel iron, plate flanges, and angle irons, which are riveted to the boxes that rest on the side walls; these boxes are bolted down to anchor plates well built in the walls, by four holding-down bolts 3in. diameter, as shown. At platform level an ornamental casting is fixed, and at the top of the plated portion of the rib, where the lattice work begins, another casting is placed which gives a finish to the springing and an appropriate commencement to the lattice portion of the rib. At the inner face of the wall a handsome ornamental spandril is fixed, which will add to the effect of the roof. The rib is 6ft. deep and the lattice part (distinguished from the springing, which is plated), is composed of channel irons 10in. by 3½in. by ¼in. with flanges 1ft. 4in. by 7-16in., the inner portions of which are connected by distance pieces 2½in. by ⅜in.

The diagonals are formed of channel irons 4½in. by 1½in. by ½in., and are placed in pairs opposite one another at intervals. These diagonals are well braced together by bent plates. Between the main ribs purlins are fixed, which are composed of angle irons 3½in. by 3 in. by 5-16in. in top and bottom flanges, and bars for diagonals 3½in. by ½in., the whole being riveted together form an effectual and strong trussed purlin. The intermediate ribs are fixed on these purlins, and are made of ⊢ iron 10½in. 5½in. by ½in., properly jointed. On these intermediate and main girders are fixed gutters, which carry the skylights, as described in our last impression. Wind ties are riveted to the whole structure, which tend to hold the building together, and prevent the action of storms from doing damage to it. The top of the skylight is capped by a galvanized iron cover.

On either side of the roof, at the ends of the skylights, is fixed a gangway which will be railed in by a light iron railing. This gangway will be convenient for repairs and cleaning out the gutters, &c. The slating of the roof will be laid on boarding 1⅛in. thick, grooved and tongued, and chamfered; the boards will be of best selected Memel, the underside of which will be varnished. The slates will be best Welsh, and each slate will be securely fastened to the boarding with copper nails, weighing about 7lb. per thousand. The lap will not be less than 3in.

The timber work throughout will be well protected by varnishing, painting, or Burnettising, according to the position in which it will ultimately be fixed. The lead for flashings is best milled, weighing about 7lb. per square foot. The glass to skylights to roof is to be of rough plate, 3-16in. thick, well bedded with putty. The holes in the ironwork of the rib are all drilled, and will doubtless come together well. We are, to a certain extent, advocates of drilling all work of this class, as we feel assured that with very little extra cost, a greater synthetic nicety of fitting is obtained, and

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consequently a much stronger and more durable class of work. It is to be hoped that a very excellent æsthetic effect may be obtained by colour; and as undoubtedly there is the opportunity opened for the use and not the abuse of artistic decoration, we are sure this subject will not be overlooked by the engineer.

EXAMINATION OF AMERICAN BREECH-LOADING ARMS.

THE supplementary report of the board appointed by Governor Fenton for the examination of breech-loading military small arms, has just been published. It will be remembered that in May, 1867, this board, consisting of Brigadier-General George W. Palmer, Commissary-General of Ordnance; Brigadier-General William G. Ward, commanding First Brigade; Colonel George M. Baker, 74th Regiment; and Colonel Silas W. Burt, Assistant Inspector-General, was, on its own recommendation, ordered to make a further test of the Allin, Berdan, and Roberts methods of conversion. The board was also authorized to test such other arms as they considered possessed sufficient merit to entitle them to be admitted for trial. The board met on July 9, and continued its sessions, with intervals, until December 11. The guns submitted for trial were subjected to the following tests, which were prescribed for all the competitors alike:—

1st. For endurance—to be tested with 1,000 rounds, in series of 100 rounds each, discharged rapidly, the arm to be cooled, cleaned, and inspected in the intervals, and the wear and tear, absolute and relative, carefully noted. 2nd. To be fired fifty rounds, with ammunition prepared by the board. 3rd. To be fired with defective cartridges such number of times as the board may deem necessary. 4th. The board reserves the right to subject all the arms to such other practical trials as may be deemed necessary to fully test their merits. The board arrived at the following conclusions regarding the principal guns tested:—

The Allin Gun.—The locking device is secure and easily manipulated. The Miller ejector is disapproved, as the forcible blow of the breech-block upon the lever, as required to eject the cartridge-case, occasions great wear by battering the lever and breech-block, and would probably, after continued use, become inefficient. This ejector was introduced to do away with a spring, which has been hitherto considered undesirable. The board, after very careful consideration, conclude that springs of proper form, material, and workmanship will equal in endurance the other portions of the mechanism. The durability of properly manufactured and inspected springs is demonstrated by those in the lock of the Springfield muzzle-loading arms. No device can secure the exact and constant ejection of the case as well as a spring of the proper elasticity. The question of ejection of the cartridge-case is, however, one dependent upon class of breech system, and in many cases mere retraction is alone necessary. The method of securing the breech-block hinge to the barrel by a band entirely clasping the latter, is a most decided improvement upon the strap merely screwed on.

The Burdan Gun, No. 2.—This gun has no independent locking device for the breech, but depends upon certain nice calculations and analysis of the forces of recoil. As a merely mechanical demonstration, such calculations may be entirely satisfactory, but applied to practice, and relying for their efficiency upon careful manufacture, and delicate adjustments involving exact measurements, they are undesirable. The best evidence of this rests in the fact that the ingenious exhibitor of this gun has presented another upon the system of absolute and separate lock.

The Lamson Gun.—This gun has no independent locking device, and the ability to close the breech and secure it when in position, depends upon a divided breech-block, the relative motion of one portion of which upon the other is equivalent in effect to the loose hinge in Berdan's No. 2 gun. As in that arm, nice adjustments and workmanship are required, nor even then can they be considered as efficient. The guns of this system exhibited to the board have been of beautiful workmanship and unexceptionable material, displaying great mechanical skill; yet at the previous session of the board both the guns exhibited were disabled by the explosion of defective cartridges, and at the present session the breech of the gun, as first exhibited, was blown open by similar cartridges. It was subsequently modified, so as to withstand the test, but it is obvious that a system requiring such nice adjustments is undesirable for military arms. The retractor and ejector of this gun are highly approved by the whole board, and its easy application to the hinge band around the barrel, or to a separate receiver, further commends it.

The Miller Gun.—The locking device of this gun is designed as an equivalent for that of the Allin, the advantages claimed being the possibility of a square recoil seat, and not crowding the cartridge-case forward in opening the breech. Conceding these points, the board does not conceive them as very material, while the sliding movement of the key and consequent friction and wear are certainly disadvantages. If to prevent wear the key is hardened, a violent explosion, as from an imperfect cartridge, may break the key, as was illustrated by the tests. The ejector of this arm has been estimated under the head of the Allin gun.

The Needham Gun.—The lateral movement of the breech-block in opening and closing the breech is a disadvantage as a departure from the unity of movements in vertical planes, and, therefore, being awkward. The locking device is defective, as throwing the whole strain of resistance upon the hammer, and tending to wrench and loosen it, and otherwise derange the lock. The propulsion of the firing pin by the wedging action of the prolonged hammer, is a very inferior substitute for the direct, forcible blow usually attained, and the acquired movement of the pin is very limited.

The Roberts gun was the only gun of this class presented at this session, and it combined many improvements since tested at the previous session. The breech-block and appendages are readily removed and replaced without dismounting the entire gun, as hitherto. A spring has also been applied to the firing-pin, retracting it when not pressed forward by the hammer. The lever should be further depressed, so as to lie closer to the neck of the stock. The strength and safety of this gun, its easy manipulation, and its capabilities for rapid firing, are conceded by the entire board. The security of the breech-block, as against accident by premature explosion, is indubitable. The ejection of the empty cartridge-case is accomplished without springs, as the inclined position of the breech-block facilitates the ejection. Original guns on this system, while embracing all the advantages of the converted gun tested, would also be capable of other important improvements.

The Conroy Gun.—This arm is capable of great rapidity of fire, and the breech, when closed, is strong and safe, the locking being very efficient. The guard-lever movement is somewhat objectionable, for reasons set forth in previous report, but less so than any gun on that principle yet examined. The main and rear spring (both in one) is exposed on the under side of the gun, and, on account of its importance, should be suitably cased. There is no danger to be apprehended from premature explosion of cartridge. The mechanism of the breech is complicated, consisting of many distinct pieces, and most of them exposed when the breech is open. Possessing several good points, those of an objectionable character, combined with the great cost arising from complicated mechanism, would appear to condemn this system for alteration of muzzle-loading arms.

The Remington Gun.—The favourable opinion of this gun, as expressed in a previous report, is reaffirmed. For conversion, the same system as in an original gun is adopted. The substitution of an entirely new lock renders this alteration more expensive than many other systems. The independence of the system in its relations to the remainder of the arm and the compactness of the mechanism are approved. The distinct receiver, as in other guns possessing it, gives an advantage in the substitution of new barrels. The brass case cartridge should be alone used in this system, as the permanent expansion of the copper cases is apt to render the opening of the breech difficult.

The Burton gun was the only one of its class admitted to competition at the present session. The majority of the board estimate it as follows:—Its capability of rapidity of fire is conceded, and also its strength, the efficiency of the retractor, and the probable low cost of alteration. Objection is made:—1. To the sliding movement of the breech-block on account of friction and wear; 2. To the compound motion in opening and closing the breech; 3. To the too facile detachment of breech-block; and 4. To the possibility of a premature explosion of the cartridge, should the firing-pin be jammed in a protruding position. General Ward dissents from the above objections, and esteems this gun, as a whole, superior to any other exhibited, on the score of simplicity, strength, and cheapness. He considers that the loose adjustment of the breech-block, a close fit being unnecessary, and, indeed, injurious, overcomes the first objection of his colleagues; that the compound motion is easy and practically single; and that the construction of the hammer and firing-pin in one piece, and the device controlling its movement, effectually prevent any danger whatever from the last objection. Finally, that in his opinion its extreme simplicity, strength, and ease of repair (there being no small pieces or screws to be lost), commend this system above all others for use in the hands of troops.

After a review of the tests and a dissection and special examination of the several guns, the following resolution, *nem. con.*, was adopted:—Resolved. That after careful and long-continued examination and experiment, and in consideration of the combined qualities of strength, durability, safety, efficiency, and economy, this board deems the Roberts system of conversion of muzzle-loaders into breech-loaders as superior to all others examined, and recommends that the muzzle-loading arms owned by the State be converted into breech-loaders upon the Roberts system. The board also recommend a reduction of calibre in the guns owned by the State by the process known as "re-enforcement" from ·58in. to ·50in.; "but if the increased cost occasioned thereby should endanger the probability of a speedy conversion of the guns, the board advise delay in the reduction of the calibre, as the vast importance of an immediate adoption of the breech-loading system outweighs all other considerations based on minor details."

The report concludes with the following recommendation on the subject of target practice:—The board begs leave, before closing this report, to offer a suggestion as to the expediency of a thorough system of target practice for the National Guard. This exercise, which has gradually fallen into disuse in this country, has been revived abroad, and in England especially has served not only the direct purpose of educating the young men of the nation in the accurate use of arms, but has stimulated martial ardour, and given to the volunteer corps, character, *esprit de corps*, and a world-wide reputation. The laborious winter drills of our National Guard serve an excellent end, but the ultimate purpose of the soldier is the effective use of his weapons, and while we discipline and drill him in all the manœuvres that contemplate him solely as the fraction of a tactical whole, we should not neglect the individual instruction as a marksman, to which all other drill is merely auxiliary, and which alone renders him formidable when detached, and also acting in hostile concert with his fellows. Accuracy of fire is especially desirable in the use of breech-loading arms, as combined with rapidity of fire and long range; it gives this improved weapon the full measure of its extraordinarily destructive power. The English system would furnish the model and general details upon which could be based a system more particularly adapted to our requirements.—"U.S. Army and Navy Journal."

ROYAL GEOGRAPHICAL SOCIETY.

AT the meeting of this Society, on Monday evening, June 8, at Burlington House, the business opened with a paper on a proposed scientific exploration of Central Australia, by Dr. G. Neumayer, late director of the Melbourne Observatory. In this memoir the author described a plan, which he was desirous of carrying out, of exploring nearly the whole of the interior of Australia by an expedition to enter at Port Denison on the east coast, proceed in a south-westerly direction to the centre of the continent near Finke River of Stuart, and thence traverse the unknown western portion by an angular course to Swan River. The expedition was to consist of twenty-five men, including seven professional gentlemen to attend to the various branches of science; and it was to be conducted on a system of establishing a number of depôts, or temporary head-quarters, at intervals of 200 or 300 miles, whence the neighbouring country could be explored in various directions. It was estimated to cost £21,535, and to occupy three and a-half years in its completion; part of the cost, he hoped, would be borne by the Home Government, the Australian colonies supplying the rest. After the reading of the paper, Professor Owen advocated Dr. Neumayer's scheme, in an eloquent speech, on natural history grounds, anticipating great accessions to our knowledge of the peculiar fauna of Australia from so thorough an exploration as that proposed. He thought it not unlikely that some of the colossal marsupial animals known in a fossil state from recent formations might still be living in the unknown interior. Professor Tyndall also took part in the discussion. Mr. Markham's paper was entitled "On the Region between Antalo and the Beshilo, and the Topography of Magdala." He said that the country to the south of the River Tacaze formed an elevated plateau 10,500ft. high, cut through by ravines of enormous depth. From Senafe to Antalo the rocks were almost all sedimentary; but to the southward there is a complete change, and this change is not confined to the geological features of the country; the scenery becomes grander and the vegetation more luxuriant. The bed of the Tacaze was found to be 7,795ft. above the sea-level, and the high plateau of Wadela rises like a lofty wall on a southern bank. After crossing the Tacaze the English troops, instead of marching direct on Magdala, turned off, in a south-west direction, a distance of thirty-four miles over the heights, in order to reach the great road made by King Theodore across the Jita ravine from Wadela to the Talanta plateau. The two plateaux are of the same height, about 9,200ft., were separated by the ravine; and it is evident they once formed a single vast mass of columna basalt, the river Jita, having, in the course of ages, gradually cut its way down to a depth of 3,500ft. Had it not been for King Theodore's marvellous

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road the English army would have been detained many days by this obstacle. The road was 30ft. wide, and well macadamized: a far more complete work than the roads made by our own men on the line of march. The aspect of this fine road, planned by Theodore and made under his own eye, had great effect in modifying preconceived opinions of his character as a barbarian chief. The Talanta plateau is a flat treeless plain, with a rich black soil, several feet thick. The ravine of the Beshilo is even deeper than that of the Jita; the length of the descent to it was 4 miles 4 furlongs. Beyond it lay the irregular mass of mountains forming the Magdala system. Magdala itself is a mass of columnar basalt with a flat summit, two miles long, by half a mile broad, and 9,050ft. above the level of the sea. The three heights constituting the Magdala system—Selassie, Fahla, and Magdala—form a triangle, and are connected by saddles; to the army approaching from the Beshilo, Magdala was invisible, being hidden by the greater elevation of Selassie. Geologically, the Magdala district formed a portion of the basaltic plateau of Talanta, detached and furrowed by the action of water during vast periods. The climate of the region described in March and April was healthy and agreeable. The difference in temperature between the Wadela and Talanta plateaux was very observable, the latter being much warmer. Mr. Markham gave some interesting details of the last days of the campaign and the end of King Theodore; and, in conclusion, summed up the scientific results of the expedition, which, he said, would prove, when published, of great interest. The country on each side of the line of march had been surveyed by General Phayre and by the Trigonometrical Survey Staff, consisting of Lieutenants Carter, Dummler, and Holdich, with assistants; its geological structure had been investigated by Mr. Blandford; its zoology by Mr. Jesse; and the meteorology by Dr. Cooke.

MANUFACTURE OF ORNAMENTAL METALLIC TUBES.

IN the ordinary manufacture of ornamental metallic tubes a solid brass or other tube of the required thickness is passed through ornamental rolls, and its surface ornamented by the pressure of the rolls. Or a thin ornamental tube made in one piece, or in several pieces produced by rolling or otherwise, is secured by soldering, or brazing, or by collars, to a tubular foundation of iron. Mr. Thomas Weston, of Birmingham, has recently patented some improvements upon this method of manufacture, whereby economy and simplicity of manufacture, combined with strength and durability in the tubes produced, are secured.

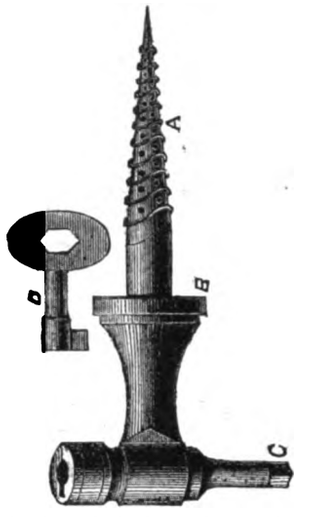
In manufacturing ornamental metallic tubes Mr. Weston proceeds as follows:—He takes a tube or foundation of wrought iron of the required strength, and another tube of thin brass, and by a drawing process, conducted in the ordinary manner, he coats or covers the iron tube with the thin brass tube. The compound tube thus produced is similar to the tubes known as cased tubes. He takes this compound tube and places in its interior a steel mandril, and passes the compound tube supported upon its mandril through ornamental rolls of the ordinary kind, the acting surfaces of the rolls having engraved upon them the pattern it is wished to impress upon the tube. By the pressure to which the compound tube is subjected in its passage through the rolls the outer brass case is impreseed with the pattern upon the rolls, and an ornamental tube is thereby produced. On being removed from the mandril the ornamental tube resembles a solid brass ornamental tube, whereas it is a compound tube, the interior being of iron and the exterior of brass.

A MARBLE RESTAURANT.

A NEW restaurant, of more than ordinary pretentions, to be known as the "Westbourne," has just been opened in Spring-street, Paddington, opposite the departure entrance of the Great Western Railway. According to the "Building News," the building is entirely constructed of different kinds of marble. The wall, in rear of the bar, is covered with coloured marbles of the choicest description. The pilasters which divide this wall into panels or mirrors, are of Spanish jasper marble, with bronze bases and capitals, the whole resting upon a ground of green marble, illuminated with incised lines of gold. Supported by the capitals runs a frieze of bright jasper, with inlaid panels of Vert des Alpes marble, and above this is a bold and massive cornice, carved in figured Bardilla marble, from the centre of which rises an elegant entablature, bearing the name of the proprietor. This entablature is executed in Bardilla and jasper, with panels of Genoa green marbles. At each end of the cornice is arranged a circular pediment, the striking effect of which is heightened by some elaborately carved festoons of flowers in high relief on a rich red ground. The counter or bar is constructed entirely of marble. The plinth, standing upon a tesselated pavement, is of speckled Coquille, and the moulded base of Bardilla marble. The pilasters are of jasper, out of which in the solid block have been wrought circular niches for the reception of bronze figures supporting the cornice. The panels separating these figures are of black marble, inlaid with green and jasper marbles of alternate designs. The frieze or upper part of the panel is also of black marble, relieved by finely cut gilded lines. The cornice is of Bardilla marble, and the counter top of long slabs of the same material, with which correspond the tables and other fittings. The whole of the marble work is polished. It has been executed by Messrs. W. H. Burke and Company, of Warwick House, Regent-street, under the direction of the architect, Mr. A. Evers, of Great Marlborough-street.

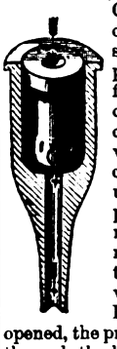
TAP AND VENT VALVE.

OUR attention has recently been called to some useful practical improvements in beer taps and vents—matters of importance at the present season of the year to all who study economy. The tap is known as the Burton tap, and is the invention of Messrs. Atlee and Sons, whose London agents are Messrs. Wheeler and Croucher, of No. 4, Cullum-street, City. This tap, as seen in our engraving, is very safe and economical, being



screwed in through the bung, damage from blows thus being avoided. The screwed part A is passed through the bung to the shoulder B, where there is a leather washer. The outer form of the nose of the tap at C is hexagonal, and the bow of the key D is cut to correspond, and forms a spanner by which the bottom part C is unscrewed and taken off for cleaning. During the process of tapping no liquor can escape, whilst no great strength is required to tap the barrel, a great advantage over the ordinary tap.

The Bourne valve vent, shown in section in the annexed cut, is another of Messrs. Wheeler and Croucher's novelties. This ingenious contrivance is intended for the admission of air into the barrel in such proportion only as is necessary for a free flow of the liquor when being drawn off. It consists of a small hollow plug of wood, one end of which is covered with a cylinder of india-rubber, closed at its lower end, and, at its upper, fastened tightly round the plug. In this cylinder there are a number of fine slits, which, while at rest, are closed, and when subject to any pressure from within the vessel, become still more firmly shut. But whenever the tap or other orifice is opened, the pressure of the air from without passing through the hollow plug, forces the slits open, and so permits the entrance of as much air as may be equivalent in volume to the liquor withdrawn, the slits by their own action resuming their closed condition so soon as the flow of liquor ceases. Placed within a sheath with a tapering end, suitable for insertion in an ordinary spile-hole, this valve forms a most valuable self-acting vent peg, which, from a trial, we believe to be the simplest, cheapest, and most efficacious yet produced.



Messrs. Wheeler have also an improved jar fitted with the vent valve. This application is valuable to the medical profession, as, by its use, infusions and other preparations liable to injury from frequent exposure to air, may be preserved a considerable time without change or any loss of aroma, and be drawn off, as required, by a tap. Medical men often have occasion to recommend special kinds of ale and beer, the best classes of which are only obtainable either bottled or in large casks. By the use of these jars small quantities can now be had, and kept in perfect condition, and drawn off in any quantity without waste.

Whilst overhauling Messrs. Wheeler and Croucher's stock, we noticed a very excellent arrangement of pump for garden and other purposes. It is called the "Standard pump," and possesses the advantage of being easy to work and of not having either leather or india-rubber valves, so that it is unaffected by variations of temperature. The price is low, so that it is at once an economical implement, in addition to which the patentee, Mr. C. W. Orford, claims that it gives the greatest results with the smallest amount of motive power. Mr. Eyles, the superintendent of the Royal Horticultural Society's Gardens, unhesitatingly states that this pump, or hydropult is by far the best he has seen. We may add that the articles above referred to have been patented by their respective inventors.

THE MANUFACTURE OF STEEL RAILS BY HEATON'S PROCESS AT THE LANGLEY MILLS.

ON the 17th of January last there appeared in this journal* an article upon the "Manufacture of Steel Rails by the Use of Oxidizing Salts." Next week a letter was inserted from a gentleman who was thoroughly conversant with what he wrote, claiming that "ever since 1844, Mr. John Heaton, now the managing director of the Langley Mill Steel and Ironworks Company (Limited), has been experimenting with a view to the manufacture of steel by merely removing a portion of the carbon from the pig iron, together with any phosphorus, &c., which it might contain." Aware that the company here named have recently taken steps to considerably extend its operations with a view to the complete carrying out of Mr. Heaton's method, we have been to Langley Mill, and will proceed to state what is going on there with no further preliminary than that what Mr. Heaton claims is the use of the nitrates of soda, potash, and, according to his patent of May 3, 1867, that of the chlorates of soda and potash "to act from the underside upwards upon cast or pig iron, when such iron is in a molten state."

Mr. Heaton, and the company of which he has the practical management, are at work in earnest. A very large sum of money is being expended at Langley Mill, and it is being laid out with much confidence as to the issue, as a result of the experience which the company have already acquired of the worth of Mr. Heaton's method. The works will soon extend over much of four and a-half acres by the side of the Midland line in the Erewash Valley, about nine and a-half miles from Nottingham, and twelve from Derby. The existing capabilities of the establishment are equal to the transforming of 600 tons of pig iron into crude steel in the converters every week. Of this, however, there can be finished only about sixty-five tons of steel and steel-iron in the same period, owing to the incomplete state of the works. But when the furnaces, hammers, mills, and the like, which Mr. Heaton has designed, and which are in course of erection, are ready, the company will be able to treat all the crude metal which they turn out. The cast steel department is on quite an extensive scale. It is divided into two distinct modes of working, designated as the crucible and the reverberatory furnace departments respectively. In the first there are forty-two crucible furnaces, which contain two pots each. Of the forty-two only sixteen are at present in a state to work, the rest are in progress. In the reverberatory department arrangements are being made for four 5-ton furnaces. From these jointly Mr. Heaton will be able to produce nearly 300 tons of cast steel weekly. This side is being worked now upon only a limited scale, extending to not more than one air furnace and six crucible furnaces. The air furnace is constructed on a principle which Mr. Heaton has patented. In the mill department Mr. Heaton is pushing forward operations which contemplate the rolling of railway bars, tires, and boiler plates. For rolling steel of small sizes a guide-mill is being put up. In the tilting department there are two hammers at work, and two of a heavier class nearly ready for use, and a shop is being built for the forging of all kinds of axles. The cast steel side embraces all the appliances for tempering clay and making crucibles; and, when completed, there will not be a finer crucible arch in the kingdom.

The nucleus of the existing establishment was a small ironworks, and in the keeping together of their old connection they make iron for hoops, wire, and

* The "Engineer"

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tinplates. Nevertheless, only common brands of pig iron are used as a rule in the making of this or any other of the commodities sent away. Still Mr. Heaton's process dispenses altogether with the puddler in the making of steel and iron alike.

The process, as we saw it, consisted in the fusing of pig iron in an ordinary reverberatory, swinging it in a ladle containing about 15cwt. upon a crane and tilting it into a projecting lip of the converter, at the bottom of which was the nitrate of soda, covered with the perforated plate, and held in a waggon cased with firebrick. The lid was clamped down, the gases began to issue, first with a simmering and quickly with a boiling sound, heightening into fierce action till the carbon, which appeared in black smoke at the top of the converter just at the time when the boiling was heard, was nearly consumed in the subsequent flame and sparks which issued from the top of the converter as though impelled by an exceedingly powerful blast, till at length the sodium coming into contact with the oxygen of the atmosphere, a brilliant hue succeeded, which lighted up the surrounding space as with a limelight possessing a slight roseate tinge. All this happened within about five minutes. In that brief time the crude iron has been turned into a valuable refined metal, which, in a creamy mass, fills the waggon before mentioned, and is now rolled away to a convenient spot, where the vessel is overturned and the contents taken in portions to a tilt hammer. Here, instead of spurting and splashing to nothingness, as we had feared, it resisted the steady impact of the tool with a thoroughness which demonstrated its sound metalliferous quality; and it fell at our feet from the tongs of the hammerman with a ring which left no doubt as to what it had become. These cakes of crude metal which, when they are cold, resemble puddled bars cut to lengths of about 10in., are either piled, and, as piles, heated in a mill furnace, taken thence as slabs to the hammerman, and drawn down or rolled as required, or they are broken in the usual manner and assorted for the crucibles—or it may be the contents of the waggons are allowed to cool, and without being placed under the hammer in the first instance, are purified in the ball furnace, and then taken to the hammer like a puddled ball, but only a little less finished than a piled slab. All these different courses are adopted according to the article intended to be produced. And in respect of crucible steel, varieties for charging the crucibles are obtained, Mr. Heaton explained to us, by the different proportion of soda employed, and the brands of pig iron operated upon.

The iron that was being fused when we were at Langley Mill, was half Middlesborough and half Workington; this mixture, Mr. Heaton explained, was an exception, and due to a condition in the negotiations which resulted in the order then under execution.

The method has not yet arrived at that perfection which will permit of an ingot being cast from the converter, but into the larger converters mentioned the iron will run, and not be ladled, from the reverberatory; and the contents of these and of the smaller converters will be placed together in one heating furnace of large dimensions, which has been put up in a contiguous position, and thus rails be rolled off at once.

Steel iron of different sizes was lying in the completed department of the works, and splendid tilted bar tool steel making up completed orders was reared up under cover in the vestibule of the office. All this, with the specimens which were preserved in two cases in the office, and which were shown at the recent quarterly meeting of the iron trade at Middlesborough, had been made of the iron of the last-named neighbourhood. Amongst the finished steel iron in the works, we particularly noticed 2¼-inch rounds for small shafting, and frames for stocking machines, which, if they should be sold at prices even very much under those of the celebrated Yorkshire brand, which was at one time almost exclusively used for these purposes, would yet leave a margin of profit which does not appertain to any transactions in iron or steel produced upon the old methods. The quality was shown in respect of the inch-square, by the fact that it had borne a tensile strain of forty tons, whilst one sample forged when cold—like all the rest shown with it—bent within 3-8in. of touching all over, and other two did not break at all, one touching at the ends, and the other being in the form of a horseshoe. But here we cannot do better than give the following description of Mr. Heaton's specimens, which we take from the "Middlesborough and Stockton Gazette":—

"Deserving of detailed and special mention were two large cases containing steel bars and rods of every description, and steel tools of all kinds, made from Acklam Ironworks' pig iron by Heaton's process. The quality of the iron turned out by Messrs. Stephenson, Jacques, and Co., has long been known to be very superior. But any one who examined what it could be made to do, as shown by the articles in the cases referred to, when put through the patent process of Mr. Heaton, could not fail to have been surprised. Many people supposed that to make steel from Cleveland iron is something new, and is what Mr. Heaton, Mr. Gjers, and Mr. Jones are straining after. What Mr. Jones and Mr. Gjers really aim at is to produce steel from Cleveland pigs at a price that can compete with other large producers, such as Bessemer. Again, steel of a certain quality has long been produced from Cleveland iron, and steel, too, that would make many kinds of edge tools of a certain quality. But what Mr. Heaton aims at, and what he has shown, by his exhibition of Tuesday, he can accomplish, is to make steel capable of being made into turning tools, drills, cold chisels, and other implements requiring an edge of uncommon hardness. These specimens of steel, and tools made from the steel, were manufactured at Langley Mill Steel and Iron Works, Nottingham, all by Heaton's process, and all from iron made at the works of Messrs. Stephenson, Jacques, and Co., Middlesborough. Bars of steel, 2½in. thick, were shown bent double, and which had been bent cold without breaking. Octagon chisel steel, of splendid skin and grain, capable of being made into masons' chisels for cutting granite, and into cold chisels for cutting iron and steel, were shown by Mr. Heaton, or, rather, were shown for him. Screwing dies and taps, and drills, the edges of which, after having been subjected to severe tests in screwing and in boring, showed edges apparently as good as if they had never been used. But perhaps the most notable things on this stall were tools that had been used in cutting chilled rolls, and which had edges about as keen as they could have had before they had torn the parings from the obdurate material on which they had been employed. The turnings from other materials, and which could only have been shaved off with tools of good and durable edge, were shown, the colour on the tools proving that they had not been ground up after having been used. A razor was shown of a fine quality, and which had been in regular use for five months, it only having required stropping during that time. Pit rails were shown bent in all directions, without the least sign of fracture, and steel rods and bars coiled and twisted in every imaginable manner. Files were also exhibited, made also from Acklam Works' iron by Heaton's process, and which presented sharp teeth after having done good service. Hammers, mill bills, and file cutters, were among the numerous articles manufactured from Heaton's steel at Langley Mill Works, from Stephenson and Jacques' pig iron. It will thus be seen that while Cleveland gives promise of becoming the seat of a new industry by the conversion of its pig iron into steel for heavy work, such as rails, tires, &c., there is rich promise afforded in these implements manufactured from Heaton's steel and Acklam pig iron, that Cleveland will be famous as much for quality as for quantity of steel produced. The price of the pigs of which all this was made was probably £2 14s. a ton at Langley Mills."

Langley Mill, a few days before we were there, had been visited by the Duke of Sutherland and other gentlemen, including Mr. Ramsbottom, of the London and North-Western. As illustrating the rapidity with which crucible steel can be produced by Mr. Heaton's process, it was told us that his grace's party took home with them, at four in the afternoon, specimens of finished crucible steel and likewise steel iron which was cold pig iron when the party arrived at the works at eleven the same morning. To produce crucible steel by the old method would occupy between four or five weeks.

No wonder, then, that some of the steel makers who have won fortunes by the old method should be, as we know they are, earnestly looking about them to find out some new plan by which they may continue in the trade without losing the money they have obtained. Here we would remark that it will be found necessary to the speedy realizing of a good profit from any new scheme that the royalties to be charged should be comparatively small. The system we have been noticing, for instance, seems to us to be likely to be taken up on many hands by persons who desire to enter the trade—for it can be adopted on a small scale at an outlay ridiculously small as compared with the expenditure necessary for the carrying on of the Bessemer process; and, next, it can be so easily adapted to blast furnaces that very little difficulty, as it seems to us, would be found in running the contents into converters, and thence following up the process until mills become attached to blast furnaces in much more numerous instances than hitherto, and steel iron and steel become available to the million, and no longer confined, as now, to the few. Mr. Nielson would never have made the money he did out of his hot blast if he had not set his royalty at a comparatively trifling figure. If Mr. Bessemer has got a heavy royalty upon his process, he has been successful because of the wealth of his constituents, and the comparative rarity of the irons they used; but we have little doubt that Mr. Bessemer, if he should succeed in devising a method for utilizing the poorer irons for steel purposes, would quickly adopt a popular tariff, and, in railway phrase, get a better dividend out of the many third than from the few first-class passengers.

Mr. Heaton and his company are evidently looking for royalty returns; for they have patented the process in the United States, France, Belgium, Wurtemburg, Austria, Hungary, Denmark, Sweden, Saxony, Brunswick, and Bavaria; Prussia, Norway, and Russia.

DISPOSAL OF SEWAGE.

MR. R. G. SILLAR, formerly of Shanghai, has just patented an invention which, if the results of preliminary experiments be verified by subsequent performances, will prove at once a most remarkable scientific discovery, an incalculable boon to mankind, and a complete solution of the greatest sanitary problem of the day. By it, says the "London and China Express," the difficulty of disposing of the sewage of our large towns and cities without polluting our streams, is entirely disposed of; and the matter possesses a peculiar interest to our China readers, inasmuch as the discovery is founded on the process so commonly practised there, and so familiar to all who have resided in Shanghai, of purifying the muddy water of the Wong-poo by means of alum. In the course of some experiments based on this use of alum, Mr. Sillar arrived at a combination that is not only capable of clearing thick or dirty water, but which, when added to ordinary sewage or the foulest productions of a drain, at once precipitates all the solid matter, leaving the water pure and clear, while the residuum is perfectly inoffensive and forms a most valuable manure, as the process fixes the ammonia and phosphates that are so important as fertilizing ingredients. Not the least remarkable feature in the process is its marvellous cheapness, as 20,000 gallons of sewage may be purified for about 4s. 6d., while the manure produced is worth about 50s. per ton. In some recent experiments at Tottenham, 35,000 gallons of particularly foul sewage were let into a tank at the rate of 1,000 gallons per minute; even at this rapid rate the process answered perfectly, the solid matter being easily precipitated and deodorized, while the liquid passed off in a state pure enough to satisfy the trustees of the River Lea. An experiment on such a scale as this would seem to put the success of the invention beyond all doubt; and the remedy can be applied with such ease that we may look forward to seeing the Thames and our other rivers very shortly as pure as they were centuries ago, and our towns far more healthy than they have ever been. In a future issue we shall be able to give further particulars of this remarkable process.

Correspondence.

THE PRESENT CONDITION AND FUTURE PROSPECTS OF MACHINE MANUFACTURE IN RUSSIA.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In following out my line of argument upon the subject I have introduced to your notice, I will now endeavour to prove that the work cut out for mechanical engineers in Russia is even now great enough to furnish full employment for several large factories for years to come. In my first letter, I hinted at the manufacture of locomotives, and stated that Russia during the past three years had ordered from abroad at the rate of 200 per year. There seems to be no appearance of a falling off in this demand. According to the statements of Russian railway engineers, Russia has, compared with such a nation as Prussia, only one-half the necessary number of locomotives for the number of miles of completed railways. This is fully borne out by the continual complaints published in the newspapers of the difficulty of getting goods sent by railway, and by the statements of the immense quantities of grain and other products stored up at different railway stations without means of carriage. As Russia had lately been accustomed to depend almost entirely upon Germany for her supply of rolling stock, the Prussian-Austrian war hindered the execution of orders, whilst the railway companies hastened to open their lines for traffic by the times originally fixed, in order the sooner to receive the benefit of the Government guarantee.

Engineers and directors complain also of the dearness of repairs to rolling stock, and say this increased cost is caused by the want of locomotive factories, where new and spare parts of engines could be easily obtained, and by the necessity of locking up an immense capital in the form of spare articles—capital which they might well employ more profitably. One railway company complains of the fact that it is compelled to keep continually on hand spare parts of locomotives, &c., to the amount of two millions of roubles; and expresses its willingness to pay for such articles, in the event of its being able to depend upon a constant home supply, a higher price than similar articles cost from abroad, and reckons it will yet be a gainer thereby. The cost of repairs seems to increase with the distance of the railways from those places

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where the few existing factories are congregated and rises very high in the southern districts. Thus the cost of repairs on the Nijigorodskoi Railway is stated to be 7½ kopecks per verst; on the Riga-Dinaburg, 8kop.; on the Warsaw, 11kop.; but on the Odessa-Balta, 22kop.; and the Wolgar-Donskoi, 37kop. Up to the commencement of the present year, no fewer than fourteen locomotive factories in Germany, France, and Belgium, and two in England, had found partial employment in making locomotives for this country; indeed, one or two of the German factories owe their very origin to Russian orders.

I cannot help here remarking, that whereas continental firms have delivered in Russia 848 locomotives, England has only supplied 90. Stephenson has supplied only 50, but Borzig, of Berlin, 250; Sharp and Stewart, 40, but Cail, of Paris, 132. A difference in price cannot be the sole reason for this: it must proceed from an indifference to the wants of the so-called (by Englishmen) Russian barbarians. In Russia itself, in the course of fifteen years, 212 locomotives have been made, and of these the greater number, 190, were made through foreign enterprise and in one factory.

The prospects for the future are:—Russia, to judge by the insufficient number of locomotives at present in use, and from the rapid extension of railways, will require a supply of, at least, 200 locomotives a-year for years to come. Of this number the Imperial Government will require, and, I believe, is willing to guarantee orders for, at least, eighty per year, for five years to come, for railways under its immediate control. Parties interested in the subject say that, to meet this demand, four factories capable of making at first twenty locomotives each per year, ought to be established—one in St. Petersburg, two in the interior of Russia, and one in Odessa. In a short time after the opening of such factories, it is to be expected that private companies would follow the example of Government, and perhaps double the amount of orders. The factories would then have to supply up to forty locomotives a-year each.

The demand for other sorts of machines made necessary by the extension of railways in the south, and the making of which on the spot this very extension will render possible, consists in pumping, hauling, and other engines connected with mining; also for the anticipated ironworks in the great coal and iron basin of the Don. Of the mineral wealth of this part of the country I will speak more fully afterwards; at present, I will only state that the constructor of the railway from Kharkoff to the Sea of Asoph is bound by his contract with the Government to establish somewhere near the line an iron works capable of turning out not less than 8,000 tons of rails annually, and that within a year after the opening of the line.

Independently of all this there are the old established produce manufactures, such as sugar making, distilling, grinding flour, &c., all of which are extensively carried on in this part of the country. Within the compass of a small circle, radiating from the spot where I write, are over forty sugar houses almost exclusively fitted with foreign machinery. The owners of them complain bitterly of the difficulty of getting even repairs done anywhere near, and of the necessity of keeping continually a staff of costly workmen to do work which could be more cheaply executed in a special workshop. They state publicly that if they had in their midst good machine factories, then with the climate and soil nature has given them, they need fear no foreign competition in sugar. Distillers also, under the new excise regulations, have found it greatly to their advantage to grind upon the spot the grain they use, and for this require suitable machinery; whilst, at the same time, the gradual drying up of the rivers and lakes makes grinding for all purposes a very uncertain operation.

It would occupy too much of your space to give full statistics of the increase of these old established manufactures, but we may rest assured that the signs of the times show that with the opening up of the coalfields and the spread of the means of communication, not only will they increase still more, but other manufactures, until now unknown in this part of the country, will spring up and prosper. For instance, this is a great wool growing district; over eighteen million pounds of wool are collected in this town every year; whilst at the same time there is no woollen manufactory in the south of Russia, and in the north none nearer than about 600 miles. One cause of this has hitherto been the dearness of fuel, owing to the scarcity of woods in the sheep breeding district, whilst the abundance of forest land in the north has encouraged the working up of the wool there. Now, however, the tables will be turned; wood fuel is rising very fast in price, whilst coal is to be found under the very fields where the sheep are fed.

To supply this demand for machinery Russia had, in 1864-5, only 108 factories of all kinds connected with the metal trades, Government, railway, and workshops, for the manufacture of tools and domestic articles, all included. These factories produced work to the amount of sixteen and a-half millions of roubles, of which sum, however twenty-nine St. Petersburg factories, including the Government ones, had for their share about thirteen and a-third millions, leaving for the other seventy-nine factories, of which twenty-three were in the Government of Moscow, only 2,279,000 roubles. The factories of all sorts coming under the name of machine factories in the south of Russia produced work to the amount of only 435,352 roubles. Of these 108 factories only fifty-two were driven by steam or water power; all the others had for prime movers either horses or human beings. In 1865-6, the work done had fallen off to twelve millions of roubles; and I do not think that the sum total was much increased in 1866-7, as although there have been some new factories opened, and properly managed ones are prospering, yet the real Russian managed ones are falling back in the race of competition. Through the encouragement given by Government there are now, I believe, four waggon and carriage factories at work in Russia; also four iron works making rails; whilst a fifth, and I might almost say a sixth, are projected. At the same time, Russia purchased from abroad machinery in 1864 to the amount of 7,027,490 roubles, and in 1865 to 6,246,428 roubles; for the nine years preceding 1866, to the amount of 71,629,599 roubles, or nearly eight millions per annum.

Such, then, is a brief and feeble sketch of the prospects of future occupation for mechanical engineers in Russia, and, with your permission, I will continue by attempting to point out in my next communication what, in my opinion, is the proper locality for the future Anglo-Russian engineer colony. It will also, I suppose, be necessary to say something on the all-important question:—Will machine-making pay here? At the same time I hold myself in readiness to answer, as far as I am able, any special questions which may be addressed to me; in fact, if I thought the subject was likely to be taken up seriously, and that my presence would be useful, I would have no hesitation in coming to England to give verbally all the information in my power. I am asked almost every day by some person or other about the probability of foreign manufacturers settling here. I heard yesterday that an English house or houses had taken up the contract for supplying Kharkoff with water and gas; if true, I am very happy to hear it, and would just give them a hint to be very careful what sort of workmen they send here. I have seen several painful examples of the inability of the common English workman to resist the many temptations to be found here, and the want of home influences. The least inclination to drinking will receive a new impulse from many circumstances, and as there is as yet such a distinction between classes here, a man must take care he does not lose caste by making himself on a level with the Russian workman in his cups, as many are liable to do.—I am, Sir, yours, &c., ALEXANDER CAMERON.

Kharkoff, May 11.

[We shall be glad to receive from our readers any comments or questions they may wish to put to Mr. Cameron on the above subject through our columns.—ED. M.M.]

NOTES ON OUR NAVY.

SIR,—I have to thank you for the insertion of my articles on the above; I consider that the subject is exhausted, and never more will men attempt to plunge the country into the ruinous expense which attends the conversion of wood ships into ironclads. My views, with respect to fighting ships, are now becoming general, and I am certain that in a few years they will be built so, and Englishmen may again hope to be predominant on the sea, and, if required, equal the endurance of their forefathers in blockading an enemy's coast. I daily see the efficiency of the many improvements I have suggested, and feel assured that in time they will all be carried out. In a service like the navy, where brains and professional knowledge are often studiously snubbed, one cannot expect to see great changes wrought in a short time, and I am, therefore, content to abide my time. The recent publication of the trials of the Channel squadron fully confirms all that I have long since predicted, and even now stand as if they did not know what class of ship they should next build. It is certain that we shall awake some day from a feeling of apathy with regard to Prussia which now exists, as our eastern seaboard is terribly exposed to a raid from the navy of that growing power. We have ceased to play "Rule Britannia," and have substituted "God Save the Queen" in its place—certainly not a flattering exchange for a martial people. The system of constantly studying to avoid giving offence does not answer either in private or public life. Let a people act correctly, and they may go on regardless of whom they offend. We have but to look at our present relations with the United States to see the truth of this maxim. Does anyone believe that if we had sternly determined to call the American people to account, that a Fenian army would have been allowed to organize itself on our frontier, or regiments to march through New York in all the panoply of war. I know of nothing more humiliating in history, or anything better calculated to distress and worry a high-spirited people. The nation which bought Russian America and St. Thomas, and could not pay for them, is not likely to plunge into a war to protect a set of the vilest assassins that the world has ever produced.—I am, Sir, yours, &c.,

X.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—W. T. B.—R. H. S.—W. M. G.—G. P. C.—J. M.—B. N.—H. D. R.—W. G. C.—R. S.—H. M.—R. B.—S. M.—R. P.—Messrs. B. and W.—T. W. T.—A. C.—R. I.—R. F.—G. W. H.—S. E.—B. B.—J. F.—I. C. E.—W. K.—G. E. P.—W. H. H.—F. W. B.—R. M.—J. B. T.—E. M.—W. H.—H. B.—R. G. S.—H. S. E.—B. T.—J. F.—M. B.—P. W. H.—H. F.—G. R. S.—H. P. T.—R. L.

Meetings for the Week.

MON.—Royal Institute of British Architects.—The Closing Ordinary General Meeting. Charles Barry, Vice-President, on "The Terra-cotta Work adopted in the New Alleyne College, Dulwich;" Dr. Oppert will give "A Short Description of the Plans of Hospitals at Paris, Munich, and St. Petersburgh," at 8 p.m.

FRI.—Royal United Service Institution.—Colonel Beauchamp Walker, Military Attaché, Berlin, on "The Battle of Koniggratz," at 3 p.m.

Naval, Military, and Gunnery Items.

ADMIRAL SIR W. BOWLES, K.C.B., has resigned the presidentship of the Royal Naval School, New Cross, and Admiral the Hon. Arthur Duncombe, M.P., has consented to be put in nomination.

WE read that a Detroit man is preparing an india-rubber boat, in which he means to "shoot Niagara." The boat will be air-tight, and he will be shut in with twenty minutes' air. Several persons are to be stationed below the Falls to tow the boat to shore.

OWING to some accidents at practice, it is reported that the Snider cartridges are in a state of non-user. Whether the whole are to be condemned or not does not appear, but orders have been issued to suspend the further firing. The declaration of Sir John Pakington, that no pains would be spared to provide the British soldier with the best possible cartridge, does not seem to have borne fruit as yet.

The new telegraphic experiments at the Camp of Chalons have proved quite successful. The dif-

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ferent commanders of corps are placed in communication with the general-in-chief, who transmits orders to them not alone when the troops are in quarters or on the march, but when they are executing the most rapid and complicated movements.

THE annual reward of cadetships and distribution of medals and prizes took place at the Royal Naval School, New Cross, on Tuesday last. The large schoolroom, in which the ceremony took place, was crowded with visitors, the ladies predominating, and was tastefully decorated with flags, evergreens, and floral devices. Mr. Alfred Eames, the secretary, read the reports of the examiners, and they were highly satisfactory.

A COMPETITIVE examination for appointments in the Royal Navy was held on board the flagship "Victory," in Portsmouth harbour, on Wednesday and Thursday week. Thirteen candidates presented themselves. On Friday, the following names were made known as those of the four successful aspirants for the vacant appointments: — 1. Mr. William Maclean (passed from Eastman's Royal Naval Academy, Southsea); 2. Mr. F. B. Pritchard; 3. Mr. J. G. Matthews; 4. Mr. B. G. L. Evans.

ON Tuesday week, the "Victoria," an iron paddle-wheel steamer, built for the river passenger traffic between St. Lucca and Seville, on the Guadalquivir, Spain, was launched from the building yard of Messrs. Lewis and Stockwell, Blackwall. The vessel is 115ft. long, and will carry about 450 passengers on a light draught of water. She is to be fitted with a pair of oscillating engines by John Penn and Sons, Greenwich, and is expected to attain a speed of fifteen miles an hour.

The "Elk" gunboat, 465 tons, 120-horse power, just completed in her outfit by the Portsmouth steam reserve for her first commission, was put through her light draught trial of speed over the measured mile in Stoke's Bay a few days since, drawing 8ft. 5in. of water at the stern, and 7ft. at the bows. Six runs over the mile with the engines condensing gave her a mean speed of 10·069 knots per hour, and the same number of runs non-condensing gave her a mean speed of 10·137 knots per hour.

SOME changes are about to be made in the uniform of the infantry of the line. The present undress cap will be replaced by a Glengarry, with the regimental distinction on the left side—a change, the "Army and Navy Gazette" ventures to think, of questionable taste. The shell jacket is to be abolished, a Karkee tunic, made after the fashion of a Norfolk jacket, being substituted. The number of buttons on this and the ordinary tunic will be reduced by ten, viz., four on the skirts and three on each arm, from which the present slashing is also to be wiped away.

THE accounts of the Small Arms Factory, Enfield, for the financial year 1866-67 show that there were made in that year and sent into store 17,996 cavalry carbines, Richards' patent breech-loading; 8,160 muskets, smooth bore, with bayonets; 2,480 fusils, ditto; 85,033 musket rifles, pattern 53, converted to breech-loaders on Snider's system; 10,012 short rifles, also converted; and 4,998 naval rifles, ditto. The value or cost of the small arms and implements for small arms sent into store from Enfield in the year is estimated according to several modes of computation; by the lowest it is £187,821, and by the highest £206,420.

THE Defence Committee, consisting of Admiral the Hon. Sir F. Grey, G.C.B.; Major-Gen. Dickens, R.E.; Major-Gen. Simmons, R.E.; Col. Harness, R.E.; Lieut. Ardagh, R.E.; and Mr. J. Hawkshaw, accompanied by Col. Westmacott and Capt. Dolford, R.E., left Moorshead's Hotel, Devonport, on the morning of Wednesday week, at ten o'clock, and crossed Hamoaze by the steam ferry at Torpoint, on a tour of inspection to the westward, visiting in succession the forts, &c., at Screasdon, Tregantle, Raine, and Cawsand, where they embarked on board the steam tender "Bann," which conveyed them to Drake's Island. The next day the committee inspected the forts to the north, including Tamerton, St. Bude, and Crabtree.

ON the day of inspection of the militia in England in 1867 there were present 1,625 officers, 2,986 non-commissioned officers, and 54,225 privates. There were absent with leave 228 officers, 17 non-commissioned officers, and 1,195 privates; and absent without leave 14 officers, 3 noncommissioned officers, and 3,518 privates. In Scotland there were present 234 officers, 429 non-commissioned officers, and 8,232 privates; and there were absent with leave 35 officers and 120 privates, and without leave 2 officers, 1 non-commissioned officer, and 441 privates. The militia in Ireland was not trained in 1867. The establishment of the militia for the United Kingdom is returned as comprising 124,622 privates, but 26,202 were wanting to complete. The largeness of this last number is chiefly caused by the reduction made in 1864 in the effective strength of all regiments whose establishments exceed 600 privates.

Miscellanea.

A COIN of the Roman Emperor Publius Lucinius Gallienus was found in Winchester last week. It was in good preservation.

THE cable across the Straits of Messina, in connection with the direct line between Susa and Alexandria, has been successfully laid.

ONE THOUSAND TWO HUNDRED tons of new potatoes from the Channel Islands and France were imported into Southampton last week.

WE hear that on one of the New Jersey railroads checks may now be obtained beforehand for seats in a train by sending to the station to engage them.

THERE is some talk of repairing the Eagle Tower of Carnarvon Castle, so as to make it available as a museum for the counties of Carnarvon, Anglesey, and Merioneth.

THE explosion of a nitro-glycerine manufactory is reported to have taken place at Stockholm on the afternoon of the 10th inst. Fifteen persons were killed, and a great destruction of property was caused.

THE cross of the Prince Consort Memorial, which is the highest point, has been fixed. The height from the ground is about 190ft. The mosaic work has arrived from Venice, and workmen are fixing it in the places assigned to it.

DURING the rebuilding of the premises of the Institution of Civil Engineers, temporary offices will be occupied at No. 11, Great George-street, where the library will be available for the use of the members, and where the business of the Institution will be conducted.

THE death is announced of Mr. George Newton Browne, secretary to the Midland Railway Company, which took place yesterday week, at Quarn, near Derby. Mr. Brown had been in failing health for a considerable period. He had filled the office of secretary for the past twelve years.

THE coral fishery on the Italian coasts is giving satisfactory results, and this industry annually acquires greater importance. The greater part of the boats employed in this fishery are Italian, and they take to Genoa, Leghorn, and Naples their produce, which forms one of the principal branches of the trade of the peninsula.

THE quickest newspaper telegraph despatch from China was received on Monday last. It contained news of the wreck of the Peninsular and Oriental Company's steamer "Benares." The telegram came from Shanghai by way of China and Russia in nineteen days. The "Benares" was on the China and Japan line. She was 1,491 tons burden, and 400-horse power.

THE Society of Arts have awarded the prize they had offered for the best essay on harvest work and the possibility of artificial aid during it under unpropitious natural circumstances, to Mr. W. A. Gibbs, of Gillwell-park, Sewardstone, N.E. The judges to whom the competing essays were submitted were Messrs. C. S. Read, M.P., C. Wren Hoskyns, and J. C. Morton.

Messrs. Partridge and Cooper, of Fleet-street, have forwarded us a specimen of their new cream-wove club-house paper, which they have manufactured expressly to meet a universally experienced want, *i.e.*, a paper which shall in itself combine a perfectly smooth surface with total freedom from grease. A trial of this paper proves it essentially to possess these peculiarities.

THE annual conversazione of the Royal Institute of British Architects will be held on Wednesday, July 1, next, at the Institute-house, Conduit-street, Hanover-square. Members who have any works of art they may be willing to lend for exhibition on this occasion should at once send particulars to the assistant secretary.

M. NEUMANN, in the Austrian report of the Paris Universal Exhibition in 1867, states that the telegraphic lines in the whole world are 49,255 geographical miles long; there are in Europe 8,000 offices, and 4,000 in the other continents. It has been necessary to employ for the conducting wires 1,300,000cwt. of iron. The expense of establishing all the lines is estimated at 416,000,000f.

AT a meeting of the majority of the curators of the University of Edinburgh, it has been agreed, though not, of course, legally or irrevocably, to appoint Professor Sir James Y. Simpson to the office of Principal of Edinburgh University. This selection, says the "Medical Times," may be, therefore, looked upon as tolerably certain, although the appointment cannot be legally made until the meeting of curators, which will be held in a few days.

THE visitors to the South Kensington Museum during the week ending June 13, 1868, were—On Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 8,442; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 2,001. National Portrait Exhibition, by payment, 2,566; total—13,009. Average of corresponding week in former years, 9,761; total from the opening of the Museum, 7,450,557.

THE corporation of London have paid for rent o Southwark-bridge during about three years and a-half £18,868; and now pay for purchase of the bridge £200,000, making a total of £218,868. The chamberlain handed cheques to the controller for the completion of this purchase on this day week, and, the legal documents being completed, the bridge is now handed over to the corporation, and becomes free for ever for the public use.

THERE has been some delay in the nomination o the royal commission on the military colleges, owing to the difficulty the Government have met with in finding a chairman whose appointment would be likely to be satisfactory to all parties. We, "Imperial Review," learn that the Earl de Grey has now consented to accept the office. Several of the other commissioners are already selected, and the complete list will be published in a few days.

THE "Journal des Connaissances Medicales" states that on January 1, 1868, Europe could boast 102,061 miles of railways; and that, for all the five parts of the world, the grand total is 162,500 miles. This length would be sufficient to encircle our globe twice round the equator, and as many times round a meridian provided with the necessary complement of polar and tropical parallels; and it has taken less than fifty years to form this immense iron girdle, the end of which the next generation is not likely to see.

The Society of Engineers will visit the Chatham Dockyard Extension Works, by permission of the Lords Commissioners of the Admiralty, on Friday, July 3. The council are desirous of making arrangements for the conveyance of the members to Chatham, by steamer, from London Bridge, should a sufficient number signify their intention of joining the party. In order to allow sufficient time for making the necessary arrangements with the steamboat company, members and associates who propose being present are requested to intimate the same to the secretary on or before the 24th inst.

A RAILWAY train brought to a standstill by caterpillars is an unexpected novelty, but such an accident happened to a goods train on the Orleans Railway on the 31st of last month. At one point the road passes through a thick wood, from which the caterpillars issued in such numbers as literally to cover the rails for a considerable distance. The consequence was that the wheels of the engine could not bite, and, after sliding a short distance, the train came to a standstill, and remained so over an hour until assistance came.

LEIPSIC is the centre, as is well known, of a large bookselling trade, producing 8,000 or 10,000 works per annum. In 1867, a bad year, 9,855 works were published. The statistics of the trade show that books on philosophy are less in demand than they used to be, but school books are more so. Treatises on medicine, chemistry, and natural sciences are increasing; jurisprudence the same; less so theology. Languages are more and more in request, as also are history, biography, and memoirs. Novels and light literature are comparatively neglected.

THE "New York Herald" says:—It is manifest, from the extreme length of the letter of the Emperor of China to the President of the United States, that the Chinese carefully graduate the size of their correspondence to the grandeur of its subject and circumstances. The imperial letter from the Brother of the Sun, which was formally presented to the Secretary of State, extended over 25ft. of parchment. No wonder that Mr. Seward could not restrain his delight at the prospect of being called upon by the President to prepare a reply of corresponding length.

THE preparation and arrangements for the forthcoming show of the Royal Agricultural Society, to be held at Leicester, are nearly completed. The portable buildings are erected, and the cattle stalls fixed. The stabling for horses will this year be on a new plan, and the style adopted in Yorkshire will be adopted, instead of having double horse-boxes, but these will be covered with canvas. The turnpikes are to be free of toll during the show-days A very large amount of prizes is offered, and the entries of horned cattle exceed any previous exhibition.

MR. N. B. WARD, the eminent botanist, just deceased, rendered good service to his favourite science by the invention of his closely-glazed cases for the growth of plants. By the introduction of these cases into the dwellings of all classes, Mr. Ward did more than most men to diffuse the love of nature, which was his ruling passion, and by the transports through their agency of valuable plants, as the tea and cinchona into India, he did the State not a little service. Mr. Ward was a fellow of the Royal and Linnæan Societies, and his portrait, painted by subscription, is in the meeting-room of the latter.

THE Committee of Council of Education will be prepared to make grants towards the building of schools of science at the rate of 2s. 6d. per square foot of internal area, up to a maximum of £500 fo-

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any one school on condition that the school be built under the Public Libraries Acts (13 and 14 Vic., c. 65; 18 and 19 Vic., c. 70; 29 and 30 Vic., c. 114); or be established in connection with a school of art aided by a department building grant; and that the terms of the minute of December 18, 1866 (No. 603), relating to building grants for schools of art, so far as applicable to schools of science, be complied with.

AN exhibition of flowers and plants has been held this week in the gardens of the Royal Horticultural Society. The roses shown were very good, and there were some fine specimens of new varieties of plants now first exhibited. Amongst these were Mr. Bull's areca palm and Mr. Veitch's alocasia antharimon, and the dalechampia rosa—a curious importation from Mexico. Mr. Henderson's bedding plants won the first prize, and Mr. Waterer had a good number of rhododendrons in the special tent. The feature of the exhibition was the variegated pelargoniums, which appear to have thrown some light on the "zoning" of these plants, which has been so disputed a question.

ON the 9th of this month, one of the seals (Phoca vitulina) at the Zoological-gardens, gave birth to a young one, which was at first covered with an abundance of fine silky hair; this, as the animal wriggled about on the ground, was entirely shed, and formed a dense blanket or rug, on which it lay. In less than three hours, says the "Field," the young phoca took to the water, and swam about actively, endeavouring to suck as the mother turned on the side. Unfortunately, however, there was no supply of milk, and the mother has since died in convulsions, since which time the young one has been fed by Mr. Bartlett, on milk and a small portion of cod liver oil, administered by means of a feeding-bottle. The young seal at birth was 32in. long, and weighed 20lb.

A BILL was recently introduced into the Congress of the United States, for the purpose of assimilating the gold currency of the American Union to that of the French system, in pursuance of the resolutions arrived at by the diplomatic monetary conference, held last year in Paris. The measure met with considerable opposition, principally from the commercial community in the United States, as it involved a depreciation of the value of the gold coinage, without providing any compensation for creditors, whose interests would be affected by the change. It appears that this difficulty has now been removed, and that the Bill has been amended so as to secure the adoption by the United States of the international system of coinage which is already in force over so large a portion of the European Continent, without, at the same time, inflicting any injury on the public faith.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3413, 3434, 3459
BUILDINGS AND BUILDING MATERIALS—3428
CHEMISTRY AND PHOTOGRAPHY—3458
CULTIVATION OF THE SOIL, including agricultural implements and machines—3424, 3441
ELECTRICAL APPARATUS—3406
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3394, 3401, 3408, 3411, 3419, 3426, 3432, 3437, 3443, 3444, 3447, 3448, 3452, 3454, 3455
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—3405, 3417, 3461, 3462
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—3396, 3410, 3412, 3431, 3460
GENERAL MACHINERY—3392, 3393, 3395, 3402, 3403, 3423, 3429
LIGHTING, HEATING, AND VENTILATING—3397, 3404, 3415, 3420, 3427, 3451, 3457
METALS, including apparatus for their manufacture—3400, 3440, 3463
MISCELLANEOUS—3414, 3416, 3418, 3430, 3435, 3436, 3442, 3445, 3446, 3449, 3450, 3456, 3464, 3465
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3398, 3399, 3407, 3422, 3433, 3438
SHIPS AND BOATS, including their fittings—None
STEAM ENGINES—3421, 3425, 3439
WARFARE—3409, 3453

3392 W. C. HOUGHTON. *Certain improvements in apparatus to be employed in connection with hydraulic or other packing presses.* Dated November 29, 1867.

The patentee claims the use and application to "stillages" of hydraulic presses of hollow bars having inclined surfaces at the bottom, upon which other inclined surfaces of plates fitting in such hollow bars act, so as to rise and fall to or from the goods in the stillages of hydraulic presses. Second, in making the other bars of the stillages, as shown in the drawings, so as to reduce the bearing and friction of the movable bars acting against their sides, as described.—Patent completed.

3393 J. H. JOHNSON. *Improvements in machinery or apparatus for grinding bones, ores, and other substances, a part of which improvements is applicable to footstep bearings generally.* (A communication.) Dated November 29, 1867.

This invention relates to improvements in that class of cast-iron grinding mills the cutting and triturating surfaces of which are made in the form, or approximating to the form, of a frustrum of a cone, and consists, first, in constructing the shell and burr of a conical, or nearly conical grinding mill of a number of cast-iron grinding sections fitted and held together, substantially as described, so that the sections can be readily removed to make way for others, the "dress" of the mill being thus rendered changeable to suit the substances to be ground, while the mill itself is more economical both as regards its original construction, and its lasting properties, and the variety of substances which it may be arranged to grind, than mills of the ordinary construction. Second, in a peculiar manner of backing the grinding sections of the shell by an exterior casing, between which and the base to which the casing is secured are confined the said sections, so that the latter can be readily disconnected from the mill. Third, in a mode of securing the cast-iron grinding sections of the burr to a block between a lip or ring or other projection at or near the lower edge of the latter, and a ring fitted to the vertical shaft which carries the burr, all substantially as described, so that the said sections can be readily detached. Fourth, in forming on the ring which aids in securing the grinding sections of the burr grinding teeth, for the purpose described. Fifth, of a certain breaker fitted to and turning with the said vertical shaft, and secured to and rendered detachable therefrom, in the manner set forth, so that different forms of breakers may be applied to the mill. Sixth, of certain detachable sections acting in conjunction with the said breaker for preliminary grinding, the said sections being fitted to and backed by a casing, and held in position by a cup plate secured to the same, and carrying the bearing for the vertical shaft which carries the burr, all as described. Seventh, of a screw and stationary nut, the latter being so connected to the cap plate that, on operating the screw, the casing or backing of the shell, as well as the cup plate, can be elevated (the fastening having been previously detached), allowing the grinding sections of both shell and burr to be removed. Eighth, in interposing between the bottom of the vertical shaft and the bottom of the step in which the shaft turns a double cone of steel, by which the oil is effectually distributed to the bearing surfaces, and the friction is diminished.—Patent completed.

3394 A. TURNER and W. E. NEWTON. *Improvements in the manufacture of carpets, and in warping and preparing warps for the same.* Dated November 29, 1868.

The first part of this invention relates particularly to the manufacture of carpets, and consists of a novel mode of delivering the warp from the warp beams, whereby a uniform length of warp is delivered at every beat up, whatever may be the diameter of the warp beam. The object of the second part of the invention is to produce warps for the manufacture of the piled fabrics in which all the separate threads, more especially those of the ground warp and stuffing, shall be of equal length and tension throughout the whole warp.—Patent completed.

3395 A. V. NEWTON. *An improved method of, and apparatus for, washing or cleansing clothes.* (A communication.) Dated November 29, 1867.

The object of this invention is to provide for a continuous circulation of the water in boilers used for cleansing clothes. To this end the boiler (which may be rectangular or any other suitable shape in plan) is fitted with a perforated false bottom to receive the clothes to be cleansed, and at its sides vertical pipes or passages are provided which communicate with the space below the false bottom, and with the space at the upper part of the boiler, or above the pile of clothes with which the boiler is charged. To allow for the charging of the boiler, it is provided with a removable cover, which may be held in place against internal pressure by any suitable means. Water is admitted to the space below the false bottom, and when the clothes are in place they may be covered in by a loose perforated plate. On the application of heat to the boiler, the water contained therein will be forced up the vertical passages and discharged upon the perforated plate, or upon the clothes, whence it will pass down through the mass and again reach the bottom of the boiler. Here its temperature will be increased, and rising again up the vertical passages will again return through the clothes to the bottom of the boiler.—Patent abandoned.

3396 A. M. CLARK. *Improvements in chronometers.* (A communication.) Dated November 29, 1867.

The patentee claims the application of a bi-metallic ring to the ordinary compensating balance of a chronometer for producing regularity of action under all changes of temperature, the whole arranged in the manner described.—Patent completed.

3397 J. J. PARKES. *Improvements in the means of ventilating rooms and buildings, and in apparatus for the same.* Dated November 29, 1867.

These improvements are chiefly applicable to such houses or buildings as are provided with a circulation of hot water. In carrying out the invention the patentee encloses a tube or series of tubes in a casing forming an air space, and placed above the chamber to be ventilated, the said tube or series of tubes being heated by the hot water circulating through them. The casing is placed in communication with the chamber to be ventilated by means of a tube terminating in a grating placed in the wall of the chamber. The upper end of the outer casing is connected with a pipe leading out into the open air, where it is surmounted by a cowl. The rarefaction of the air surrounding the heated tube or tubes, and contained in the outer casing, causes the air to ascend and escape into the atmosphere by means of the pipe and cowl above mentioned, thus forming a partial vacuum in the pipe below the heated tubes, the air in the chamber being drawn off through the grating to supply its place—thus effecting a continual ventilation of the chamber, so long as the tubes are kept heated.—Patent completed.

3398 W. E. GEDGE. *Improved means of connecting and disconnecting locomotive engines and railway carriages and other vehicles.* (A communication.) Dated November 30, 1867.

This invention is not described apart from the drawings.—Patent completed.

3399 W. E. GEDGE. *An improved brake washer.* (A communication.) Dated November 30, 1867.

The patentee describes this invention as follows:—To secure the constant tightness of a nut, it is sufficient that the washer be always fixed on the object to be tightened up by means of a spur, or otherwise, and that thus the washer be no longer loose around its bolt. The washer being thus fixed, and pressed upon by its nut, any possible rotary movement of this latter will be stopped by raising one of the segments of the washer upright with one side of the nut. This nut is thenceforth a prisoner, can no longer unscrew, and its primitive tightening up is forcibly maintained.—Patent completed.

3400 R. M'CLURE. *Certain improvements in moulds for casting Bessemer steel and other metals.* Dated November 30, 1867.

This invention consists, first, in casing or lining internally such moulds, either entirely or partly, with tubes or plates of wrought iron, cast iron, or steel; and such protective lining may either be applied in the process of casting the mould, or afterwards by forming dovetail grooves in the interior surfaces of the moulds, and keys on the back of the lining plates to slide into them; or any ordinary means may be applied to form the attachment, or the moulds may first be used without the lining, and when burnt by the molten metal in process of casting the lining may be applied, and new linings may be subetituted for old ones as they become destroyed. Second, the improvements consist in the employment and use of detachable or removable lifting loops or ears for such moulds, so that when the lower part of the interior surface becomes destroyed or damaged, the loops may be applied to the opposite end, and the mould reversed, so as to bring the part which was at the lower end to the top.—Patent abandoned.

3401 T. BRIGGS. *Improvements in machinery or apparatus for drying and stretching woven fabrics, paper, or continuous lengths of other similar materials.* Dated November 30, 1867.

This invention consists in arranging, combining, and constructing a series of hollow steam chests in a framing which holds them in the form of a curved volute, or an angled volute; the steam chests are arranged side by side in such form, and have their exterior surfaces slightly convex or curved, with which the fabric is in contact, and a circulation of steam or hot air is maintained throughout by a series of union pipes causing the steam to enter at one end and pass out of the opposite end of the next steam chamber, and so on alternately. At each of the angles a roller is mounted in bearings, and all the rollers are driven from behind by a series of bevel wheels, or other suitable gearing; and if used for stretching purposes, in addition to drying, the surfaces of these rollers are furnished with the points or pins set in a right and left-hand screw-like direction, so as to distend the fabric laterally as they rotate. The back of the machine is enclosed by doors, and a blast or exhaust fan, or other draught-creating apparatus, is applied to remove the vapour arising between the chests during the process of drying. The woven, fabric, paper, cloth, or other material to be dried, is passed, first, on to the uppermost steam chest and over each roller until the end so passed through is folded by a plaiting apparatus in the middle of the volute, and one side only of the fabric comes in contact with the chests or rollers; but if this is not an object, and an extended heating surface is required, rollers may be arranged inside the corners of the volute.—Patent abandoned.

3402 W. STARKEY. *An improved apparatus for obtaining motive power.* Dated November 30, 1867.

This invention is carried out as follows:—Upon a strong framework of wood or iron the patentee mounts three horizontal shafts in the same axial line, and supported so as to be capable of revolving in suitable bearings, an open space being left between the ends of the centre shaft and the inner ends of the outer shaft. On the extremities of the central shaft he keys or otherwise fixes two massive discs or wheels of large diameter, and on the inner ends of the outer shafts he keys or fixes two similar discs or wheels facing the former. On the outer ends of the outer shafts he keys or fixes two balance wheels or driving pulleys, from which the power is to be transmitted by bands or otherwise. Each pair of discs or wheels (that is, one on the end of the central shaft, and the one facing it on the inner end of the outer shaft) is connected together at two diametrically opposite points by two coupling shafts running parallel to the central shafts or axes, and supported in lugs attached to the periphery of the said discs, the lugs and their coupling shafts being so arranged that when those of one pair of discs or wheels are perpendicular to the axis one above the other pair of discs or wheels are horizontal, and in the same horizontal plane as the axes, so that they exactly counterbalance each other. Hung from each of these coupling shafts is a disc or wheel (or a pair of discs or wheels) of smaller diameter than the before-mentioned discs or wheels) so that, as each coupling shaft passes over the centre, the smaller disc or wheel hangs in the space between the two larger discs or wheels above, and clear of the other coupling shaft, which is then at the lowest point below the axis; these smaller discs or wheels are hung from the links, but in shorter links or cranks which are jointed thereto. As each of these smaller discs (or pair of discs) descends by the revolution of the larger discs, it falls into and rolls down a curved or concave way which supports it, taking the weight off the links, and, consequently, off the larger disc or wheel. The impetus which the small disc or wheel gains on descending the curved way carries it partly up an incline on the opposite side of the centre, where it is held by a catch. The other smaller disc on the opposite coupling shaft is at the same time descending, and comes in contact with a lever connected to a massive balance beam above, the other end of which beam is attached by a connecting rod at the outer end of the movable portion of the incline. The movable part of the incline being mounted on a fulcrum at its lower or inner end is tilted up by the action of the beam, and raises the smaller disc still higher, thus keeping its weight off the coupling shaft until the latter has passed over the highest central point of the larger discs, when the smaller disc immediately swings across the space between the two larger ones, and brings its full weight to bear on the descending side of the latter. Thus it will be seen that the weight of each smaller disc or wheel acts upon the descending side in succession, the said weight being taken off the said larger discs, and supported on the concave way and the incline whilst it is being raised on the ascending side, and, hence, there being always a preponderating weight on one side of the axis, the machine will revolve by the action of gravitation, which is confined to one side of the centre only.—Patent completed.

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3403 W. R. LAKE. *An improved lubricating apparatus.* (A communication.) Dated November 30, 1867.

This invention consists in a lubricator having a transparent reservoir from which the oil is fed automatically upon the journal or other bearing when in motion. This invention is not described in detail apart from the drawings.—Patent completed.

3404 S. E. T. STEANE. *Improvements in globes and glasses for the transmission of artificial and other light.* Dated November 30, 1867.

Here the inventor makes the globe of a double thickness of glass, presenting a convex form both on the outside and inside, and having a hollow space between to contain water or other liquid or fluid for increasing, by its refractive and reflective power, the light encircled by said globe.—Patent abandoned.

3405 W. R. LAKE. *An improved mode of, and means for, clarifying saccharine solutions.* (A communication.) Dated November 30, 1867.

When a solution of raw sugar or molasses has been made in lime water, the inventor employs the neutral sulphate of alumina, by which the colouring and other foreign matter is precipitated and aggregated into a mass that is thrown to the surface by the application of heat, whence it may be removed by skimming, or other appropriate means.—Patent abandoned.

3406 S. SHARROCK. *Improvements in the posts or uprights for electric telegraphs.* Dated November 30, 1867.

This invention relates, under one head, to hollow metal telegraph posts, and consists in strengthening and protecting such posts by using wrought iron or other metal aprons or shorter tubes, ordinarily three or four diameters in length, fitting tightly on the lower ends and joints of the above said metal posts, outside by preference, so as to strengthen and protect such posts at these parts, their usual breaking points, thereby removing the breaking points of such posts further up the posts, where they are proportionately stronger and better able to resist the strain that then comes upon them; they also serve to protect the posts from oxidation considerably above the ground line.—Patent completed.

3407 R. F. COMPTON. *Improvements in couplings for railway waggons.* Dated November 30, 1867.

Here the coupling is effected by means of lever handles arranged at each side of the waggon, and attached to an axis moving in supports at the end of the waggon frame. Upon this axis a lever is mounted near the centre in such a position that, when the axis is caused to make a partial revolution, the lever raises the coupling link, which can then be dropped upon or raised from the hook of the adjoining carriage, and by means of an endwise movement, of which the axis is capable, the coupling link can be moved sideways so as to pass the hook of the adjoining carriage in the act of being raised or lowered.—Patent abandoned.

3408 T., W. W., and J. F. HOLMES, and J. B. and D. LANCASTER. *Improved applications to spinning machinery.* Dated November 30, 1867.

The objects of this invention are to "doff" and afterwards to "fill" with empty bobbins the spindles of spinning frames by a combination of apparatus in lieu of the manual system in use.—Patent abandoned.

3409 R. CLAY. *Improvements in breech-loading firearms.* Dated November 30, 1867.

The patentee claims, first, the stationary cartridge holder or extractor, through the disc of which the striker acts, which disc is supported and held in its required position relatively to the barrel by a metal strap, or by two metal side straps, or by a stem (either solid or hollow) passing through the back of the breech chamber, such cartridge holder or extractor being more especially adapted for use with ordinary central-fire cartridges, and capable of preventing "back flash," in the manner described. Second, the combination with the aforesaid cartridge holder or extractor of the several arrangements of locking tube and parts connected therewith, as described, for the purpose of holding the breech chamber to the barrel as required.—Patent completed.

3410 J. FITTER. *Improvements in the construction and manufacture of mechanism for expanding tables and other expanding furniture.* Dated November 30, 1867.

The patentee claims, first, the construction and addition to the said mechanism of a secondary or supplementary sliding barrel for lengthening the ordinary barrel, so as to make the said ordinary barrel completely cover the screws, substantially as described and illustrated in the drawings. Second, making and fixing the screw boxes or nuts in which the screws of the said mechanism work by casting them in the ends of the screws or barrels of the said mechanism, substantially as described and illustrated in the drawings.—Patent completed.

3411 W. PRIESTLEY and W. BOWER. *Improvements in spinning machinery.* Dated November 30, 1867.

This invention has reference to the production of yarns of a variegated character, that is to say, for example, when it is desired to produce yarns of three or four colours in continuation, or partially in continuation, and partially twisted. To effect this the inventors use what may be termed a double set of back rollers, one pair in front of the others, and they place them parallel to and in proximity with each other; passing, for example, one roving through the back pair of rollers, they pass another through the other pair, and cause the two to meet when they reach the back carrier rollers; and at given periods in the revolutions of the back rollers they cause one or other of the pairs to stand still by means of suitable gearing, the result being that, when, for instance, they stand still alternately, and for equal times, the two supposed colours appear alternately in the yarn and produce a variegated effect, which may be further increased by arranging the gearing so that partially they run alternately and partially together, thus giving a result of "partial continuation" and "partial twist," and, in some cases, two rovings pass through each pair, causing two or more rovings to meet when they meet the carrier rollers.—Patent abandoned.

3412 T. F. WIDENHAM and J. REYNOLDS. *An improvement in the construction of easy chairs, settees, sofas, seats for railway and other carriages, and invalid hospital couches or carriages.* Dated December 2, 1867.

This invention consists, first, in the application of springs coiled at one end, applied by fastening them to the sides of the seat, to the ends of which springs the back is fastened, giving to the same a concentric form, so that when the chair or seat is occupied, the back yields to the pressure put on it, and when unoccupied returns to its original position. Second, with the view to produce the same effect, the inventors use india-rubber, or other elastic material, which is applied by means of bars of wood or metal placed diagonally to the seat, fastened at the front part by hinges or joints, and to which bars the back is fastened. The elastic material is then made to connect the front part of the seat with the back, producing the moving effect as described above.—Patent abandoned.

3413 J. C. WOOLFIELD. *Improvements in boilers for supplying hot water to apparatus for heating buildings.* Dated December 2, 1867.

This boiler may be cleaned internally without disturbing the outer shell, or any of the pipes or other apparatus attached thereto It is formed by an outer shell, and an internal flue tube connected together, or cast in one piece. The union between the shell and flue tube is at the end nearest the fire doors; the flue tube is closed at the end furthest from the fire doors, called by the patentee the "back end;" on the "back end" of the shell is a flange, to which is attached by bolts a lid, and on removing this lid the interior of the boiler may be cleaned. The flue tube is divided into three divisions, namely, first, the ashpit or lowest division; second, the furnace or middle division, which is enclosed by fire doors and contains the grate and deadplate; third, the return flue or highest division which is in direct communication with the funnel or smoke pipe. When of a circular form, the boiler is supposed to be horizontally in a line parallel to its longer axis.—Patent completed.

3414 G. HEIRON. *A method of constructing and combining a castor for pepper, salt, and such like condiments for domestic use.* Dated December 2, 1867.

This castor is divided into two or more compartments, each compartment containing either pepper, salt, or other condiments. The top of the castor is to be perforated, or partly perforated and slotted, or both, round the rim or sides. By this means, not only are the ordinary salt cellars, spoons, and pepper boxes dispensed with, thereby economizing space on the table, but all is protected from dirt.—Patent completed.

3415 E. PRICE. *Improvements in apparatus for regulating the supply of gas to burners.* Dated December 2, 1867.

The object here is to prevent the necessity for daily lighting and extinguishing the public lamps by hand. The apparatus may be constructed of various forms, but the principle of its action is the same—that is to say, that as the pressure of gas is increased during the lighting hours, a bell holder of flexible diaphragm is acted upon and communicates motion to a cock or valve, which is opened thereby, and the gas allowed to pass to the burner, which, when the apparatus is at rest, emits but just enough gas to keep an almost imperceptible flame alight, but when in action allows an ample quantity to give an efficient light. Or the apparatus may be so arranged that, when it is out of action, the flame may be entirely extinguished at the ordinary burner, but as soon as it is put in motion, may be relighted through the intervention of a small supplemental though hidden jet, which is kept constantly burning.—Patent completed.

3416 C. and S. HARGROVE. *An improvement in the manufacture of bells.* Dated December 2, 1867.

This invention relates to the economical production of cast bells. The inventors effect this by the use of carburet of iron and sulphur, the proportions being one hundred parts of Staffordshire, or such other make of iron containing combined or uncombined carbon, and from one-half to five parts of sulphur, varying the amount of sulphur according to the size and tone of the bell to be cast.—Patent abandoned.

3417 W. R. LAKE. *Improvements in the means for filtering syrup in the manufacture of sugar.* (A communication.) Dated December 2, 1867.

The object here is to employ a material for a filtering medium that is not affected by acids or alkalies, and which is practically indestructible, and to arrange it in such a way that it may be cleansed and the deposit removed without taking the filter to pieces. To effect this object the inventor applies asbestos to sugar making as a filtering material, submitting the asbestos in the filter to the action of a current of steam or water flowing in an opposite direction to that taken by the syrup when being filtered, so that the deposit may be washed from the surface upon which it was placed, and removed from the pores of the filtering material in the same relative direction in which it was deposited.—Patent abandoned.

3418 J. H. DEAN. *Improvements in handles for bails, buckets, cove hods, scoops, and the like.* Dated December 2, 1867.

This invention consists, first, in forming the said handles with a straight or cranked centre. Second, in fitting the said straight or cranked part with a rotating centrepiece of wood or metal, or other suitable material; and third, in forming the said handles of metal tapered or reduced in section from the centre to the two extremities, where the handles are attached to the articles to be supported thereby.—Patent abandoned.

3419 W. SCHOFIELD. *Improvements in preparing cloth and yarn to be dyed Turkey red, part of which improvements are applicable to bleaching yarn.* Dated December 2, 1867.

The patentee claims, first, in preparing cloth to be dyed Turkey red, restricting or limiting the quantity of oil with which it is saturated to that required for the subsequent process of mordanting, or as little in excess thereof as practicable. Second, in washing or bleaching yarn, and in preparing yarn to be dyed, and in finishing or cleaning after dyeing, dividing the hanks into portions, and connecting these portions by strings or bands, so as to form the hanks into a continuous chain, whereby yarn may be manipulated with the same facility as piece goods, and a great economy of space in the stove effected. Thirdly, in preparing yarn to be dyed Turkey red, passing the chain of yarn through an oil bath, or working it in the emulsions arising from that mode of preparation, whereby the subsequent processes can be performed without the necessity of exposing the yarn to sunlight and air. And, lastly, preparing and dyeing warps of cotton Turkey red, as described.—Patent completed.

3420 D. BARKER. *Improvements in the construction of chambers for drying artificial fuel and other substances.* Dated December 2, 1867.

Here the outer walls of the chambers are built of bricks, &c., an important principle of the invention being that every part of the fuel, &c., is subjected to the influence of the heat employed, and in provision being made for the continuous exit and removal of the moisture and vapours resulting from the process of drying at the several points from which the same is or are evolved.—Patent completed.

3421 W. BLACK and T. HAWTHORN. *Improvements in valves for steam engines.* Dated December 2, 1867.

The patentees claim so forming and arranging the valves of steam engines when the pressure of the steam is equalized that the steam is supplied to and withdrawn from the cylinder through openings formed through internal cylinders into annular spaces, as shown and described, the advantage of the lap of the ordinary slide being maintained in the piston valve. They also claim rendering cylindrical valves sufficiently steam-tight by means of grooves supplied with a lubricating substance, as shown and described.—Patent completed.

3422 G. PHILCOX. *A new method of shoeing horses.* Dated December 2, 1867.

This invention relates to a permanent shoe and wearing shoe to be fixed on horses' hoofs without nails or screws entering the hoof. The permanent shoe is fixed on the hoof with two bands coming from the hind part of the shoe to the front of the hoof, screwed together with a screw; the shoe is made in two pieces to the shape of the hoof, with a joint to open and close to the shape of the hoof, fixed or held together with an iron plate across the shoe, and two frogs or clips to hold on the front of the hoof. The wearing shoe is screwed on the permanent shoe, and when worn thin can be taken off, the permanent shoe released to pare the hoof if required, and a new one replaced.—Patent abandoned.

3423 R. W. PAGE. *Improvements in the construction of hand garden engines and hydropults.* Dated December 2, 1867.

This invention relates to a garden engine for pumping and forcing water for use by hand, the engine being also useful as a hydropult for extinguishing fire, &c. It consists of a cylinder of brass provided at one end with a stuffing box, through which a piston rod or plunger is made to work, actuated by the right hand of the operator; the other end of the cylinder is fitted to an air globe or vessel, to the opposite side of which an outlet pipe is fixed by a screw or otherwise, in order to cause the water to flow as a jet or stream. The details of the invention are too voluminous to be quoted here.—Patent abandoned.

3424 J. HADLEY. *An improved mode of, and apparatus for, decorticating and drying corn and other grain.* Dated December 2, 1867.

In treating wheat, for example, according to this invention, the patentee first runs it through a wire gauze cylinder of the ordinary construction, to separate therefrom the dust, stones, &c., it may contain, and he then submits it to a damping process. This damping may be effected either by passing the grain through a water bath, or by sprinkling water thereon while the grain is kept in motion by a stirrer, or by a traversing archimedean screw, or otherwise. When the grain is sufficiently and uniformly damped, he submits it to the decorticating and drying apparatus which forms the subject of the present invention. This apparatus may consist of one or more machines, and the form of the apparatus may vary considerably, but in all cases the same character of action will be preserved. The apparatus is not described apart from the drawings.—Patent completed.

3425 G. BREEN. *Improvements in steam winches, which are also applicable to other similar purposes.* (A communication.) Dated December 2, 1867.

This invention relates to a peculiar arrangement of valve box and valve and indicating apparatus to be used in conjunction therewith, and has for its object the facilitating the instantaneous starting, stopping, and reversing of steam winches by the aid of a cheap, simple, and effective arrangement, which is less liable to get out of order than the arrangements hitherto employed for that purpose. According to this invention the seat of the valve which admits the steam or other actuating medium to the working cylinders of the winch is formed with apertures, above which a circular valve is fitted capable of rotary motion. Such valve is provided with an aperture or thoroughfare on one side of its centre, and a cavity or chamber on the diametrically opposite underside of the valve. An indicator and dial are provided, and by turning the printer to one or other of the positions marked on the dial, the motion of the valve is effected, and the winch instantaneously started, stopped, or reversed, as the case may be. Thus, if the indicator be turned to one position, the aperture in the valve will correspond to one of the apertures in the valve seat, and the steam will be admitted through a pipe to one side of the pistons in the cylinders, and the apparatus put in motion; after having acted on the pistons the steam returns by another pipe to the valve box, and passing through the second aperture in the valve seat enters the cavity formed in the underside of the valve, and thence passes through the third aperture in the valve seat into the exhaust pipe, whence it is conveyed into the atmosphere. If the indicator be now turned to another position, the aperture in the valve will correspond to the second aperture in the valve seat, and the steam will be conducted through it to the opposite side of the pistons in the cylinders, and after producing its effect it will be conveyed to the exhaust, and the motion of the winch will be reversed. By turning the indicator to the third position the valve closes the orifice, and the passage of the steam and other actuating medium is instantaneously intercepted.—Patent completed.

3426 J. H. W. BIGGS. *Improvements in apparatus to be used in joining warp ends, which apparatus may also be otherwise applied* Dated December 2, 1867.

Here the inventor employs an apparatus in which the spacing of the threads can easily be corrected, and in which the threads can then be shedded, that is to say, every (say) fourth thread raised or separated from the other threads, so as to be accurately prevented from joining, and with sufficient spaces between them. The old ends are similarly shedded by raising one of the heddles, so that their ends also are presented with suitable spaces between them ready for joining. The joining may be effected either by hand or machinery. There is much detail in the specification.—Patent abandoned.

3427 F. FOSTER. *Improvements in miners' safety lamps, and in the mode of manufacturing the same.* Dated December 2, 1867.

The invention consists, first, in providing existing lamps, or constructing new lamps, in such manner that they carry in, at, or near the roof of the lamp, or in suspending by a projecting spindle or piece or frame above the flame, an extinguisher, which extinguisher is carried on a fusible spindle passing through to the inside of extinguisher, and there held by a nut, which may or may not also be fusible;

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but if a fusible nut be employed, the use of a fusible spindle is not necessitated. The spindle and nut, or either, or both, are made of any known alloy or composition that will fuse or melt should the temperature exceed a certain degree, and thereby the extinguisher will be instantly set free, and will at once fall over the flame, and by extinguishing it prevent the possibility of explosion. The inventor also provides a guide or guides to insure the accurate descent of the extinguisher upon the flame. Second, in the peculiar construction and application of three concentric rings of metal. The first or outer one has a thread upon its lower exterior surface by which it can be screwed into a corresponding thread in the upper part of fluid reservoir. This ring has at its upper interior surface a shoulder, by means of which the second or middle ring is retained in its proper place. This second ring is provided with perforations or orifices through which the air can flow to feed the flame. The second or middle ring has at its upper inner surface a screw or thread, into which is screwed the third or inner ring, which ring carries the glass of the lamp. This ring is, like the second or middle one, provided with holes or perforations for the admission of air to the flame. Between the outer and middle, and middle and inner rings, are interposed wire gauzes, so that all air entering the lamp by means of the holes in the rings must pass through a double set of wire gauzes before it can reach the flame. Third, in an improved construction of the bottom part of miners' lamps, or that part below the reservoir containing the fluid to be burned. He constructs this part of a metal ring or annular stand having perforations or orifices for the admission of air. This ring is provided with an annular shoulder for the purpose of receiving two diaphragms of wire gauze, which are held in position one above the other by means of a small spring until the bottom is screwed securely in its place. All air entering from the perforations or orifices must pass through the double wire gauze partition formed by the two diaphragms. The diaphragms are bent or made concave, so that there may be an air space between them. Fourth, in the result produced by the peculiar construction described in the second and third parts of this specification. There is double gauze in every part of the lamp, through which air is admitted to the flame, excepting the part where the light has to pass through where the flame is protected by a glass chimney. Fifth, in the mode of manufacturing that part of the lamp forming the reservoir for the fluid to be burned. This, with the exception of the bottom part or floor of reservoir, he prefers to spin up of sheet metal. The bottom part he makes of sheet iron. Sixth, instead of using a tube for the purpose of raising and lowering the wick, he cuts away the lower portion of the tube in such a manner as to leave sufficient metal only in which to cut a longitudinal slot for the purpose of raising and lowering the wick.—Patent adandoned.

3428 R. PORTER. *Improvements in the construction of metallic and other buildings.* Dated December 2, 1867.

This invention has reference, principally, to buildings constructed mainly of metal, and consists, first, of the following method of constructing the walls of the said buildings. The patentee makes the said walls of corrugated sheeting either of iron or zinc, the corrugations being situated vertically, and he supports and strengthens the said wall by means of standards made of metal, rolled or otherwise formed into a trough-like figure. The said standards are fixed against the corrugated walls in such a position that the edges of the said trough-like standards fall into and fit against the bottoms of the corrugations in the walls. The standards may be made of a width proper to include two, three, or more corrugations. Along the interior of the walls, and nearly midway between the floor and roof, he fixes horizontal rails which may be made of wood, iron, or of both combined. The said horizontal rails are supported in brackets connected with the standards, the connection between the said standards and brackets being effected through holes in the corrugated walls. Horizontal rails of the kind described may also be fixed in a similar manner at any required height inside the building. The standards may be fixed inside the building, and the horizontal rails outside where required. The walls may be lined internally with a cheap description of paper board, such as mill boards, straw boards, and the like. He attaches the said lining by making it in sheets or panels which are inserted in rebates or grooves of wood or metal fixed to the walls, or to the horizontal rails. The invention consists, second, of the following method of attaching the ridge caps on the roofs of metallic buildings, and other buildings having corrugated metallic roofs. On the summit of each side of the roof he fixes a strip of hoop iron, which has been corrugated with corrugations similar to those of the roof plates. The said strips of corrugated hoop iron are so fixed on the summits of the sides of the roof that the concavities in the said strips are opposed to the concavities in the roof plates, and there is thus formed a series of nearly circular spaces or openings. The ridge caps are fixed upon the said corrugated strips of hoop iron. There is thus left a series of nearly circular openings along the whole length of the ridge of the roof, by means of which the ventilation of the building is effected.—Patent completed.

3429 W. B. LEACHMAN and J. HOLROYD. *Improved machinery for leather shaving and dressing.* Dated December 2, 1867.

The object here is to cause the knife by which the hide is dressed to accommodate itself to various thicknessess. For this purpose the patentees use a cylinder, hollow or otherwise, mounted on a convenient frame, and of the width of one skin or more, if desired; on this cylinder he makes a notch having a spring catch, to which he attaches one end of the hide or skin; the other end of the hide passing round the cylinder is kept in near contact to the same by friction rollers. On one side of this cylinder, at an angle, say, for instance, of about twenty-eight degrees, they apply the knife. When the skins are tolerably even in thickness they use a fixed knife, that is to say, one fastened to what may be termed the equivalent of a "rest" in a slide lathe, such knife being actuated when needful to cover the breadth of the skin by an ordinary screw and slide rest motion. When they have skins of various thickness to deal with, they employ a roller against the periphery of the cylinder before named, and above that they place the knife with a spring underneath fastened to the fixed rest before named.—Patent completed.

3430 J. H. WILSON. *Improvements applicable to water-closets and pumps connected therewith, which latter improvements are applicable to lift pumps generally.* Dated December 3, 1867.

The patentees claims, first, constructing closet pans or basins of glass. Second, forming the same at the lower end with a shank or hollow faucet, having a lateral opening or aperture therein for discharging the contents thereof, substantially for the purpose and in the manner described and set forth. Third, turning the closet pan on its vertical axis for discharging its contents, substantially for the purpose and in the manner described and set forth. Fourth, constructing closet pans so that they may be removed or lifted from their seats, substantially for the purpose and in the manner described and set forth. Fifth, forming the rotating pan neck or seat of the rotating pan with recesses to receive tallow or other lubricating material. Lastly, the general arrangement and combination of the several parts described and set forth as applied to ships' and other water-closets.—Patent completed.

3431 S. VAILE. *Improvements in tables.* Dated December 3, 1867.

The patentee claims, first, the general arrangement or combination of parts of tables, substantially as described and represented in the drawings, whereby a dining or ordinary table can be converted into a game table, and *vice versa*, or whereby the table top, or a portion of the table top, can be reversed in order that the under side thereof can be made use of, as explained. Second, constructing tables in which one of the rails, or a portion of one of the rails, can be moved out and in, substantially as and for the purpose described.—Patent completed.

3433 J. ECKERSLEY and D. MARTIN. *Improvements in the construction of the permanent way of railways.* Dated December 3, 1867.

These improvements have reference to constructing and securing the joints of rails with the intent and object of cheapening the cost of, as well as doing away with, the bolts, joints, or fish plates, and other similar details at present used, and the invention comprises the following constructions:—An iron chair or bracket is used for each joint, on which there are attached or formed one or more snugs or projections for holding the rails, one or more cushions of wood being placed at the side and underneath the rails. When the rails are put in position they are firmly secured by one or more wedges being slightly bevelled, are drawn tightly into position by a bolt passing longitudinally through the same, and secured by nuts or other contrivance through or into the end of each rail; one or more holes are formed into which pins are inserted that pass into corresponding holes in the bracket or chair. Instead of using loose or separate pins, the projections or snugs on the chair or bracket may be formed with projecting studs which pass into correspondingly formed holes in the rails, so that when the wedge or wedges is or are drawn tightly by the bolt, the studs retain the parts firmly in position, and render their junction very effective.—Patent completed.

3434 J. G. HOPE. *Improvements in utilising mineral and other oils for generating steam, and in the means or apparatus for effecting the same.* Dated December 3, 1867.

Here the firebox of the boiler is fitted with brickwork, or other material, from the front end to the bridge or tube plate up to the level of the dead plate. The firebars are dispensed with, and the top of the brickwork is covered with a slab or slabs of fire-clay, or other suitable material. One or more pipes lead from one or more reservoirs or receptacles containing the oil or oils to be burnt, and pass into the space contained between the slabs and the top of the firebox or flue of the boiler; the ends of the pipes are open or perforated, and the oil or oils pass through the openings in the fire clay or other slabs whereon they are injected. To effect the complete combustion of the oil, and to prevent the formation of smoke, holes are formed in the door of the furnace for the admission of the requisite quantity of air. The holes or openings are provided with covers to regulate the admission of air, according to the quantity of oil at any time being burnt. The oil or oils may be passed through a meter or measuring apparatus, and the flow is regulated by a valve, stop cock, or other means. To increase the draft, and supply hydrogen for the purpose of still further increasing the temperature, a jet or jets of steam may be passed into the furnace.—Patent abandoned.

3435 W. SHAVE. *Improvements in rabbit and vermin traps.* Dated December 3, 1867.

This invention relates more particularly to that class of traps known as the "Dorset trap," and consists in connecting the trigger and plate with the spring direct when setting the trap, in lieu of the separate cross-piece and tongue at present employed for that purpose.—Patent abandoned.

3436 W. PIDDING. *Improvements in placing, arranging, or fixing needles and threads and other like fibrous materials on to reels or receivers so as to render them more convenient for use, also in the manufacture and forms of such reels or receivers, and in the materials thereof.* Dated December 3, 1867.

This invention consists mainly in placing or threading numerous needles on to one length of thread, &c., and after fixing, inserting, or embedding the points of one, two, or more of such needles near to each other into a cushion placed in a hollow formed in and through the centre of such reel or receiver, and then winding in the usual way a layer of thread round it, fixing, inserting, or embedding one, two, or more needles into the cushion placed in the centre at the opposite side of the reel or receiver, and so on, alternately, until the whole of the needles are fixed, inserted, or embedded in the cushion, and the thread they are threaded on is wound round the reel or receiver. In using the thread needles hereinbefore described, the last one, two, or more inserted into the cushion near to each other are removed from it, and those (if any) not placed nearest to the end of the thread are slid along it, and then any required length of thread is cut off for use.—Patent abandoned.

3437 J. THORPE. *Certain improvements in the manufacture of waterproof or liquid-proof paper or glazed paper.* Dated December 3, 1867.

This invention consists in applying to the surface of paper, on one or both sides, a mixture of copal or other varnish (ordinarily used to varnish wood) and linseed oil containing litherage, litharge, or oxide of lead, to produce a superior quality of liquid-proof paper.—Patent completed.

3438 H. F. GARDNER. *Improvements in horses' bits and stirrups.* (A communication.) Dated December 3, 1867.

This bit consists of a curved bar of a circular or other section, extending on each side of the bit from the nose strap, or other portion of the head strap (to which it is attached by a ring), to the mouth of the horse, at which point it is connected to the bit bar by means of a bit through which it passes, and then attached to the bridle rein by a metal loop or ring. A disc or small plate of leather or metal is fixed on each internal side of the bit to protect the horse from injury by the sliding movement of the curved bar in conjunction with the bit bar. The operation of this form of bit allows of the combined bar or snaffle bit and a perfect substitute for the curve bit in one and the same arrangement. The improved stirrup consists in the application to the vertical side bars on the stirrup rest of rollers of metal, wood, vulcanite, ebonite, or other suitable material, and of such diameter as to permit the foot of the rider to pass through the stirrup merely to a sufficient extent to effect the proper bearing of the foot, so that the boot cannot pass through beyond its widest part, which is in front of the instep; in case of the rider being thrown, his foot will be immediately released by the action of the rollers.—Patent abandoned.

3439 W. BROWN and C. N. MAY. *Improvements in portable and other steam engines and boilers.* Dated December 3, 1867.

This invention relates, first, to improvements in portable and other steam engines, by means of which great economy in the consumption of fuel may be effected. It consists of what is commonly known as a "feed water" heater, so constructed that the exhaust steam after leaving the cylinder passes outside the boiler through a pipe which runs alongside nearly its whole length, and is then turned into the smoke-box in the usual way. This steam tube the patentees surround by a jacket through which the cold water is passed, so as to become heated by the steam in the exhaust pipe before passing into the boiler. Below the exhaust pipe, and parallel with it, runs a smaller tube formed in one with the jacket casing, which is placed in communication with the water supply tank, and is for the purpose of returning the heated water thereto when not required in the boiler, together with the condensed steam formed in exhaust pipe. Water is forced through the jacket by means of a pump placed in communication with the supply tank, and driven by the fly wheel of the engine or otherwise. The jacket communicates with the boiler by means of a pipe having a check valve, while the return tube is provided with a stop cock having an index to show its position, which is opened when water is not required in the boiler, so as to allow of its return to the supply tank, and when the pump is working a constant circulation of water in the jacket is maintained, which also warms the water in the supply tank previous to its again passing through the heater. Both the exhaust and return tubes open into the lower part of the blast pipe, an inclined partition or diaphragm being placed across the end of the exhaust pipe to prevent any water of condensation blowing up the chimney with the steam, and to cause it to run back to the supply tank through the return pipe. The jacket is provided with a foot plate for the engine driver to stand on when oiling or otherwise attending to the engine; and it may have circular, longitudinal, or other partitions formed or placed therein to impede the progress of the water and keep it as long as possible in contact with the heated exhaust pipe in the centre. The water may be passed through the heater as many times as required before entering the boiler, but once is generally found sufficient. The second part of the invention consists in strengthening the manholes of boilers as follows:—Instead of riveting a ring around the manhole, as usual, thereby increasing the thickness at that part, they cut the hole smaller than is required, and force a die through it, which raises the edge of the plate. This raised lip or flange may either be turned down or left projecting, the object being to strengthen the boiler at the manhole, the reverse effect being produced by riveting on a ring, as in ordinary.—Patent completed.

3440 J. GJERS. *Certain improvements in the manufacture of cast steel and homogeneous iron.* Dated December 3, 1867.

Here, when crude iron or refined iron is caused through the action of iron cinder, or other additional matter, to boil and to come to nature, the patentee transfers the material under treatment from the puddling, or other equivalent furnace, even before the process of balling, and by remelting, fluidifying, or keeping fluid such material, he causes it to separate from the cinder and to attain an uniform quality ready to run into ingots. Thus, he melts crude pig iron, or refined iron, or recarbonized puddled iron, and works it in the usual way in a puddling furnace, and causes it, through the action of rich pure iron cinder, or other additional matter commonly used when making puddled steel (for instance, as manganese and salt), to boil and to come to nature in the manner adopted for making puddled steel or puddled iron.—Patent completed.

3441 R. HORNSBY and J. E. PHILLIPS. *Improvements in reaping and mowing machines.* Dated December 3, 1867.

In constructing a reaping and mowing machine the patentees mount the axis of the pinion gearing with the ring of teeth on the main carrying wheel, and also the axis of the crank which drives the knife on a cast frame which pivots on the axis of the carrying wheel on its inner side, or between it and the cutters. This frame also has the finger bar fixed to it. The driver's seat is supported from the axis of the main carrying wheel, and from the shafts, so that the finger bar can rise and fall altogether independently of the driver's seat, and, consequently, the finger bar runs very lightly over the land. The finger bar is lifted and adjusted to the height required by a chain connected with the cast frame already mentioned, and passing to a lever jointed to the shafts. At its other end this lever drops between teeth or stops formed for it on the side of the support of the driver's seat.—Patent completed.

3442 W. SANGSTER. *Improvements in umbrellas.* Dated December 3, 1867.

Here the inventor forms a gutter around the umbrella just above the curves at the edge by fastening a band of india-rubber fabric, or other fabric, by one edge to the umbrella in such manner that, when the umbrella is open, its other or free edge stands off from the umbrella all round, and inclines upwards, so as to form the gutter required.—Patent abandoned.

3443 N. GREW. *Improvements in apparatus for cleaning or decorticating cotton seed and other grains or seeds.* Dated December 3, 1867.

This invention is not described apart from the drawings.—Patent completed.

3444 F. R. ENSOR. *Improvements in the manufacture of lace in twist lace machines.* Dated December 3, 1867.

This invention is not described apart from the drawings.—Patent completed.

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3445 C. PALEY. *An improved elastic material to be used as springs in boots and shoes, and in various other ways to which the same may be applicable.* Dated December 4, 1867.

One part of this invention consists in manufacturing an elastic material by means of a sheet of india-rubber placed between either two pieces of leather, or any other suitable materials, the colour and description of either of which, as also the strength of the spring, can be varied according to circumstances. Another part of this invention consists in inserting these springs in certain parts of boots and shoes in a manner similar to those now in use, and otherwise.—Patent completed.

3446 J. SANDERS. *Improvements in braces for supporting articles of dress.* Dated December 4, 1867.

The inventor employs two straps or bands passing over the shoulders in the ordinary manner, the back ends being connected together by a stud or otherwise. To each of the buckles by which the braces are lengthened in front he attaches a small frame carrying a pulley or roller, and over the said pulley or roller the catgut or band carrying the tabs or brace ends passes. At the junction of the braces at the back he also attaches a frame carrying a pulley or roller, over which a catgut or band having tabs at its ends passes. In wearing the braces the several tabs at back and front are connected by means of the buttonholes in them to the buttons of the trousers or article of dress. When, by the inclination of the body, a great strain is put upon either of the tabs, the catgut, or band it is connected with travels over the pulley it bears upon, and the strain is immediately distributed over both the tabs, instead of being borne by one only. The distribution of strain described takes place at the tabs at the back, as well as at those in front of the wearer.—Patent abandoned.

3447 T., G. B., and B. STEPHENSON. *An improved mode of waxing warps in the process of weaving.* Dated December 4, 1867.

The patentees employ a roller made of wax of any convenient diameter, and of sufficient breadth to cross the loom beam. This roller they place in the back part of the loom in such a position horizontally that all the threads of the warp pass over it, and, consequently, are uniformly waxed. The position it is preferred to place the rod in is to rest upon the warp as it unfolds from the beam, and thus by its own gravity to bring about the desired effect.—Patent completed.

3448 J. NEWTON. *Self-acting radial doffing knife or comb motion.* Dated December 4, 1867.

It has hitherto been difficult in the machinery referred to in the title (which has special application to tow or jute machinery) to give proper oil or lubrication to the axle of the doffing knife, and the eccentric in connection with it. The difficulty arose from the fact of the doffing knife requiring oiling or lubricating once in every three hours, or thereabouts. To obviate this defect is the object of this invention, and for this purpose the inventor places upon the end of the doffing-knife shaft a quadrant; he secures to it another smaller quadrant by means of bolts and screws in the ordinary manner. In connection with that smaller quadrant he places a small longitudinal and horizontal tube made of wrought iron, or any other convenient metal, and this being bored or hollow, as the case may be, is capable of receiving oil or lubricating mixture from a point near its extreme end, as well as from the end nearest the doffing-knife shaft or comb by means of suitable cups. Upon its being charged, and, in consequence of its communication with the doffer or knife shaft, and a further small passage being made to the eccentric shaft, which is generally surrounded with bearings of hard wood, he is enabled to give the necessary lubrication for (say) generally about three days' supply.—Patent abandoned.

3449 R. M. LETCHFORD. *Improvements in circular boxes for the purpose of abstracting their contents without removing the lid or cover.* Dated December 4, 1867.

The boxes to which this invention is particularly applicable are the boxes in which cachou aromatise are kept. In carrying out the invention the patentee cuts, punches, or otherwise makes an opening or aperture of any desired size or shape in the side of the rim of the cover of the box, and he also cuts or otherwise makes a corresponding opening or aperture in the rim of the body of the box, but by preference twice the width of the opening or aperture in the side of the cover. It will now be understood that when the cover is on the box, and the openings or apertures in different positions or places, the contents will remain in the box, but when the lid or cover is moved round until the holes are brought opposite each other, the pilules or other like contents of the box will fall out slowly and gradually. When sufficient for the time being has been extracted, the lid or cover can be moved round and the contents secured.—Patent completed.

3450 R. R. GRAY. *Improvements in metallic casks or vessels.* Dated December 4, 1867.

This invention is not described apart from the drawings.—Patent completed.

3451 E. T. HUGHES. *An improved lighting, heating, and cooking apparatus, part of which is applicable to other purposes.* (A communication.) Dated December 4, 1867.

This apparatus consists of a stand of suitable size and form, on which is placed a hollow vessel for containing petroleum, or other hydrocarbon oil, the said oil being supplied to the hollow vessel through a hole closed by a screwed-up cap. On the top of this oil vessel are fixed one, two, or more burners, according to requirement, in which are placed felt wicks, which wicks are raised and lowered by pinions turned by hand, or in any well-known manner. On the top of the oil vessel are three or more projections, on which is placed the heating chamber, the spaces between the said projections allowing air to pass into the heating chamber with the flame of the lamp, and thus assist combustion. The heating chamber is made of metal, and has a perforated metallic diaphragm at its base for the admission of air, the said diaphragm being provided with slots through which pass the burners, and with projections corresponding with those on the oil vessel, into which they fit, thus keeping the heating chamber securely in position. In the interior of the heating chamber is placed a strong metal plate, also provided with slots corresponding to the size and number of burners, the said slots being cut or cast in projections on the said plate, which serve as chimneys, and into which the burners pass. Near the top end of the heating chamber is a grid, on which can be placed small vessels containing the food or liquid to be heated or cooked, and the top of the heating chamber is provided with projections on which can be placed larger vessels containing the food or liquid to be heated or cooked. At any convenient point in the heating chamber is an aperture over which is fixed talc, or other transparent non-fusible material, so that the state of the flame may be observed therethrough, and the wicks raised or lowered according to requirement. A plate of metal or other material is placed over the grid, which aids the consumption of the smoke or gases issuing from the flame, thereby preventing all smell arising from the apparatus. Felt wicks can also be applied to any other description of petroleum lamp now in use.—Patent completed.

3452 F. B. BAKER and L. LINDLEY. *Improvements in ornamenting lace and other textile fabrics.* Dated December 4, 1867.

The inventors employ seeds of various kinds, and globular and other shaped ornaments, made of compositions of sugar, plaster of Paris, or other suitable material, and paper cut or stamped out to any desired pattern, such materials being suitably dyed, stained, or coated with a composition of the colour desired. Or, in the case of paper, it may be embossed and printed to any desired pattern and colours. Ornaments of the character above mentioned the inventors apply to lace and other textile fabrics by dipping them in gum, or other suitable adhesive material, or by applying gum or other suitable adhesive material to the back thereof, and then placing them in position on the textile fabric to be ornamented in any desired pattern.—Patent abandoned.

3453 E. WALKER. *Improvements in the construction of breech-loading ordnance.* Dated December 4, 1867.

The patentee claims the construction of breech-loading ordnance by the application to a fixed barrel of a series of horizontal rotating chambers, turned either by manual power, or by a lever, and tightened or jammed against and in line with the fixed barrel ready for discharge by means of a vertical eccentric axis, operated by a lever, and released from such barrel after discharge by the same means, substantially as described.—Patent completed.

3454 F. JOLLY. *Improvements in machinery for clamping and stretching woven fabrics.* Dated December 4, 1867.

This invention consists in the employment of rollers working in conjunction with travelling bands, between which two parts of the cambric to be clamped and stretched pass, and in such manner that the fabric gradually leaves the detaining bands so as to allow the stretching to extend to the selvage. For this purpose the inventor proposes to employ the flanged rollers, the axes of which are placed at an angle to each other. Against these flanges the fabric to be stretched is clamped by travelling bands, which he proposes to pass over rollers, and to provide with a weight for giving the necessary tension. He proposes to drive the flanged pulleys by toothed wheels in gear with projecting pins.—Patent abandoned.

6455 J. T. WEBSTER and W. OXLEY. *Improvements in machinery for spinning and doubling fibrous materials.* Dated December 4, 1867.

This invention consists in an arrangement whereby the drag necessary for spinning and doubling is obtained, and in such manner that it can be varied in amount as required. The spindle is placed within a tube to which it is connected by a pin and slot, and its lower part is provided with a flange having an inclined surface. Upon this a circular plate rests, carried by a collar, within which is a boss surrounding the spindle, but of larger diameter. This boss may therefore be moved backward or forward by an eccentric or similar means, so that the aforesaid plate may be caused to bear upon the inclined flange at different distances from its centre of motion, the drag being thus capable of variation.—Patent abandoned.

3456 J. F. CLARKE. *Improvements in means and apparatus to be applied for melting snow and ice in public thoroughfares, or otherwise.* Dated December 4, 1867.

This invention consists in the employment of a blast of air in combination with a jet or jets of gas in ignition, as described.—Patent completed.

3457 W. A. HERRING. *Improvements in apparatus for warming buildings in which high pressure steam engines are employed.* Dated December 4, 1867.

Here the patentee causes the exhaust steam from the engine to pass a coil of pipe of such diameter that the back pressure on the engine may be insignificant. This coil he encloses in a cistern or close tank with which pipes for warming the building are connected. The outlet pipe passes away from the top of the cistern or tank, then circulates through the rooms or buildings to be warmed, in the ordinary way of a hot water apparatus, and afterwards the pipe returns the same water in a comparatively cold state to the bottom of the cistern or tank. This water remains in the cistern or tank until it again becomes hot, and then it again circulates through the pipes of the hot water apparatus. In this way the rooms or buildings are warmed without other fuel than than that necessary to keep the high pressure steam engine at work, and at the same time an economy of water is effected, which sometimes is of importance, the exhaust steam from the engine being condensed into a pure water which is returned into the boiler.—Patent completed.

3458 J. H. JOHNSON. *Improvements in the production of materials suitable for blasting and other similar purposes.* (A communication.) Dated December 5, 1867.

Here, according to one modification, the nitro-glycerine is mixed with a porous combustible substance, such, for example, as finely divided wood charcoal, which, by preference, has been previously saturated with a solution of saltpetre, or nitrate of soda, or mixtures of the same, and also with a solution of carbonate of soda, and subsequently dried, so as to expel the water employed for effecting such solution.—Patent abandoned.

3459 D. SMITH. *Improvements in steam boiler furnaces, and in apparatus connected therewith.* Dated December 5, 1867.

This invention consists in placing within the furnace of steam boilers a retort or chamber made of metal, fireclay, or other similar substances. This retort is closed at one end, and has an opening or openings in its side or sides. The fire grate is placed below the retort, so as to receive the gases generated in the retort. Coal or common slack is thrown into the retort, which, when heated, details over the gases contained in the coal or slack; the gases then pass through the opening or openings in the retort, and are consumed in the fire under the retort, which, to a great extent, will prevent dark-coloured smoke from passing up the chimney. An aperture for the admission of air is made in front of the furnace with a sliding door, so that the quantity of air passing into the furnace to support combustion may be controlled by the fireman.—Patent abandoned.

3460 S. L. WORTH. *Improvements in step chairs, ladders, and steps.* Dated December 5, 1867.

The seats of these chairs are usually cut across parallel with the front, and jointed with hinges, the said cut being carried on both sides down to bottom of back leg. The back part of chair being thrown over the front, forms steps for libraries, halls, and other purposes. Now this invention consists in placing a locking bar from the front leg to the back, which secures the chair; or when turned over, and used as steps, the said bar turns the opposite way, fastening on the back of the chair and keeping the steps perfectly secure. The inventor also places a handrail in an upright position, which can be turned down, forming part of the top step when used as a chair.—Patent abandoned.

3461 J. GREEN. *Improvements in machinery or apparatus for cutting or breaking sugar.* Dated December 5, 1867.

This invention consists in the application of a self-acting feed apparatus to ordinary machines employed for cutting or breaking lump sugar into small pieces. This feed apparatus consists of two grooved rollers, mounted in suitable framing, one on each side of the cutting block or bed upon which the knife acts, and an endless cord or band passing around the two said rollers in a series of coils, embedded in the said grooves, thus forming an endless apron which is caused to travel or move intermittently by means of a ratchet wheel fixed on the end of one of the rollers, operated by a pawl or catch lever connected by a rod to the ordinary cutting knife, so that, after each stroke of the knife, or in its upward movement, the ratchet is operated, thereby turning the roller, and, consequently, the cord or apron is moved forward a suitable distance, according to the arrangement of the ratchet and lever, which are capable of adjustment as required. A self-adapting spring pin or holder is also attached to the ordinary knife frame, which strikes upon the sugar on the fall of the said knife to hold the sugar during the cutting or breaking thereof, and notches are also formed in the bed to receive the cords and prevent them being cut by the action thereon of the knife.—Patent abandoned.

3462 J. MABSON. *Improvements in bags for coffee and other pots.* Dated December 5, 1867.

This invention consists in attaching a float to the bags used for containing coffee, tea, or other material in pots in which an infusion or extract is to be made, so that the bag is always suspended from about the level of the surface of the liquid in the pot. In carrying out the invention the patentee takes a tube or float of annular or other form, and he hinges to its lower side a bag of wire gauze, or other suitable material; the float has a catch diametrically opposite the hinge to secure the other side of the bag when in place. The upper or lower side of the float may be covered with wire gauze, or other suitable material.—Patent completed.

3463 S. PERKINS and W. SMELLIE. *Improvements in the manufacture of malleable metal of a steely quality, partly from Bessemer scrap or other Bessemer metal.* Dated December 5, 1867.

The patentees claim the manufacture of metal having a steely quality, by melting scrap or other steel with common pig iron in a cupola or other melting furnace, and adding to the mixture thus produced more common pig iron, and puddling the same in a puddling furnace, substantially as described.—Patent completed.

3464 J. G. SCOTT. *An improved means to be employed for effecting the safe transmission of money or money orders, whereby the present system of book-keeping in connection with such transactions is avoided and the possibility of fraud prevented; also improvements in the formation of documents that have to be separated.* Dated December 5, 1867.

Reference to the drawings is essential to a full description of this invention.—Patent completed.

3465 J. ADAMS. *Improvements in apparatus for dating railway and other tickets.* Dated December 5, 1867.

This invention consists of an improved machine or apparatus for printing or stamping the dates upon railway or other tickets as they are issued, which may be used either for printing the date with ink in ordinary type, or for stamping or impressing the date either with or without ink by steel type. The machine is of the same character as the ordinary dating machine, in so far as that the pressing of the ticket into a mouthpiece brings down the type and gives the impression, the inking of the type (when ink is used), being also self-acting on the withdrawal of the dated ticket. The mouthpiece is supported and swings upon two links mounted on pivots beneath, and has an arm projecting from its rear side which is jointed to a bent lever, keyed or otherwise fixed on a rocking shaft, the said shaft being supported in suitable bearings. Upon the rocking shaft is also secured another lever, the outer end of which is joined to a vertical type carrier in such a manner that, when the mouthpiece is pressed inwards, the type carrier is brought down to give the impression. The type carrier is kept always perpendicular by a parallel link attached to its upper end. The inking pad swings upon pivots, and is connected by a link to the bent lever, so that when the mouthpiece is pressed inwards, and the type carrier is brought down, the inking pad is drawn out of the way; but as the type carrier rises, the inking pad is raised also, and pressed against the face of the type. A spring or other equivalent contrivance is connected to the rocking shaft or other movable part of the machine to bring the apparatus into the last described position on the withdrawal of the dated ticket.—Patent completed.

PROVISIONAL PROTECTIONS.

Dated April 4, 1868.

1139 F. A. Calvert, Manchester, engineer. Improvements in machinery for cleaning and preparing cotton and other fibrous substances; also for selecting the long from the short fibres, and for opening twisted yarns and woven fabrics.

Dated April 11, 1868.

1208 J. C. Wilson, Lime-street, City, civil engineer Improvements in hydraulic packing presses.

Dated April 16, 1868.

1250 J. H. Johnson, Lincoln's Inn-fields, Middlesex. Improvements in heating and ventilating, and in apparatus employed therein. (A communication.)

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Dated April 22, 1868.

1310 R. Side, Southwark Bridge-road, Southwark, Surrey. A new machine for obtaining motive power.

Dated May 5, 1868.

1458 D. P. Wright, Birmingham, lamp manufacturer. Improvements in the method of and means or apparatus for pouring, drawing off, measuring, and regulating the flow of liquids.

Dated May 13, 1868.

1563 H. B. and A. Mullord, manufacturing stationers, Horton, Middlesex. Improved materials for the manufacture or ornamentation of bonnets and other articles.

Dated May 14, 1868.

1578 J. Dewar, doctor of medicine, Kirkcaldy, Fifeshire. Improvements in preserving certain vegetable substances for use as food for animals.

1583 W. A. Brown, Victoria-road, Peckham, Surrey, and R. L. Jones, Edgware-road, Middlesex, civil engineer. An improved hand signal lamp.

1586 W. Walker, East Cross-causeway, Edinburgh, engineer. Improvements in the processes of cutting and dressing millstones, and in apparatus to be employed for such purpose.

Dated May 15, 1868.

1589 T. J. Gathercole, High-street, Homerton, Middlesex, engineer, and T. R. Comyn, Raleigh House, Mare-street, Hackney, Middlesex. Improvements in the construction of frames and furniture for umbrellas, sunshades, parasols, and other such like articles.

Dated May 18, 1868.

1620 J. W. Anderson, Glasgow. Improvements in temples for looms, and in the cases containing them.

1627 A. M. Clark, Chancery-lane. Improvements in apparatus for ironing and finishing linen and other fabrics. (A communication.)

Dated May 20, 1868.

1646 A. G. Hutchinson, Stoneycroft, Liverpool, builder. Improvements in apparatus for offering resistance to the opening of doors, windows, and other movable parts, and for giving alarms in cases of improper or burglarious attempts to open the same.

Dated May 21, 1868.

1685 A. M. Clark, Chancery-lane. Improvements in differential gearing applicable to lifting jacks, cranes, windlasses, and other purposes. (A communication.)

Dated May 22, 1868.

1692 J. Oury, Blois, France, civil engineer. An improved construction of meter or apparatus for measuring liquids or gases, applicable also for obtaining motive power.

Dated May 23, 1868.

1702 J. S. Richard, La Mairie du Temple, Paris. Improved arrangements of apparatus for stopping the motions of spinning machinery, and machinery for manufacturing textile fabrics when a thread breaks or a bobbin is exhausted, or the tension of a thread is too great.

Dated May 25, 1868.

1706 H. W. Everard, Manchester. Certain improvements in articles of wearing apparel called braces.

1710 F. Hargreaves and J. R. Collins, Bradford, Yorkshire, stuff manufacturers. Improvements in looms for weaving.

1712 A. M. Clark, Chancery-lane. Improvements in rotary engines or apparatus, applicable also as a pump blower or liquid meter. (A communication.)

1714 H. Ferguson, South Wharf-road, Paddington, and A. Mulvey, Kilburn, Middlesex. Improvements in machinery for cutting tenons and shoulders.

1716 W. W., R., and M. W. Johnson, Limehouse, Middlesex, lead manufacturers and merchants. Improvements in the manufacture of sheets of lead or tin, or alloys or compounds of these metals.

1718 J. E. Holmes, Ruabon, North Wales. Improved machinery for cutting or dressing stone.

Dated May 26, 1868.

1722 J. Ferrabee, Briscombe Port Mills, near Stroud, Gloucestershire, engineer. Improved machinery for feeding carding engines.

1723 H. J. Bakewell, Devonport, Devonshire, engineer. Improvements in apparatus for steering ships.

1725 C. E. Brooman, Fleet-street, City, patent agent. Improvements in decolourizing tannin juices. (A communication.)

1727 A. and C. Edmeston, Salford, Lancashire, engineers and machinists. Improvements in machinery or apparatus for printing hanks of yarns or threads and warps with one or more colours.

1728 A. S. Macrae, Liverpool, produce broker. An improved process and composition for removing ink and colours from paper, and dirt from rags and other paper stock. (A communication.)

1731 T. Smedley, Holywell, Flintshire, hotel keeper. Improvements in brakes for carriages on common roads.

1732 W. E. Newton, Chancery-lane. Improvements in rotary, steam, and other engines. (A communication.)

1733 W. Buttery, Sheffield, manager at powder flask manufactory. Improvements in apparatus for turning and closing cartridges.

1734 I. B. Miller, Hackney-road, Middlesex. Improvements in the manufacture of packing for steam engines and other machinery. (Partly a communication.)

1735 W. E. Debenham, Massingham House, Haverstock Hill, Middlesex. Improvements in wristbands, cuffs, collars, and other such like articles of wear.

1736 B. Burton, Brooklyn, New York, U.S. Improvements in breech-loading firearms and cartridges.

1737 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in ploughs and other implements for cultivating land. (A communication.)

1738 W. B. Lord, Stamford Lodge, Hampstead Heath, Middlesex. Improvements in portable filters.

1740 A. M. Clark, Chancery-lane. Improvements in apparatus for dressing millstones. (A communication.)

1741 F. Wirth, Frankfort-on-the-Maine, Germany. An improved regulator or governor for steam and other engines. (A communication.)

Dated May 27, 1868.

1742 J. Dixon, Hillsbro' Hall, Sheffield. An improved coupling link for railway vehicles and other purposes. (A communication.)

1743 H. A. Bonneville, Sackville-street, Piccadilly. Certain improvements in the permanent way of railways. (A communication.)

1744 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in breech-loading firearms. (A communication.)

1745 W. Cooper, Bradford, Yorkshire, iron and tin plate worker. An improvement in sliver cans or cotton cans.

1746 J. Morris, Liverpool, printer. An improved method of, and apparatus for, facilitating the finishing of printed sheets of paper.

1747 J. Vidie, Dean-street, Finsbury-square, City. An improved process for the ornamentation of glass, earthenware, and other similar materials.

1748 H. and G. Kearsley, Ripon, Yorkshire, agricultural engineers. Improvements in mowing and reaping machines.

1749 H. E. Mines, Cheltenham, Gloucestershire. Improvements applicable to register stoves or grates for curing smoky chimneys and controlling the draught of air.

1750 M. Gray, Highbury, Middlesex, engineer. Improvements in the manufacture of insulated electric conductors.

1751 J. Scholl, Berwick-street, Soho, engineer. Improvements in gas burners, and in apparatus to be used in connection therewith.

Dated May 28, 1868.

1754 R. Fell, Robinson-row, Middlesex, engineer, and R. Barlow, Shacklewell-lane, Middlesex, builder. Improvements in apparatus for preventing waste of water in or from water-closets and drinking fountains, cisterns, tanks, and other like receptacles.

1756 W. Alexander, Liverpool, ship owner. Improvements in the arrangement of mechanism for applying auxiliary power to sailing ships.

1758 F. Hauducœur, Rue St. Maur, Paris, merchant. An improved apparatus for malaxating butter.

1760 W. E. Newton, Chancery-lane. Improved apparatus for hopping beer. (A communication.)

1762 J. and J. B. Palmer, Palace Works, Old Ford-road, Bow, Middlesex. Improvements in the manufacture of matches and fusees, and of friction surfaces to be used therewith. (Partly a communication.)

1764 R. H. Bentham, Bedford-row, Middlesex, architect. Improved apparatus for facilitating the flow of liquids from barrels or other closed vessels, and for lifting or forcing liquids to any desired height.

1766 T. S. Horn, Grove-street, Newcastle-upon-Tyne, agent. Improvements in miners' safety lamps.

Dated May 29, 1868.

1770 J. Turnbull, Edinburgh, Writer to the Signet. Improvements in connecting and disconnecting carriages and waggons on railways, and in the apparatus connected therewith.

1774 E. Newton, Mount, Sheffield, merchant. Improvements in the means of, and apparatus for, obtaining and applying motive power.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated June 5, 1868.

1845 H. A. Bonneville, Sackville-street, Piccadilly. A new and improved process for feeding sugar factories or distilleries. (A communication.)

1853 E. A. Dana, Brookline, Norfolk, Massachusetts, U.S. Improvements in the construction of projectiles for rifled cannon or ordnance.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," June 16, 1868.

362 J. Combe and J. Barbour. Machinery for hackling and scutching flax.

368 H. B. Wright. Apparatus for sweeping chimneys.

372 R. A. Jones. Warming and ventilating vessel.

383 P. Graham. Stoppers for closing bottles.

390 B. J. Jones. Machinery for manufacturing clog soles.

391 F. Ardache. Apparatus for winding flat cords.

392 M. P. W. Boulton. Apparatus applicable to propulsion and aerial locomotion.

396 H. Moore and J. Hamilton. Construction of furniture expanders.

401 A. E. Borgen. Preparation of phosphor free matches.

402 W. J. M. Rankine and J. M. Gale. Condensing steam.

411 W. Tongue. Machinery for preparing fibrous materials for combing or spinning.

418 A. B. Ibbotson. Steel spring railway fastenings. (A communication.)

419 W. Hann. Safety lamps.

421 W. Drake. Machinery employed in the cutting of wood laths.

433 J. Key and E. Hoskins. Metallic bedsteads.

434 H. Woodward. Knife cleaner.

439 W. B. Marston. Lamps for lighting railway carriages.

440 N. C. Szerelmey. Rendering paper fabrics waterproof.

441 N. C. Szerelmey. Preserving wood.

445 W. Burgoyne. Better and invoice holders.

452 H. Schlotter. Apparatus for raising water.

458 J. W. Melling. Machinery for excavating coal.

459 C. and L. Verhulst. Construction of fireplaces. (A communication.)

463 G. Seamer. Manufacture of silk fancy weavings.

470 S. C. Lister. Looms for weaving cut pile fabrics.

479 W. Wootton. Envelopes.

480 H. B. Condy. Manufacture of acetic acid.

488 J. Wood. Apparatus for indicating the position of railway points.

490 F. Tolhausen. Machinery for brush making. (A communication.)

492 G. Roberts. Candles.

500 J. P. Lack. Albums and scrap books. (A communication.)

505 J. S. Raworth. Mode of connecting and disconnecting revolving cylindrical surfaces.

509 W. Easterbrook. Machinery for actuating and controlling railway points and signals.

532 J. and J. Hinks. Portable stoves.

537 J. and J. Thompson. Fastening railway rails.

561 M. Henry. Manufacture of nails. (A communication.)

572 G. Davies. Taps. (A communication.)

582 M. A. F. Mennons. Bristle brushes. (A communication.)

612 R. Nicholls. Combined material or fabric to be applied to the manufacture of bags.

632 J. L. Jacquet. Heels for boots and shoes. (A communication.)

664 W. E. Newton. Construction of boats. (A communication.)

743 A. M. Clark. Paving roads. (A communication.)

770 A. M. Clark. Steam pumps. (A communication.)

829 J. Wallis. Apparatus for dressing millstones.

844 J. Browne. Auxiliary propulsion.

1025 A. P. Price. Treatment of ores.

1090 M. Hawthornthwaite and T. Abbott. Taps, cocks, or valves for water, gas, or other liquids.

1162 A. V. Newton. Anchors. (A communication.)

1205 C. Martin, W. Barrett, and T. S. Webb. Treatment of titaniferous iron ores for the manufacture of iron.

1309 H. Howse. Safety matches.

1365 A. Clark. Steam generators and furnaces. (A communication.)

1522 S. Moulton. Treatment of vulcanized india-rubber for obtaining a substance of a mossy nature.

1535 A. M. Dix. Apparatus for supplying fixings to casks.

1578 J. Dewar. Preserving certain vegetable substances.

1628 J. Mitchell. Railway and other carriage springs.

1682 C. Barnard. Chairs.

1719 H. L. A. Lippens. Looms for weaving.

1736 B. Burton. Breech-loading firearms.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed June 12, 1868.

3548 L. A Damm	3590 W. A. Gilbee
3554 H. Atkinson	3604 H. H. Murdoch
3558 W. and F. Bates	3614 W. H. Richardson
3559 J. Hargreaves	3627 J. Kenyon
3556 A. M. Clark	3672 E. G. and E. E. Rafer
3567 E. and A. Tatham	3680 J. Clarke
3569 L. A. W. Lund	3703 J. Aschermann
3580 J. Standfield	189 D. Timmins
3585 W. Simons and A. Carmichael	282 W. Ellis
	489 C. Blyth
3587 E. M. Du Boys	952 J. Abraham and T. R. Bayliss
3588 S. Marsters	
3589 F. L. and C. L. Hancock	1236 A. V. Newton
	1314 W. R. Lake

Sealed June 16, 1868.

3599 J. Hall	14 T. B. Daft
3602 O. A. Hebert	57 H. Smyth
3608 J. S. Gisborne	89 R. Winder
3612 A. Cochran	248 M. Tildesley and J. Bird
3613 E. Breffit	
3624 L. L. Tower	417 J. and J. Cash
3643 W. W. Urquhart and J. Lindsay	575 R. Fennelly and P Kenny
3657 A. M. Clark	930 C. E. and J. Green
3663 J. Addie and F. Kohn	970 V. A. Deaubeuf
3716 W. Wilson	1042 J. Lyall
3720 A. M. Clark	1222 T. Forster

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

3007 P. G. Gardiner	1629 R. A. Brooman
1578 G. E. Meek and W. H. Howes	1678 G. Haseltine

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1487 F. E. Schneider	1553 A. R. Le M. de Normandy
1533 G. Leach	
1534 H. J. Kennard	1654 H. J. Rouse

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending June 13, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2822	0 4	2966	0 8	3042	1 4	3104	0 4	3131	0 10	3156	0 4
2849	0 8	2971	0 6	3044	0 8	3105	0 4	3132	0 4	3157	0 4
2896	4 10	2991	2 2	3056	0 10	3109	0 4	3133	0 4	3161	0 4
2914	1 8	2998	0 8	3067	0 10	3114	0 4	3134	0 4	3162	0 4
2920	0 8	3000	1 0	3071	0 8	3115	0 4	3135	0 4	3168	0 4
2922	0 6	3002	0 8	3079	0 8	3116	0 4	3136	0 4	3170	0 4
2926	0 10	3003	0 10	3091	0 4	3118	0 8	3142	0 4	3173	0 4
2933	0 8	3020	0 6	3096	0 4	3120	0 4	3144	0 4	3174	0 4
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2942	1 0	3033	1 0	3099	0 4	3125	0 4	3147	0 4	3176	0 4
2956	0 10	3035	0 8	3100	0 4	3127	0 4	3150	0 4	3185	0 4
2960	1 6	3038	0 8	3102	0 4	3128	0 4	3154	0 4	3250	0 4
2961	0 10										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department), on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

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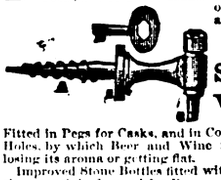

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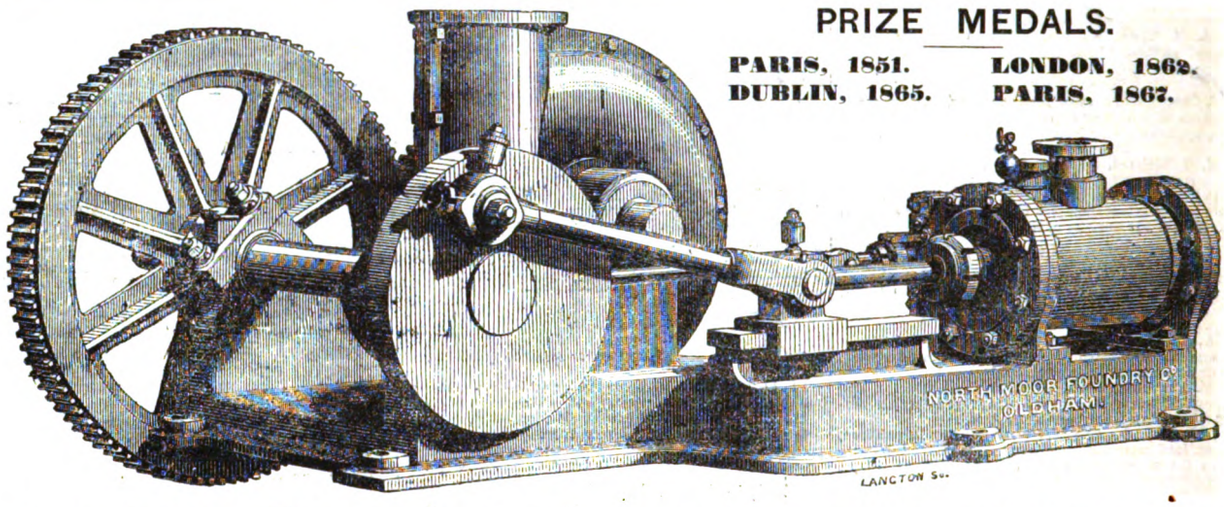

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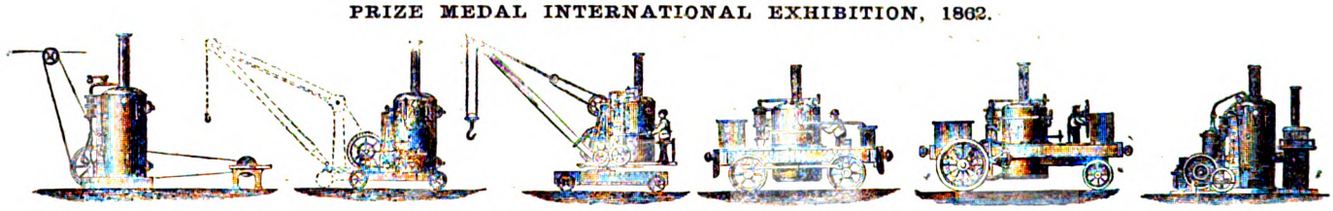

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JUNE 26, 1868.

LIQUEFACTION OF GASES.

WHATEVER views may be adopted respecting the abstract nature of cohesion, or that mysterious agency which binds together the particles of matter,—whether the atomic theory or that of infinite divisibility be received,—it is nevertheless true, though unaccountable, that heat tends to relax the fetters of natural union, and cold and pressure to rivet them closer. The force with which the results of the application of any of these agents acts is known as expansion and contraction, and their power is irresistible. But a very trifling allowance is needed to allow them to expend their force with impunity, but unless that space be afforded them, the most solid masonry, the heaviest metallic construction, would be shaken by their effect. According to the natural constitution of bodies, and the circumstances under which they are placed with regard to temperature and pressure, so do they exist in one or other of their three limited conditions, namely, solid, liquid, and gaseous or aeriform. Some bodies—water, for example—pass from one of these stages to another when subjected to simply natural variations of temperature, but the majority require artificial means to compel them to change their state. To liquefy bodies, other than gases, is incomparably an easier task than to solidify. By the aid of electricity the most refractory substances can be liquefied, and their molten globules falling upon the table of the laboratory, bear witness to the invincible agent employed in their reduction. It may be said that every solid substance can be rendered liquid, or very nearly so, but the same cannot be stated with respect to the opposite operation of solidification. There are some gases which have hitherto defied all the attempts of the most experienced and skilful chemists to reduce them to a liquid much less to a solid form.

Of the many able experimentalists and *savans* who devoted themselves to the task of accomplishing the liquefaction of gases, none have been more distinguished or successful than Faraday. The basis of his operations was founded upon the circumstances attending the liquefaction of chlorine. This gas is soluble to a considerable extent in water, which, at a temperature of 15½deg. Cent., absorbs nearly twice its own volume. At a few degrees above zero this mixture of chlorine and water freezes, throwing down a yellowish substance containing about a quarter part of chlorine and three quarters of water. It was upon this substance that Faraday experimented. He enclosed it in a strong glass tube sealed hermetically, and then plunged it into hot water. The compound solution was decomposed and liquefied, the water returning to its original condition. But the case was otherwise with the chlorine, which, not having sufficient space to expand and return to the gaseous state, was condensed, by the elastic pressure of its own vapour, into a pale amber-coloured liquid. The pressure necessary to effect its liquefaction, and which must have been excited by its own efforts to expand, was about four atmospheres. By applying this principle of confining solid and liquid substances, capable of furnishing under various changes of temperature large volumes of gas in strong envelopes of glass or metal upon an extended scale, numerous gases were reduced to the liquid state. They were, in fact, all compelled to endeavour to return to their original state in a space too small to allow of the necessary expansion, and the enormous reaction generated a pressure sufficient to liquefy them. That many of these experiments were attended with much danger, and that accidents arose occasionally, is well known, but the man of science is equally brave in his own sphere as the man of war, and life is as frequently risked in the laboratory and workshop as in the field of battle or on the stormy ocean. Until recently, great difficulty was experienced in liquefying the protoxide of nitrogen, represented by the chemical formula NO, and also termed nitrous oxide; it is, however, best known by the name of laughing gas. A pressure of about fifty atmospheres is required for its condensation, and it is now manipulated so safely that it may be poured in the open air from one jar into another without the least fear of explosion. Some remarkable circumstances attend the liquefaction of this gas. A small portion of mercury introduced into it congeals with the rapidity of thought, and assumes all the appearance of bar silver. If at the same time a piece of lighted charcoal be placed in it, a vivid illumination is the result, and we thus witness in close conjunction to one another temperatures of extreme divergence—the one lower than that prevailing in the regions of the north pole, and the other higher than that emitted by the most intense furnace.

Carbonic acid CO^2 is liquefied with facility at a pressure of about twenty-eight atmospheres, yielding a colourless fluid, which requires to be enclosed in vessels of great strength and solidity, as the elastic force of the vapour is of a very powerful nature, and an explosion would be attended with serious results to those near at hand. Besides condensing this gas to a liquid condition, it has also been solidified, converted into a transparent mass resembling ice, and also produced in a form somewhat similar in colour and weight to snow. Under this form the solidified gas can be preserved in the open air for a great length of time, and manipulated without fear of any dangerous consequences. It is by the aid of these substances that temperatures are produced of an intensity of cold scarcely credible, and they are justly termed frigorifics. If carbonic acid in the state described be wetted with ether a temperature of 87deg. Centigrade below zero is produced, and the ordinary temperature of the liquid protoxide of nitrogen is 90deg. below the same point. A degree of cold yet more intense is obtained by subjecting these frigorifics to a quick evaporation in an exhausted receiver, when a temperature of 120deg. below the melting point of ice has been recorded. The contact of these frigorifics with the human flesh sears it like the touch of red-hot iron, and cold pieces of metal plunged into them hiss in the same manner as when hot metal is dipped into water. A jet of cold water thrown upon them re-converts a portion of them into gas, while the water itself congeals with a sharp report. The theory of these actions and reactions is, of course, readily explainable, upon the principle of specific and latent heat. In the last example, the frigorific robs the water of an amount of latent heat sufficient to convert a portion of itself into gas, and at the same time reduce the latter into a frozen mass. The resources at our command for producing elevated temperatures are far superior to those we possess for obtaining low ones. If necessary, we can heat bodies to a temperature of 2000deg. Centigrade; but, until the researches of Faraday, we were not able to produce a temperature lower than 50deg. below zero, and now we are limited to 120deg. below the same point. So that, while we can rise 2000deg. in one direction, we can descend only 120deg. in the other. A very peculiar feature of these frigorifics is that they appear to lose the affinities and qualities which distinguished them in their gaseous or normal state. Thus the most inflammable substances can be brought into intimate union with them without evincing any of those effects that would occur were they combined in their original condition. Sodium, a metal that takes fire spontaneously, exhibits not the slightest appearance of combustion when placed in contact with the liquefied protoxide of nitrogen. Antimony, which inflames rapidly in the presence of free chlorine gas, remains unaltered in substance and appearance when subjected to the influence of that gas in a state of liquefaction. It would almost appear as if the intense state of cold in which those bodies existed rendered inert and powerless those active qualities and affinities which would unquestionably have been displayed under different circumstances.

RECENT GUNNERY EXPERIMENTS AT SHOEBURYNESS.

WE last week noticed the gun practice which was made on the Tuesday and Wednesday previous to our issue, against the Plymouth shield and the 15-inch rolled and hammered plates. This practice was resumed yesterday week, first against the upper portion of the Plymouth shield. The first round was a 12-inch shell, with full charge, aimed at the upper part of an extra plate placed on the front of the shield, and which it broke into several pieces. It penetrated 16in. and exploded backwards, doing no damage at the rear of the shield beyond fracturing another horizontal iron plank. The Rodman gun, with a full charge, was then brought to bear on the upper part of the shield. It struck the curved plate at the left-hand top corner, a portion of which was already knocked off, and broke it in two, doing no further damage. Round No. 3 was a shell from the 12-inch gun, fired with a charge equivalent to 1,000 yards range. The shell struck the second plate from the left hand, carrying away a piece from the corner, and bursting, the explosion lifting up a large triangular fragment of the adjoining plate previously broken, and hurling it on the roof of the building. This mass of iron was about 6ft. base by 5ft. sides, and remained pivoted on one of the large roof bolts, which held it without breaking. Inside the casemate at the rear, the ironwork in connection with the roof was much distorted, and a great cavity, admitting daylight, was formed through the plates, the head and point of the shot remaining jammed amongst the débris of the cavity. The fourth round was a 10-inch shell, with a reduced charge, which hit in a horizontal line with the last one, but some feet to the right, and over the porthole. It penetrated 16in., and burst outside, driving back a corner of the plate struck, and loosening the washers in various portions of the recessed part of the arch over the porthole. In the fifth round the shell struck the granite basement and smashed out some large pieces. The sixth and last round at the Plymouth shield was a 10-inch shell, fired with a powder charge of 48lb. The shell broke away a space of 15in. in the lower proper left side of the front plate above the porthole, the fissure extending from the corner of the plate to the corner of the port and traversing the indent of a previous shot.

The firing was next directed against the granite base on which the target stood. This forms a plinth about 4ft. high, projecting about as much from the surface of the shield, the step being rounded off. The shot—a 450-pounder, from the Rodman gun, with full powder charge—struck the granite towards the right hand, ploughing a furrow some 5ft. wide and 3ft. deep, smashing the granite to powder, and scattering a cloud of fragments and dust around. After this shot two rounds were fired at Sir John Brown's solid rolled 15-inch plate, which our readers will recollect was merely stood against some iron standards and a few balks of timber

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This target had already had three rounds fired at it with a result highly creditable to the plate, considering the conditions under which it was tested. The first was a 12-inch shell, with 76lb. of powder, and which struck the plate about 2ft. from the end, which it broke off and hurled about 6ft. to the rear. The second shot, which was from the Rodman gun, with full powder charge, struck the plate near the centre of the original length, and close to where it was hit by the two shots of the previous day. The plate at this point was already severely cracked, and the result of the last shot was to complete its destruction, the plate separating into four pieces. The fractures showed a splendid quality of iron, although here and there symptoms of bad welding were visible, and this was all the most adverse criticism could pronounce against it. In its favour there was everything to be said. Considering its unsupported position, and the widely different conditions under which it was fired at to those of a fort where it would be fixed as a defence, it stands out at once as a great success. Although the Plymouth fort stood a good amount of battering, it is to be remembered that it has been improved upon by replacing some of the bars by plates. These were just the points that withstood the firing the best, and this strengthens the conclusion that a mighty strength of resistance would result from the use of a single solid plate instead of a compound laminated plating.

This was the conclusion of the third day's experiments, and at this point we may pause to notice the recorded details of the practice as regards the forces and velocities of the shots fired, and which are as follows:—The Woolwich 12-inch rifled 600-pounder, with 76lb. pellet powder, 5,588 foot-tons, 1,159ft. per second velocity. The 10-inch rifled 400-pounder, with 60lb. l.g.r. powder, 4,431 foot-tons, 1,264ft. velocity. The 15-inch smooth-bore Rodman, with 50lb. English powder, equal to 60lb. American, 4,215 foot-tons, 1,161ft. striking velocity. In the same gun, with 83½lb. charge—equal to 100lb. American powder—the velocity was above 1,400ft., and the total energy about 4,000 foot-tons.

Upon the resumption of the experiments on Tuesday last, a structure known as the "War Office Casemate" was the object of attack. This casemate was manufactured at the Millwall Iron Company's works, and was designed with the view of testing the resistance offered by a given weight of iron plate disposed in various thicknesses and positions. It is divided into six sections, each one of which represents a different system, the whole being lettered from A to F. The first section consists of an 8-inch solid plate placed direct upon the 2-inch skin which is common to all the series. The second is of 4½-inch plate upon a backing 7in. deep, formed of channel-iron placed back to back. The third is a 6-inch plate, with backing 7in. deep of Hughes's hollow stringers. The fourth is a 4-inch plate, with 7-inch backing of channel iron; the fifth is a 4½-inch plate resting partly upon 7-inch backing of channel iron and partly, with only the interstices between itself and the inner 2-inch skin, filled up with 7in. of concrete, forming the sixth section. The structure was roofed in with brick arches and concrete, as in ordinary casemates. The firing was from the 7-inch, 9-inch, and 10-inch rifled guns and the Rodman 15-inch smooth-bore gun, with battering charges, and at the same range as the Plymouth shield, viz., 200yds. Only Palliser shells were used, these having established their superior penetrative power over the Palliser shot.

Twenty rounds were fired in all at this target, the first being a 7-inch shell, which struck the 8-inch plate, penetrating about 8¼in., but doing no damage to the rear. The second round, a 7-inch shell, struck the 4½-inch plate supported by 7-inch channel-iron backing. It penetrated 14in. into the target, but caused no damage to the rear. The third shell struck on the vertical junction of the last plate fired at, with the 6-inch plate backed by hollow stringers. The result was a penetration of 8¾in., the head of the shell remaining in the hole, and the rear remaining undamaged. The above three portions are marked A, B, and C respectively, and they are backed with a massive tapering concrete pier. The fourth shell struck the last-named section (C) where it has behind it 2ft. 6in. of concrete, strengthened by iron girders. The penetration was 10½in., with half a dozen nuts stripped off in the rear. The fifth shell struck that portion of the target covered by 4-inch plates upon 7-inch channel iron. The plate buckled ½in. for about 2ft. around the shothole, and the total penetration was 13½in., the head of the shell remaining in the hole. Seven more nuts in the rear were stripped off the bolts. The sixth shell struck the 4½-inch plate on concrete backing, penetrating 14in. into the structure.

The practice now commenced with 9-inch shells, the first round striking section A of the target, penetrating 13in. The second shell struck the B section, penetrating 21½in., the plate buckling considerably, and seven nuts twisted askew in the rear. The third shell struck on a bolt in section C, causing a buckle of ½in. at the top edge of the plate, the penetration being 18½in. The fourth shell struck the same section, penetrating 14½in., and clearing off five small nuts in the rear. The fifth shell hit on section D, the penetration being 9ft. 8in. At the rear the ⅝-inch iron skin mantlet was driven back 8in., and twenty small nut-heads were stripped off. This portion was driven back by a bolt, and the mantlet skin was turned up also beside the port, the whole forming a considerable smash. The sixth round struck upon the E section, penetrating 22½in., and causing no damage in the rear. The 10-inch gun was then brought into play, the first shell from which struck the A section, buckling the plate, and penetrating 32in. The second round struck the B section, causing a buckle, and penetrating 4ft. 9½in. The shell was supposed to have burst in the concrete backing. One of the vertical channel irons lifted up a few inches through the concrete roof. The ⅝in. skin at the back of the pier opened slightly at the joints. The third shell struck the section C, penetrating 6ft., and passing into the concrete pier. At rear the covering slip at the angle of the pier ripped open over a length of 5ft. 8in., with ten rivets sheared, and a bulge of 5in. in the ⅝-inch skin on the back of the pier.

The next shell struck the C section in another place and completely penetrated the structure, clearing everything before it, the point of the shell being carried 200ft. to the rear. Some pieces of the ⅝-inch skin were thrown 20ft. away. The point struck was a weak one, being near a joint which was not covered by the backing. This points out the necessity of placing the stringers so that the joints of the plates should be supported by them, instead of having them at right angles to the line of the plates, as at present. The fifth round, with the 10-inch shell practice, struck the D section, making a clean penetration. One of the ⅜-inch mantlet plates in the rear was blown 20ft. away, and the timber screen was smashed up. There was an opening in the back of the target 4ft. in height and of considerable width. The angle iron of a vertical girder on the left of the shothole was curved 3in. out of the straight, a 2-inch bolt was broken off, and the concrete was blown out. The sixth and last 10-inch shell also struck upon the D section, and drove the whole side of the target back from its brickwork setting about ½in. It penetrated 4ft. 11in., lodging in the concrete backing, and bulged the cover plate in the rear, stripping some more small nuts, and cracking the roof slightly all round. After this shot the Rodman gun was fired, a round shot striking the junction of the 6-inch plates above the porthole. It caused an indent 7in. deep, and sheared off a bolt-head 6in. from the face of the target. At the rear the angle iron supporting the ⅝-inch skin over the port bent 3in., thirty small screw-nuts were knocked off, and the whole skin, ⅝-inch plate, was knocked out a distance of 9in. One rivet was knocked out from the top of each port jamb. The second round from the Rodman gun struck the A section of the target, making an indent of 4½in., but doing no further injury.

The result so far was, in the first place, to prove the iron to be of splendid quality, the plates being remarkably free from cracks, and the punctures clean and true. In the next place, the 15-inch Rodman gun, with its heavy charge, has practically failed, having been distanced in penetrative quality by the rifled guns of far smaller calibre and charge. In the third place, the results of the trial were favourable to the system of compound backing and Mr. Hughes's stringers as against the plate and bar system of the Plymouth target. It is true that two clean penetrations were made, but then they both occurred at weak points which can readily be strengthened in future by altering the disposition of the stringers. The casemate underwent another day's pounding on Wednesday, and was finally disabled by a 600lb. shot from the 12-inch gun, propelled by a 76lb. powder charge. We, however, leave the details of the concluding trials for next week. We may, in conclusion, add that the velocities of the respective shells from the 7-inch, 9-inch, and 10-inch guns were 1,460ft., 1,340ft., and 1,290ft. per second, and the bursting charges were 2lb. 6oz., 5lb. 10oz., and 9lb. 10oz.

INDO-EUROPEAN TELEGRAPH.

WE understand that five cargoes of stores, consisting of Siemens' iron posts and insulators, and of wire, left England last week for Persia. These stores will be trans-shipped at St. Petersburg into smaller steamers, which will take them through the Neva and the Volga to Astrachan, where they will again be trans-shipped for the ports of Rescht, Lencoran, and Astara, on the north coast of Persia. From these ports they will be conveyed to the interior on mules. It is expected that these stores will arrive at their destination (about 5,000 miles distant) in the month of October, when the erection of the line will at once be proceeded with, a staff of superintending engineers having already left England for that purpose. The three scientific advisers of the company, namely, General von Luders, the Director-General of Russian Telegraphs; Colonel von Chauvin, Director-General of North German Telegraphs; and Mr. W. H. Barlow, C.E., met lately at Berlin, in order to decide upon the mode of construction of this international work, the execution of which has been undertaken by Messrs. Siemens Brothers, and is to be finished before the end of next year. The cable in the Black Sea is to have three insulated conductors, which are to be enclosed by a copper sheath to protect it against oxidation, and against the attacks of marine insects which abound in these regions. The Indian Government having decided to add another conductor to their existing lines between Teheran and Kurrachee, in anticipation of the increased traffic to be expected from this new line, we may look forward to very perfect communication between this country and its eastern possessions, which is so much needed. The Russian and Prussian Governments have formally declared that in case of war the transmission of commercial messages over the new line will not be interrupted.

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ARTIFICIAL GRAPHITE.

WITHIN the last few years carbon in various forms has been much used for various purposes, but more especially for filters and galvanic batteries. When M. Bunsen invented his nitric acid carbon battery, he tried to cut his negatives out of graphite, preferring that which is formed in gas retorts from the distillation of coal. But this material is so untractable that he was obliged to give it up, and he devised an artificial substitute for gas carbon by mixing together finely powdered coke and pit coal. Of these powders he made a paste with water, and then moulded the paste into such forms as he required. After having dried the moulded paste, he then soaked it in a strong solution of brown sugar, and again dried it, and then subjected it to an intense heat, at the same time carefully excluding it from the air. This formed a very good substitute for coal graphite for electrical purposes, but still inferior in conducting power.

A much better artificial graphite is formed in the following manner:—Carefully select the coke, taking none but the brilliant granular pieces, and instead of pit coal use charcoal made from hard wood. These being powdered and mixed in equal proportions, and made into a stiff paste with a thick syrup of brown sugar and gum arabic, and then moulded into whatever shape is required, and left to dry, are then covered with sand, or otherwise excluded from the air, and heated to a bright red heat till the sugar and gum are thoroughly charred. These will bind the whole together, and will form an artificial graphite scarcely inferior to coal graphite for electrical purposes. At present, an artificial porous carbon is being made for filters and other purposes which is somewhat similar in composition to this latter, but we think it would be improved if it were made to approach more nearly. The process for making this porous carbon is the following:—A mixture of animal and vegetable charcoal is ground to a coarse powder and mixed with sawdust and dried. As soon as the material is dried, and while still warm, 20 per cent. of tar is added. When cold, a certain proportion of mineral pitch is added. The articles are then moulded and put into a sheet-iron box, and covered with sand and charcoal powder. They are then carefully calcined for twenty-four hours. The quality of the carbon depends very much on its proper calcination.

This may make a very fair filtering charcoal, but we think it would be improved by the rejection of the bitumen and tar, and instead of these a syrup of gum and sugar used as a binding material. If a very porous charcoal be required, of course the sawdust should be retained. On calcination, the sawdust is partially consumed, and leaves the mass more porous than it would otherwise be, and this for filtering purposes would be a great advantage, for a porous charcoal will absorb more oxygen than a dense one, for which it has a great affinity; in fact, it is the power of absorbing oxygen which makes charcoal so efficacious as a filtering substance, the carbon giving up its absorbed oxygen to the organic matters in the water, thus oxidizing them and destroying their pernicious properties. For electrical purposes this carbon is much inferior to the second mentioned, and also to M. Bunsen's. We may here say a word on carbon filters, for if the purifying properties of charcoal be not properly understood there is danger of drinking more impure water through them than from any other source.

A carbon filter is effective only so long as it contains some of its absorbed oxygen. After this is exhausted the carbon exerts no further chemical action on the water. Of course, it will still act as a mechanical strainer, but it is not the mechanically suspended matters that are so deleterious in water, but the products arising from decomposing organic matter which are in chemical solution. If the water be highly charged with these, the shorter time will the filter be effective. But to make the filter as effective as at first nothing more is required than to drive off the moisture and other foreign matters by calcination. To keep a filter which is in constant use in a thoroughly efficient state the carbon should be recalcined at least once in ten days, but the frequency required can be easily calculated. Given the amount of organic matter in the water passed through the filter daily, the amount of oxygen required to oxidize it can be easily calculated, and the ratio that bears to the amount of oxygen which the carbon will absorb will give the number of days that the filter will remain effective. At present many people think filters are effective as long as they remain unbroken and water will pass through them, a notion which is beneficial to the makers only.

ARTIFICIAL LIGHT IN PHOTOGRAPHY.—No. II.

THE lime light is also very useful in photography. It is, in some respects, worse than the magnesium light, because, notwithstanding its great brilliancy, it does not contain such a large proportion of actinic rays as might be expected. Likewise, it is not ready for use in an instant, like a magnesium lamp, because great bags or gasometers have to be filled with gas, and several gallons of oxygen have to be made before operations can begin. On the other hand, the oxyhydrogen flame is very steady, and gives off no smoke, in which respects it is much better than magnesium. Those employed in enlarging photographs by artificial light, as a business, seem to so equally use the lime and magnesium lights that it is difficult to say which of the two is preferred by practical men. With the lime light a longer exposure is necessary, but, on the other hand, the flame is easily controlled, and gives off no smoke or noxious gases. There are more actinic rays in the lime light than commonly supposed by photographers, the value of the light in this respect having been much understated by many writers, as we know by experiment.

Those who intend to use the lime light extensively in photography had better provide themselves with large zinc gasometers, fitted up with safety valves, such as have recently been described in these columns. Gas bags are not only expensive, but they last a very short time, whilst gasometers made at about the same cost should last a lifetime, with very little trouble in the matter of repairs. Where the operator is likely to do much in the way of moving or travelling, gasometers are, of course, inconvenient, and gas bags may be preferable because of their portability.

When constantly using the lime light, the great danger to be guarded against occurs in the manufacture of oxygen, because if the black oxide of manganese be purposely adulterated or accidentally mixed with organic matter—such, for instance, as soot—an explosion will result after it has been mixed with chlorate of potash, and heated in the retort. Explosions of this kind are of a most deadly character, and in those rare instances when they have occurred, have sometimes killed the operators. When a new sample of black oxide of manganese is bought, a little of it should be mixed with half its bulk of chlorate of potash, and put in a test tube, which should then be heated over the flame of a spirit lamp. If organic matter be present in the black oxide, the whole of the mixture in the tube will go off something like a squib, directly the bottom of the tube gets hot. Having once obtained a good sample of black oxide of manganese, the best plan is never to use any other, because this substance is, strange to say, not altered in the manufacture of oxygen, but remains in the retort when the operations are over. When the retort is cold it should be washed out with water, and the black muddy liquid poured into a large deep dish. The supernatant liquid may afterwards be poured off, and the black oxide which sank to the bottom of the dish may be allowed to dry for future use. Any impure sample of black oxide of manganese may be heated to redness in a covered crucible, which operation will destroy the organic matter, and render the oxide perfectly safe to use in the manufacture of oxygen. In making this gas too much heat should not be applied at first, and the delivery tube of the retort should not be less than half an inch in internal diameter, because sometimes the gas comes off with uncontrollable violence, and would blow off the head of the retort without the above precautions. For the same reason a retort of thin metal is best, because on removing the flame when the gas comes off too violently, the reduction of heat at once makes its beneficial effects visible. For the same reason a retort with a broad bottom is better than one of a globular or tall cylindrical form, because in the former case a thin layer of mixture only is ignited, instead of a great substantial mass, likely to retain a great deal of heat. These remarks, if carefully attended to, will enable anybody to keep the operations of manufacture of oxygen gas under easy and safe control.

An exceedingly brilliant light, very rich in photographic rays, may be made by burning a mixture of nitric oxide gas and bisulphide of carbon vapour. This is a light which might well be utilized in photography were it not that it gives off suffocating fumes of sulphurous and sulphuric acids. Hence this light can only be burnt under a chimney, and no private individual has a moral right to turn such deleterious substances into the atmosphere, to the injury of his neighbours. Supposing apparatus were made to consume these unpleasant products of combustion, the only difficulty to be overcome would be the devising of a jet to give a good flame, because the two vapours must be mixed in certain definite proportions to give the best results. Wrong proportions considerably diminish the intensity of this peculiar light. One way in which we have obtained the light was by passing nitric oxide through warm liquid bisulphide of carbon, and then igniting the product at a jet at the top of the bottle. The flame obtained was very long and pale. The best results can only be obtained with a larger proportion of bisulphide of carbon vapour, such as would be produced by boiling the liquid. The mixture of the two vapours is explosive, so they should not be mixed in large quantities.

The light of common gas or of a paraffin flame is very poor indeed in photographic rays, so as to be useless in portraiture and in enlarging processes. Yet these lights are very useful in printing transparencies on wet or dry collodion, by superposition. Supposing a sensitive plate prepared by any of the dry processes to have a negative placed in contact with its surface, a picture may then be printed by exposing the plate through the negative, at a distance of 18in. or a little more, from a gas flame. The picture will then have to be developed in the usual way, and toned with chloride of gold, or some other substance, to give a pleasing appearance to the eye. Beautiful stereoscopic transparencies upon glass, such as are sold by some of the best philosophical instrument makers, may be taken in this way, and at a future time we may possibly publish detailed instructions how to take such pictures.

THE AERONAUTICAL EXHIBITION.

OUR readers are aware, from our occasional notices, that an extensive exhibition of aeronautical machines has for some time past been in course of preparation. This exhibition opened yesterday, at the Crystal Palace, and will continue on view until the end of next week. We shall, therefore, reserve our

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notice of the exhibits for our next number, contenting ourselves for the present with a few remarks upon the exhibition generally. Whatever doubt may have been felt as to the possibility of forming anything like an attractive aeronautical exhibition in London is certainly more than dissipated by the present show. In this respect, to commence with, it is a decided success, and might have been still greater had the Aeronautical Society possessed means which would have enabled them to give their proceedings greater publicity, and to make their intentions more widely known. But the exhibition bears evidence of a large amount of careful earnest thinking and working upon a very special subject. It is to be hoped that out of the mass of ideas now placed before the world, a digest will be formed by the united action of the inventors, which shall embody the correct theory of aerial locomotion, and tend to a solution of the question. There is a general expectation that the exhibition will be repeated next year, upon a much grander scale than the present; this idea is warranted by the great encouragement the society has received in its first attempt. Such being the case, we cannot be considered premature if we call the attention of those who wish either to become guarantors, or to offer prizes, to the fact.

That the exhibits are not mechanically perfect in all their details is a circumstance at once evident and easily accounted for. The study of aeronautics has been chiefly pursued by those who are indifferently versed in mechanical laws. It has hitherto been a study more or less of an imaginative character, and has exercised higher flights of thought, in which mechanical motions and arrangements have taken but a secondary part. They have been too earthly and unethereal for the flights of fancies, which would float in space. But the tendency of the aeronautical movement of the present day is to reduce vague and uncertain theories to sober practice, and attention is therefore directed at the outset to mechanical conditions. Hence, one result of this exhibition will be to lead to practical effect being given to the ideas of those whose theories may be sound and feasible, but which yet may be very indifferently illustrated in a mechanical point of view. A careful examination of the exhibition doubtless discloses instances of misapplied talent, but, on the other hand, it also exemplifies progress and the gradual development of the great idea of aerial navigation. We confess ourselves to be less sanguine of ultimate success than many who have toiled at the question for years. There are so many delicate conditions, requiring such extreme care and accuracy in their fulfilment, upon which safety and success depends, that we are justified in accepting with extreme caution anything like an assurance that the accomplishment of the fact is at hand. But then the subject is in its infancy, as regards its practical bearing upon the question of aerial flight, and the Aeronautical Society could have taken no better step for its advancement and development than the one they have—the promotion of an aeronautical exhibition.

ELECTRICITY AND TELEGRAPHY.

IF two zinc plates of equal dimensions, connected with a galvanometer, be plunged at the same moment and to the same depth in a liquid, no result will be shown on the galvanometer. But, according to M. Caudray, if one be first immersed and then the other, a strong current is perceived flowing from one plate to the other, showing that the first is negative. The polarity of the plates depends upon the order of immersion, the second being negative, so that any one plate may be made at will positive or negative according as it is immersed first or second. The polarity may also be reversed when both plates are immersed by touching one or other with a piece of carbon. The strongest effect is noticed when one plate is wholly and the other only half immersed.

Some experiments have been tried lately by M. Edlund on the peculiar effects of elongation in conducting wires due to the passage of a current. From a series of careful experiments he deduces the fact that an electric current traversing a solid body produces an elongation due to itself, and independent of that due to the increase of temperature, this elongation increasing rapidly with the intensity of the current.

We learn from a report recently published that a Russian telegraphic agency exists at Pekin, through which messages are transmitted from the Atlantic to the Pacific Ocean. If the American Government carry out their intended plan of extension through the Russian territory, lately ceded to them, we may probably see, by means of the extension in Russian Asia to the Behring Straits, an almost uninterrupted line of telegraphs round the globe. It is also mentioned in the report, which is full of statistics, that the total amount of telegraph in the world, exclusive of submarine lines, is over 75,000 miles, of which over 52,000 are European.

Mr. W. T. Henley has just sent away from his works at North Woolwich a length of forty-two miles of cable manufactured by him for the Norwegian Government. The core of insulated wire was covered at the Telegraph Construction and Maintenance Company's Gutta-Percha Works, at Wharf-road, and was composed of a seven-strand copper conductor, weighing 107lb. to the nautical mile, coated with three alternate coats of gutta-percha and Chatterton's compound to the weight of 166lb.—making a total weight of core of 273lb. per nautical mile. The core was served with yarn, and sheathed by Mr. Henley with ten No. 6 iron wires, and finally protected with a serving of yarn and Clark's bituminous asphalte compound. The insulation of the completed cable is very high, and, we believe, superior to any that the Maintenance Company have produced from their works. The iron wires were drawn and galvanized by Mr. Henley himself, who has been engaged for some time past most extensively in this branch of telegraphy, who, although possessing large means for not only drawing but galvanizing wire, is now engaged in making extensive additions, in order to be able to produce at any time a larger supply of wire than formerly.

The Telegraph Construction and Maintenance Company have laid a cable across the Straits of Messina to complete a portion of their contract with the Anglo-Mediterranean Telegraph Company. This cable completes the special communication erected by them between Susa and Modica.

The main cable from Malta to Alexandria has just been commenced at the sheathing works at Greenwich, the gutta-percha core having been commenced some time back at their works at Wharf-road.

The "Electric Telegraphs" Bill, after several postponements, was brought before the House last week, and, being read a second time, was referred to a select committee, on the understanding that an instruction will be moved to the committee to inquire into all the important points of the general question. Great delay has been experienced in the promised returns relative to the railway telegraph. Up to the present time particulars have not been received from the North-Western, Caledonian, South-Western, Great Western, and Great Northern. The petitions presented in favour of the bill are very strong evidence of the opinion of the country generally. There has hardly been a chamber of commerce or a newspaper that has not petitioned in support of the Government acquiring the telegraph. The difficulty at present experienced is one of purchase money, the companies requiring twenty-five years' purchase, and the Government offering the highest price of their various companies' shares at a certain date. The one is too high and the other too low, but it is a fair question for arbitration, and one we hope to see an early and satisfactory solution of.

It has been decided that the core of the new cable for the Persian Gulf shall be made of india-rubber of the manufacture known as "Hooper's core." The trial that the India Government gave to this core has proved so highly satisfactory that they are again going to make use of it. The high temperature of the water where this cable will be submerged renders india-rubber more suitable than gutta-percha, on account of its being affected less by temperature.

M. Alvergniat, of Paris, has constructed a new apparatus for proving that electricity does not pass through a perfect vacuum. In a tube, having two platinum wires so placed that their extremities are only $\frac{1}{8}$in. apart, he produces a vacuum by means of a mercurial column. When a vacuum is established, no trace of a spark can be perceived.

In some experiments, tried by M. Felix Lucas, he establishes the fact that the electric spark is visible at a greater distance than a permanent electric luminous ray, whose apparent intensity is 25,000 times that of the spark. The light that is employed in some of the French lighthouses has, we are told, an illuminating power equal to 125 times that of the Carcel lamp. From experiments tried, a spark having a power 200 times less than that of the lamp, is visible at a greater distance than the rays from the lighthouse. It is suggested that by the use of a series of intermittent sparks, a system of lighthouse illumination can be easily made of very great power.

Some highly interesting experiments have been successfully tried lately by M. F. Carré with regard to varying the colour of the electric light. The colour of the voltaic arc has been modified by introducing in the carbons saline solutions of substances having the property of colouring flame. The salts of strontium give a purple light, the salts of copper a green. Nearly the same results are obtained by the introduction of the metallic oxides of these salts. It is stated that the metallic powders do not in any way diminish the conductibility of the carbons. The application of boracic acid to the carbons has the property of considerably increasing the time of their duration. It surrounds them with a protecting varnish which prevents their combustion, acting almost the same as in a vacuum.

The U.S. steamer "Gettysburg" has returned, after an interesting cruise in the West Indies. She has been entirely engaged in making soundings between the British West Indies and the shores of South America. The result has been successful, and establishes the fact that the bottom is muddy, and the depth suitable for a cable. The deepest water was met with between Jamaica and Cuba, as much as 3,000 fathoms having been found.

NEW DOUBLE-ACTION SWITCH.

THE magnificent array of signals and signal boxes that grace, professionally speaking, the entrance to the Charing-cross and Cannon-street Stations, are not only of too elaborate a nature to be employed in smaller instances, but their application would not be attended with an advantage commensurate with the outlay incurred. For ordinary stations not terminal ones, a simpler and less expensive method of working switches is required, and numerous have been the patents and inventions that have been applied to the purpose. A patent has been recently taken out in Belgium for a new switch lever, which renders the operation exceedingly simple, and prevents the carriages getting off the rails through the careless or inattention of the switchman. The system has been adopted by the Belgian railway authorities, and will be readily understood by aid of the annexed diagrams, one of which represents a section and the other the plan of the arrangement. Many of the details are necessarily common to other systems. The box B is of cast iron, and bolted down

FIG. 1

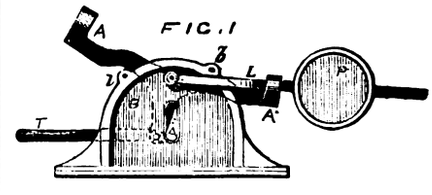
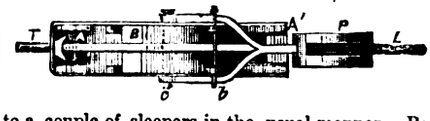


FIG. 2



to a couple of sleepers in the usual manner. Between the two vertical sides of this box is mounted upon a central pivot C the lever with three branches A A^1 A^2. Upon the last, A^2, is fixed the switch rod T, the other end of which is connected with the points. The lever handle L carrying the counterweight P is also mounted upon the same pivot bolt c. To shift the points, all that is

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necessary to do is to reverse the lever either at the extremity A or A^1, which, oscillating upon its centre under the weight of the counterpoise, pulls or pushes the rod T by the medium of the branch A^2. The lever can be maintained in either of the extreme positions by simply passing a small iron pin through one of the eyeholes *b*, cast on the box.

Accidents have frequently happened to carriages owing to the points shifting while the train was passing over them, and, in self-acting points, it is easy to witness the points oscillating backwards and forwards, accordingly as the wheels alternately press them down and release them. It was to obviate this dangerous tendency in common points and switches that Messrs. Livesay and Edwards introduced their patent bar system, as it may be termed, which consists in attaching to the points a long bar by the side of the rail in the vicinity of the points. This bar is kept down by the pressure of the train, and it is impossible for the points to shift during its transit. The bar is of sufficient length to be always pressed upon by a couple of wheels at a time, which is more than enough for the purpose.

THE HANDEL TRIENNIAL FESTIVAL.

DURING last week the Crystal Palace was the scene of one of the greatest—if not the greatest—of musical successes ever achieved. It will be remembered as such by many thousands until the next festival comes to eclipse the last. Its perfect success is due, on the one hand, to the highly efficient arrangements made by Mr. Grove, the secretary; Mr. Bowley, the general manager, and the other members of the executive of the Palace, for the good of the public. On the other hand, we have the labours of Mr. Harrison, the president; Mr. Brewer, the hon. secretary of the Sacred Harmonic Society, and others, by whose exertions nearly 5,000 vocalists and instrumentalists were gathered together in the Handel orchestra from all parts of Great Britain. Above all, and the crowning point of the whole, was Mr. Costa and his admirable direction, without whom and which it is certain the success would have been very incomplete. The attendance throughout was larger than on any previous occasion, not even excepting the great commemoration festival of 1859. The numbers attending the several festivals since their inauguration are as follow:—In 1857 the total was 38,414; in 1859, the commemoration year, 81,319; in 1862 the total was 67,567; in 1865 it was 59,434, and the attendance at the festival just closed was 82,465. With such resources as the Crystal Palace possesses, and with such an executive to turn them to good account, we believe that the latter number will be exceeded at the next triennial festival.

WELSH STEAM COAL.

MOST of our readers are aware that for several years previous to 1866 the steam coal of South Wales, known as smokeless coal, was almost exclusively used on board the vessels and steamers of the Royal Navy, and it gave general satisfaction as regards the speed attained and the evaporative power. In consequence, however, of the recommendation of a committee appointed in 1866, at the instance of some of the north of England members, who complained that undue preference was shown to South Wales coal, it was determined that navy contracts for the future should be in the proportion of two-thirds Welsh and one-third north country coals, the mixture, it was alleged, giving superior results to either coal alone. This arrangement was observed for about two years, but it was soon discovered that the mixed coal did not do the service of Welsh used alone. Repeated complaints followed from the navy officers of the inefficiency of the fuel, and the result has been that the old arrangement is again reverted to, and Welsh smokeless coal is exclusively used. This decision on the part of the Admiralty authorities will add considerably to the demand for South Wales coal, and indirectly it will be a material benefit to the trade, in consequence of the reputation for quality that will thus be given to the coal. We understand that the navy of the Federal States of Germany will in future use Welsh coal.

CONVERSION OF WOODEN SHIPS.

THE latest plan for utilizing our wooden ships of war for defensive purposes is that promulgated by Mr. C. P. Stone, of the 77th Regiment. Instead of placing armour on the sides of the ships, his idea is to cover the deck with a movable iron plating. This method of defence, however, would be entirely ineffective if the sides of the ships were exposed to fire, so Mr. Stone purposes the following expedient. Two or three immense iron tanks are placed in the hold of the vessels, fore and aft, and by gradually filling these with water, the ship is made to sink until the deck is flush with the sea. The tanks are filled by means of valves in the end or sides of the ships, which are opened, and the air in the reservoirs is exhausted by means of a pump, worked by a small engine. When it is necessary to raise the vessel again, condensed air is forced into the tanks, and it rises quickly or slowly, according to the pressure employed. Mr. Stone believes that in this way he can combine the comfort, the commodiousness, and the sailing qualities of the best frigates with the impregnability of a monitor. The deck not being exposed to a vertical or perpendicular fire, it is of course unnecessary that the armour used should be anything like as thick as that of the "Warrior" or "Achilles." A thickness of 3in. is deemed sufficient, and one of the chief features of Mr. Stone's plan is that he proposes that the plating should be removable at pleasure, and only be put on when the ship is going into action. The bulwarks are to consist simply of rails and chains. We admire the simplicity as much as we believe the impracticability of this latest theory of conversion.

ARTIFICIAL GRANITE.

A METHOD of manufacturing artificial granite has just been patented by Mr. P. M. Parsons, of Blackheath, well known by his system of converting cast-iron guns into rifled ordnance. The materials of this artificial granite are disintegrated natural granite mixed with clay, together with pounded glass, lava, or iron slags. The disintegrated granite is obtained by submitting fragments of natural granite to a strong heat, about 700deg. or 800deg. Cent., in an oven, by which, after a sufficient time, it becomes dissolved into a granitic sand, the constituent parts of which, quartz, or feltspar, possess great powers of adhesion. One part of this granitic sand is then mixed with about an equal quantity of pounded glass, or the constituents of glass, or lava, or iron slag, to which is added from twenty to thirty parts of refractory clay, or from thirty to fifty parts of ordinary clay. This mixture is thoroughly kneaded together with a sufficient quantity of water to make it of a pasty consistency. It is then moulded to any form required, and submitted to a degree of heat sufficient to vitrify the mass for about thirty-six hours, which converts it into a hard and durable substance resembling granite. The artificial granite thus produced may be moulded into any forms required to render it suitable for various kinds of buildings, fortifications, docks, and other engineering structures, and particularly for all kinds of pavements, for which its great hardness renders it particularly suitable. When very large blocks are required, it is preferable to make them hollow, and, after they have been baked or burnt, they may be filled with concrete, rubble, &c., to make them solid. Any kind of furnace in which the requisite heat can be generated will answer for dissolving the granite and baking or vitrifying the blocks or bricks; but Mr. Parsons finds Hoffman's annular furnaces perform this operation satisfactorily.

THE SOLID LEVER BRIDGE.

THIS bridge, in its essentially original features, is the invention of Messrs. Cottrell, Liscom, and Merrill. These features may be best explained by describing the mode of construction, as we find it in the "American Railway Times," and which is as follows:—In throwing a span from one abutment to another, the first step of all is to lay down upon each abutment a timber projecting over the edge of the bank a short distance. The length of the portion of the structure projected over the chasm is to that portion upon the bank (which is the balance power), as ten to three. Upon the first layer of timber is placed another, extending further, and firmly treenailed to the first, each successive course projecting further outward over the chasm, and well secured by bolts and treenails, so that when by successive projections the final layer is brought to reach the middle of the span and unite with the corresponding lever from the opposite side, it presents a well proportioned lever, nearly as solid as if sawn entire of one piece, its projecting weight balanced by that portion of the lever resting on the abutments, and the two united and strengthened by two or three additional courses laid over all. The two levers thus making the sides of the bridge are connected by girders, or floor timbers, on which the flooring is laid—the shore ends bound together to form a cradle for the reception of ballast. Thus completed, a span of 200ft. would reach back 30ft. upon each bank, and a span of 500ft. 50ft. back. Over this structure two wooden arcs are placed, of slight and graceful curve, united and securely fastened to the main structure by upright iron rods, and abutting in the shore ends of the bridge.

The advantages of this bridge may be stated thus:—1. Economy and facility of construction. It is claimed that an almost unlimited length of span is attainable, and the building of piers, which in deep and rapid rivers are very costly, and which obstruct the navigation, is avoided, and the cost of scaffolding saved. The plan of construction is such that any carpenters and blacksmiths can furnish the materials and do all the work. 2. Strength—From the peculiarity of the structure, being lightest in the centre, all the material bears its true proportion of strain, and there is no waste, and the distribution of the component parts makes them all act at the greatest mechanical advantage. The sides of the bridge being levers balanced by the shore end, the bridge is relieved of the necessity of sustaining its own weight in the centre where an ordinary truss-work sags the most; and being very light in the centre, there is no unnecessary strain upon the balancing or shore end. 3. The arch adds great compactness and increases the strength of the whole in a peculiar manner. Like any other arch it thrusts laterally against its abutments, but its abutments are the two ends of the bridge into which it is built, and it thus forms with the stringcourses of timber a wooden bow with a wooden string. In order to spread this arch, the chord or upper string timber would have to be dragged apart by longitudinal strain. Thus there can be no deflection of the bridge after it is well set together. It is this combination of the arch on the one hand, with the re-enforced lever on the other, which gives this bridge a strength immeasurably superior to that which the same amount of material would give when arranged in any other form.

In the Iron Bridge, patented by the same inventors, and involving the same principles, the strength attained is practically illimitable. A model of this, 32ft. in length, is exhibited at the office of the Solid Lever Bridge Company, 46, Congress-street, which illustrates this. The advantages of a cheap, easily constructed, and strong wooden bridge are manifest to all—but those connected with railways are best aware of the immense importance of cheap and strong iron bridges. The obstruction of the western rivers by piers is so serious an impediment to navigation, that this invention becomes of the utmost importance, and comes just in time to solve the problem of how the railways are to cross the Upper Mississippi and the Ohio rivers, without navigation being destroyed. This is a matter of national interest, and is now engaging the attention of Congress. The new invention promises to reconcile the objection, and provide at a moderate cost the means whereby river navigation may be preserved, and railway communication across them be attained.

BRICKWORK IN CALCUTTA.

CALCUTTA brickwork has not the reputation of being first-rate; indeed, many people could be found who would say that it was essentially bad, or at least that that portion which is constructed under the auspices of the D.P.W. is bad, but that which is built by private persons or firms is much better. To the latter we ("Calcutta Engineers' Journal") would recommend a visit to Victoria-square, where two houses in course of construction have been severely injured by the heavy rain of April 25. The rain was preceded by a stiff north-wester, which, we must suppose, injured more or less the houses in question, but it was not till the heavy rain began to fall that the south walls of these houses were actually washed down, some of the so-called bricks being melted by the water. Of the bricks which have been brought to the site of the works, several are melted in the same way; and many, when dropped upon the ground from a height of two or three feet, broke into pieces like a bit of clay. The materials and workmanship of these houses is really disgraceful, and we hope that steps will be taken to have them properly examined, and, if necessary, pulled down, instead of allowing the Baboo, to whom they belong, to conceal with plaster a state of things which would be sufficient to deter any one from occupying the buildings. Two men were, we understand, severely injured, and were removed to the hospital; and, had it not been that at the time of the storm most of the men were working at the stables and servants' houses, the consequences would have been much more serious.

THE SCIENTIFIC WONDER.—Have you seen it? It magnifies 32,000 times. Price thirty-two stamps (post free), with book of full instructions. To be had only from A. McCulloch, Philosophical Instrument Maker, 18, Blucher-street, Birmingham.

N.B.—For further particulars, see Advertisement in this paper, page 1, column 2, headed "Scientific Wonder."—[ADVT.]

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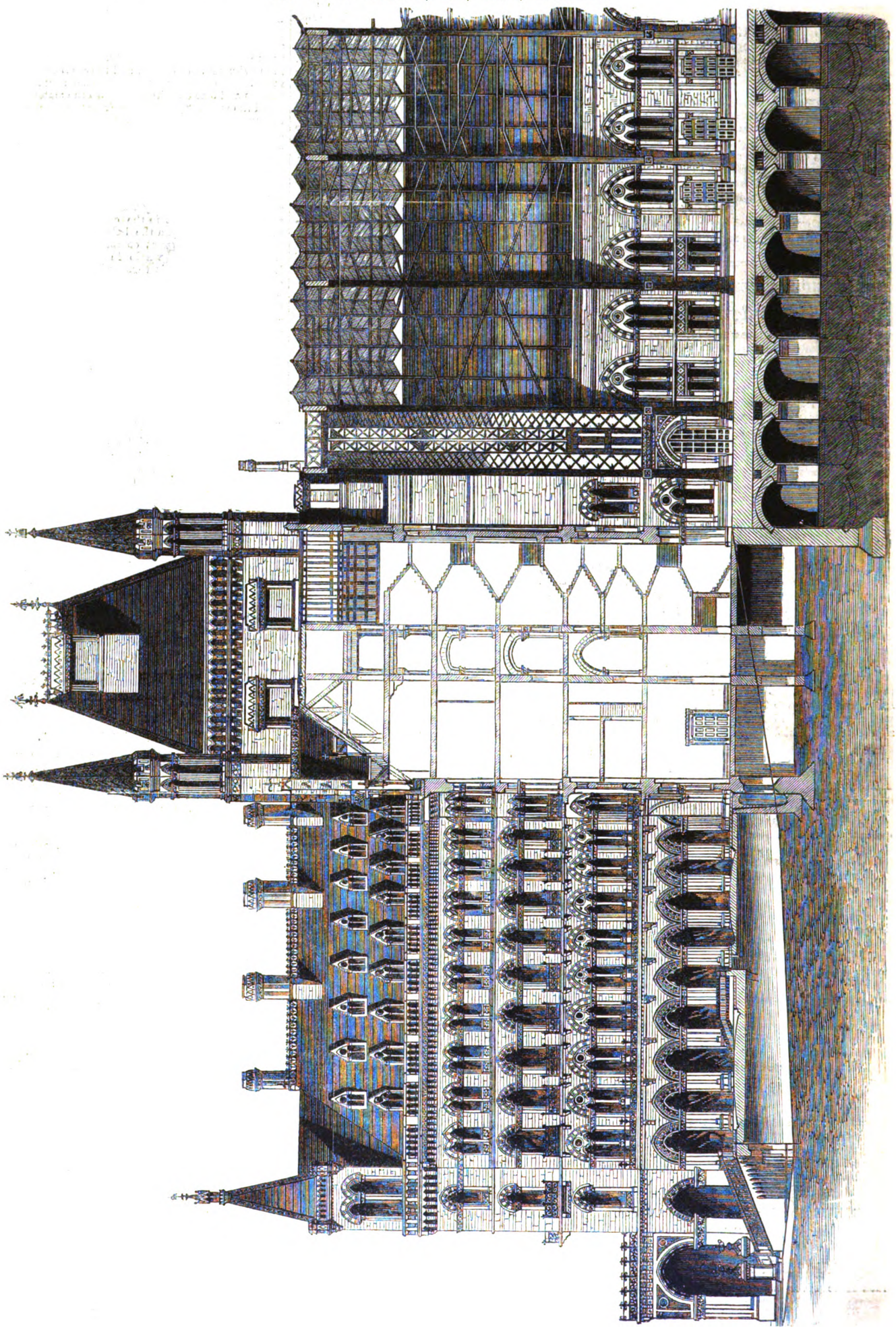
THE ST. PANCRAS STATION, MIDLAND RAILWAY EXTENSION—LONGITUDINAL SECTION THROUGH HOTEL.

MR. W. H. BARLOW, C.E., F.R.S., ENGINEER.



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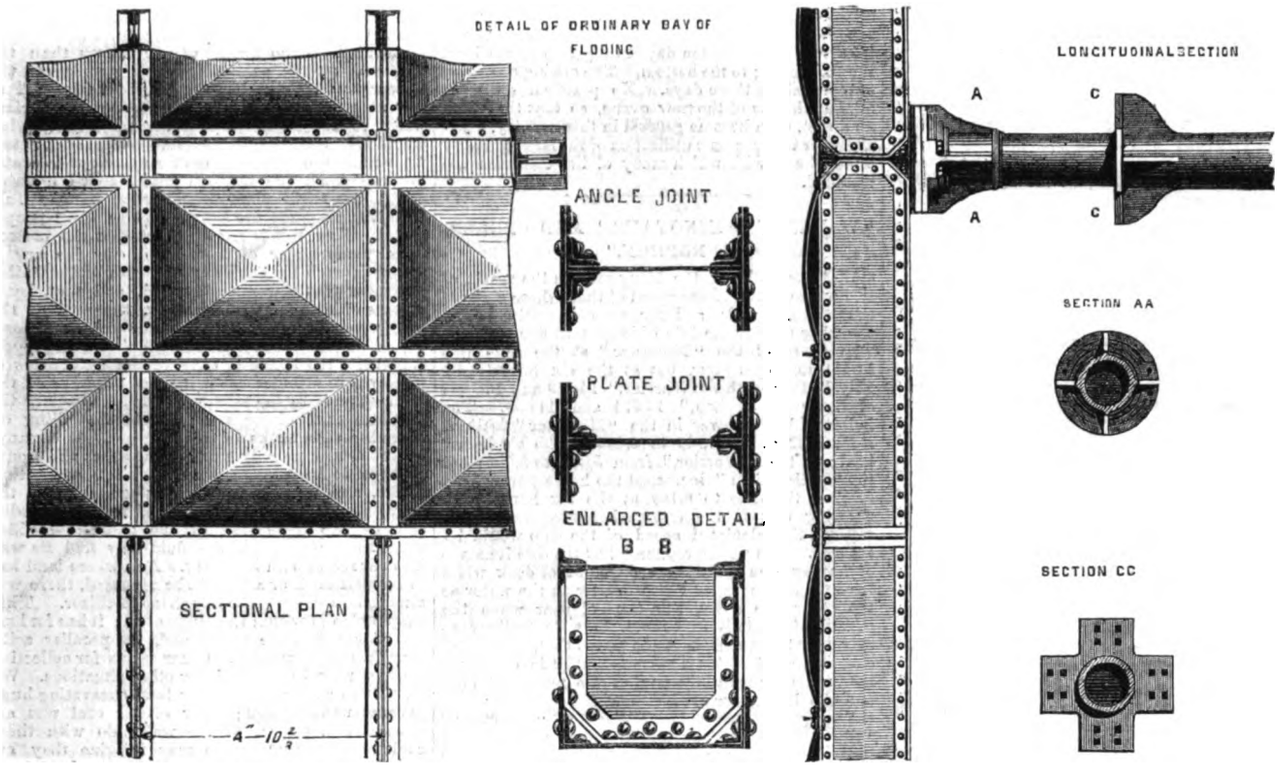
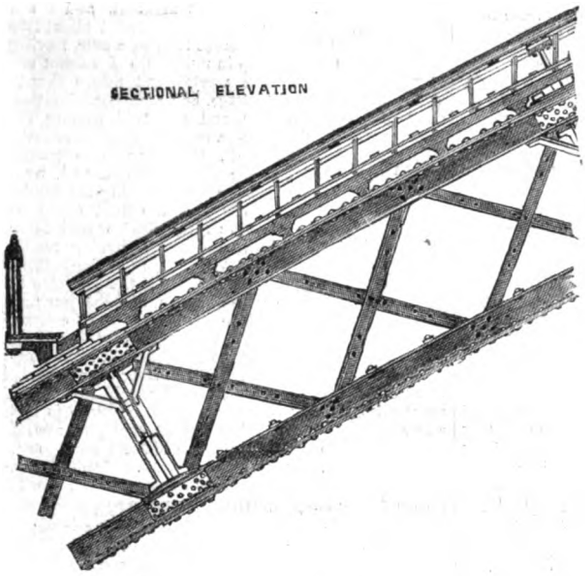
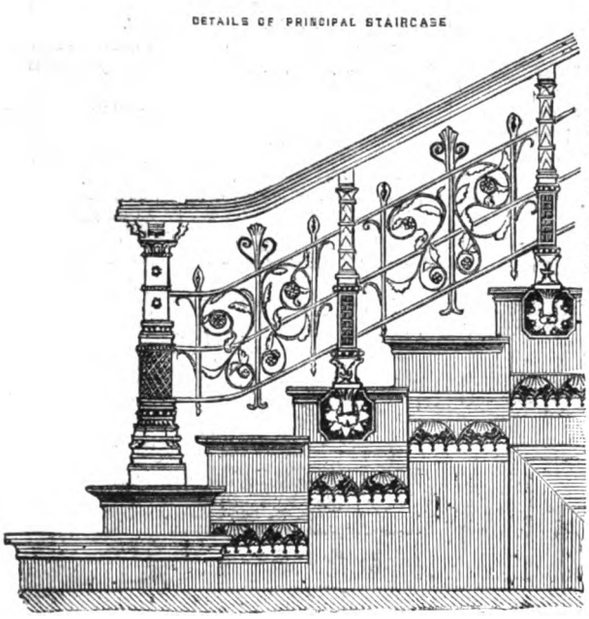
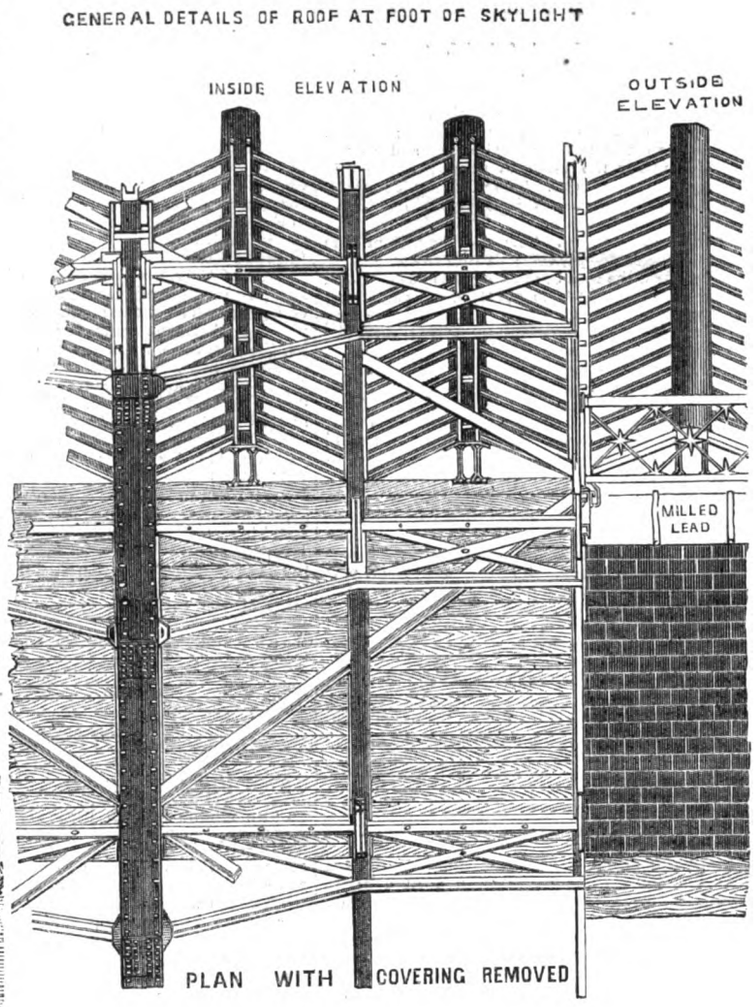
ST. PANCRAS STATION—DETAILS OF ROOF, FLOOR, AND FLOOR GIRDERS.









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THE SAINT PANCRAS STATION, MIDLAND RAILWAY EXTENSION.

WE give this week engravings of the remaining details of the ironwork of this great roof, and the flooring, &c. The following are the dimensions of the flooring:—Height from floor level of cellar to underside of girders, 13ft. 6in.; height from floor level to bottom of column, 1ft. 6in.; total height of column 15ft.; diameter of column about 12in. clear. Wrought iron floor girders, 1ft. 9in. deep; width of flanges, 1ft. 2in. by 9-16in. thick; angle irons, 3½in. by 3½in. by ⅜in.; web plates, 5-16in. thick; span of girders, 14ft. 8in. Cross girders, 1ft. 9in. deep; flanges, 3½in. by 3in. by ⅜in.; angle iron web plates, 5-16in. thick. The main floor girders which connect end boxes of arched rib have an additional plate on bottom to take horizontal thrust of roof. Buckled plates, 5-16in. thick; size of rivets throughout, ¾in. diameter by 4in. pitch.

We also give an engraving of a longitudinal section through the hotel, and a portion of the adjoining roof. The new Midland terminus and hotel will be one of the largest of the metropolitan stations, the total extent of the site being about ten acres. The frontage will be in the Euston-road, not far from the present King's Cross station of the Great Northern Railway; the east side of the station borders on the Old St. Pancras-road; and the west in Brewer-street, which is diverted; the hotel building will occupy the corner between Skinner-street and the Euston-road. Seven streets have been diverted, and their intermediate houses, including St. Luke's Church, have been taken down for the new works.

The following is a summary of the present position of the work:—Fifteen out of the twenty-five main ribs are permanently erected. A portion of the work for the screen at the north end is completed. The woodwork and slating in the sides of the roof are finished for about 200ft. in length, and the sash bars are being fixed. The flooring is finished with the exception of a few lengths at the south end. The side walls are progressing rapidly. In conclusion, we beg to tender our thanks to the officials for their courtesy in facilitating our inspection and in affording us information.

UTILIZATION OF SMALL COAL.

AN improved form of coke oven has been devised by Messrs. Carves and Co., the object of which is to utilize the products of the coal, without deteriorating the quality of the coke produced; in fact, to produce a sound metallurgical coke, and at the same time utilize the products usually obtained in the manufacture of gas. The "Mining Journal" states that several works in Belgium have now adopted the invention, and the results obtained have been quite satisfactory. The first efforts in this direction were made by Messrs. Pauwel and Dubochet, who conceived the idea of utilizing the gas generated for the heating of the coke oven, or of employing the illuminating gas, and at the same time obtaining a good metallurgical coke, instead of the soft coke that had hitherto been obtained in the process of gas manufacture. They succeeded. After condensing the tarry, ammoniacal, and other condensible products, they employed the gas for heating the oven, and it then became a question whether the gas, deprived of its richer hydrocarbons, had still sufficient strength to give the necessary temperature to produce hard coke. The first experiments upon a large scale were made at Messrs. Carves' works, at St. Etienne, and it was found that when a large number of ovens were worked, so that the gas production and the heating should be regular, the process was satisfactory. As in the case of all new contrivances, the cost was at first very high, and some doubts were entertained of the economy of the arrangement, although its ingenuity could not but be admired. Step by step, however, Messrs. Carves overcame the obstacles, and by collecting the condensable products before the gas was ignited, and then devising a plan by which they could convert their old ovens at a cost of not more than £40 each, the process became a success. The new ovens are now arranged in groups of twenty-five each, which ensures great regularity in work and temperature. The importance of the new principle at collieries where a large quantity of small is made will at once be seen from a description of the process. The impure coal is first washed by the ordinary processes, and then pounded small by means of grooved rollers. This pounding is necessary when a good coke, of regular character, is required, and has the further advantage of much facilitating the distillation. A bed of pulverized coal is then formed in the oven, between 2ft. and 3ft. thick, and, of course, sloping down towards the doors, and the doors are then closed and luted with clay. The gas is then turned on and, upon entering the ovens, at once becomes ignited, for the temperature still remains high. The production of gas then commences, and passes off towards the gasometer, depositing its tar and ammoniacal compounds on its way. The Belgian oven and the bakers' oven are each said to be equally capable of conversion to the new system. The condensed ammoniacal products and tar run off into pits, and take from a week to ten days to separate themselves, the tar sinking to the bottom. The coking operation occupies about three days. No practical difficulty attends the use of the new ovens, so that they will, no doubt, soon become general in this country, especially for the economic utilization of the large quantity of small coal with which many of the collieries are troubled.

"WARRIOR," "MINOTAUR," AND "BELLEROPHON."

THE Controller of the Navy reports the result of a recent trial of the speed of these three ships at the measured mile, and for six consecutive hours' steaming outside the Isle of Wight, in fine weather. The speed of the "Minotaur" at the mile was 14·411 knots per hour, but at the six hours' trial only 14·165; of the "Warrior," 14·079 and 13·936; of the "Bellerophon," 13·874 and 14·053. The indicated horse-power in the "Minotaur" declined from 6,702 at the mile to 6,193 in the six hours' trial; in the "Warrior," from 5,267 to 5,092; but the "Bellerophon" increased the horse-power from 6,002 at the mile to 6,199 at the six hours' trial, showing that if the expected horse-power were realized the calculated speed of the ship would be assured. The "Bellerophon" had the disadvantage of having been twenty-one days out of dock when tried for six hours, or twice as long in the water as the other two ships, at a time of year when the growth of weeds is very rapid. The Controller considers that these experiments prove that, with good coal and good stoking, there is but little difference between the result of a trial at the measured mile and one lasting for six hours on the open sea; that the bad performances of the "Warrior," "Minotaur," and "Bellerophon" during their cruise last autumn arose from causes over which the designers of these ships had no control, and that any judgment on their qualities dependent on such records would have been illusory and misleading.

THE COTTON MANUFACTURE IN SWITZERLAND.

ONE of the most important industries in Switzerland is the spinning and weaving of cotton. Spinning is chiefly carried on in the eastern part of Switzerland. The "Society of Arts' Journal" informs us that the total number of spindles in all the establishments amounts to 1,600,000, of which 607,082 spindles are in 78 establishments in the canton of Zurich; 266,805 in 22 establishments in the canton of Argovie; 200,000 in 12 establishments in the canton of Glaris; 172,136 in 20 establishments in the canton of S. Gallo; 109,800 in 4 establishments in the canton of Zug; 50,400 in Svitto; 42,800 in Turgovie; 31,600 in the Grisons; 30,000 in Bern; 22,768 in Soletta; 10,000 in the canton of Bale; 16,120 in Scaffhausen; and 6,016 in the canton of Lucern. The total number of workpeople employed in this manufacture is about 15,400, and adding the number of managers, the clerks, and other employés, and the families of the workpeople, about 30,000 persons may be said to depend on this industry for their livelihood. The annual production of the spinning mills in Switzerland is estimated at 338,630 quintals. In 1857, the exports of cotton yarn was 18,504 quintals against 4,818 imports; in 1863, 53,836 quintals exports against 47,475 quintals imports; and in 1866, 35,738 quintals exports against 16,686 imports. This decrease must not be attributed to a smaller production, for during the years 1864, 1865, and 1866, the imports of raw cotton and the exports of cotton goods had largely increased; it should rather be attributed to the greater development of the cotton weaving during the last few years in Switzerland, which has tended to augment the consumption of cotton yarn, and for this reason a greater quantity has been imported.

Correspondence.

TOWN REFUSE PRACTICALLY UTILIZED.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—We have for long turned some of the refuse of the metropolis into building material, and allowed the more offensive sewage to flow into the Thames without extracting its useful properties as a fertilizer. Of course, everyone has his own idea on the subject, and are more or less interested in the various schemes proposed. As far back as I can remember—indeed, for centuries—house refuse in its natural state has been collected in suitable ash-pits, the offensive being deodorized by the inoffensive. I need not state that this plan is not at all suited for large inland towns, as the ashpits could not be formed without giving offence, and any other means adopted is not at all calculated for civilized life; dry-earth closets and pneumatic scouring is only suited for conveniences when placed in a garden or outhouse; the latter plan, is, of course, less suited for the insides of our houses than the dry-earth system, as, in this steaming weather, the vapours arising would be very noxious; indeed, at this season of the year, we cannot get sufficient water to scour our present arrangements: what would it be with the dry method? Were such fitted, we would be forced to deluge the system with water to keep down the noxious gases, and, I have no doubt, the small pipes would soon become full. However, all plans are very good in their proper places. Now, this is not a subject that the metropolis groans under of itself alone, for the cry is raised through the length and breadth of the United Kingdom that sewage is wasted, and that, by a process of manufacturing cheaply, the poor of the parishes could be maintained by the crumbs, I may say, falling from the rich man's table. In this respect it becomes the bounden duty of the authorities of all towns to manufacture a manure cheaply for the farmers, and, by the sale of this manure, relieve the destitution that ofttimes visit, from the falling off of trade on the banks of the Thames. To manufacture a manure only requires the ashes and house garbage to be conveyed to Barking, and other places, and by properly mixing or straining the sewage through large filtering and retaining media, and by the application of the partially purified water to meadow land, the fluid may find its way into our rivers with impunity. And where land has to be reclaimed, or a farm to be manured, there will always be a demand for this cheap fertilizer. This simple plan is within the range of all; it has for long been adopted in the north, and, for peculiar soils, forms a capital manure. Other plans for collecting sewage may be adopted for other situations. We have been busily engaged for long excavating huge caverns underground; many of our coal pits are worked out, and what are we to do with these cool storehouses? Some may imagine they are warm, but they are mistaken; a nicer, cooler retreat I could not wish at the present moment, and I am not writing at random, as I have crawled about two miles through a mine without turning a hair, having been ofttimes knee-deep in mud. So I cannot see any objection why these worked-out mines should not be filled up with sewage, and after consolidating or settling at the bottom, and the fluid finding its way up an upcast shaft at a considerably lower level than the downcast shaft, this invaluable guano would thus be collected and worked out, and, by a method of surface filtering and retaining the solids, at certain seasons of the year the fluid could be simply poured down, and, as the fluid would filter upwards instead of downwards, the filtering media being placed in the upcast shaft, and at the bottom of the pit covering a large area, thus the particles of sewage would settle at the bottom, and the purified fluid may find its way into our rivers. Of course, many, from interested motives, will raise the cry, it is not practical to do so—the sewage would contaminate other works. That is not so clear in my mind, but I am inclined to think that it would not. We must all remember that our last resting place is but a few feet below ground, and that coal pits, and, I may say, these used-up caverns of solid rock, are, on the average, sixty fathoms deep. Hoping you can give space for this somewhat long letter, I will return to the subject, with your permission.—I am, Sir, yours, &c.,

JOHN G. WINTON.

London, June 23.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—C. E. J.—M. E.—C. H.—J. W.—T. C.—W. D. R.—J. C. B.—F. G. S.—E. C.—L. S. B.—S. K. M.—B. J.—W. H. H.—J. N.—G. E. P.—J. H. R.—C. R.—G. B.—R. T.—F. C. L.—W. O. R.—F. W. B.—E. T.—J. N.—J. G. W.—Messrs. M. and Co.—G. W. H.—R. H. S.—N. L. L.—J. J. J.—Messrs. S. Bros.

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Meetings for the Week.

MON.—Royal United Service Institution.—Captain E. A. Inglefield, R.N., on "Naval Tactics; with some Remarks on the Recent Experimental Cruising of the Mediterranean and Channel Squadrons." Captain Edmund Wilson, R.N., Will Exhibit and Explain certain Models Illustrative of his Plans for Armour-Plating, Working Heavy Guns, &c., at 8.30 p.m.

Naval, Military, and Gunnery Items.

PRINCE ARTHUR, who has received a commission as lieutenant in the corps of Royal Engineers, arrived at head-quarters, Chatham, on Tuesday, for the purpose of commencing his professional studies at the Royal Engineer establishment.

THE Council of the National Artillery Association have received from His Royal Highness the Prince of Wales his usual prize of £21, which will be added to the list for competition on Thursday, August 6, the day on which Her Majesty's prize will be shot for.

TO-MORROW—Saturday—the Lord Bishop of Chester will preside at the annual distribution of prizes on board the school frigate "Conway." The usual excellent accommodation, including a special boat, will be provided for visitors. Afterwards, his worship the mayor will entertain his lordship and a select party at dinner.

THE Prussian Government has authorized the Krupp establishment at Essen to execute a considerable order for cannons of cast steel on account of the Russian military administration, Russia being about to transform the whole of her artillery on the Prussian model. M. Krupp has gone to St. Petersburg in connection with this business.

THE standing orders for the volunteer artillery camp at Shoeburyness during the ensuing meeting of the National Artillery Association, the prize list, and order of firing, together with the terms of camp accommodation, &c., were issued on Saturday. Firing will commence on Tuesday, August 4, and continue till the 7th. The camp will be broken up on Saturday, August 8.

WE have to announce the death, from yellow fever, of Captain Blakeley, R.A., the inventor of the strengthened gun bearing his name, and which occurred on May 3, in Lima, Peru, whither Captain Blakeley had gone for the purpose of examining the condition of the guns furnished by him to the Peruvian Government, that did such good service during the engagement on May 2 with the Spanish fleet.

ON Saturday last two fine merchant vessels were launched at Rotherhithe, an event which, it is stated, has not occurred among the old shipbuilding yards of that district for about half a century. One of the vessels was a merchantman, called the "Mikado," 700 tons register, classed A1 for sixteen years at Lloyd's, and was launched from the yard of Mr. Walker, Lavender Dock, Rotherhithe. She has been constructed upon the composite principle, with the most recent improvements introduced into her build. The other vessel launched was the "Ruby," 266 tons register, built in the adjacent yard of Mr. Salisbury, at Rotherhithe, and is intended for the copper ore trade.

THE Admiralty lately effected the sale of an old ship out and out for £2,180. The fortunate purchaser extracted copper bolts, &c., therefrom £4,221 in value, which sum eventually was subtracted from the British exchequer "to repurchase the old stores bearing broad-arrow mark." The official comfort from this transaction, says the "Express," is that a clear gain still accrued to the Admiralty of £2,180, inasmuch as the copper bolts, &c., so repurchased for £4,221 would fully realize that amount in the open market. It would seem that, according to Admiralty arithmetic, a man who buys back a thing which he has given away is as well off as he was before he parted with it.

SEVERAL launches have recently taken place on the Clyde. Amongst others, Messrs. W. Denny and Brothers, of Leven, have launched an iron screw, named the "Abyssinia," built for the British India Steam Navigation Company. Her dimensions are 240ft. 6in. by 30ft. and 19ft. Her burden is 1,065 tons builders' measurement, and she will be supplied by Messrs. Denny and Co. with direct-acting surface condensing engines of 200-horse power nominal. Messrs. Wingate and Co, of Whitcinch, have launched a screw of 187 tons builders' measurement, named the "Celt," 100ft. by 20ft. and 10ft., and fitted with engines of 30-horse power nominal. Messrs. Randolph, Elder, and Co., of Glasgow, have launched a screw steamer of 1,339 tons builders' measurement, and 250-horse power nominal. This steamer, which has been named the "Biafra," is of the following dimensions:—Length over all, 285ft. 6in.; breadth, 32ft.; and depth (moulded), 20ft. 9in. The "Biafra" has been built for the African Steamship Company, and is intended for carrying mails to the West Coast of Africa. Her engines, which are being supplied by Messrs. Randolph, Elder, and Co., are on their patent compound high and low pressure principle, with surface condensers.

Miscellanea.

THE death is announced of Mr. G. Walker Arnott, professor of botany in the University of Glasgow.

THE Newfoundland seal catchers report having already secured 455,000, or upward of 1,000,000 dollars worth of seal this season.

THE lightning, during a recent storm, is stated to have melted upwards of 1,000ft. of telegraph wire in Illinois, in America.

AT Pilcot, in Hampshire, a tom-tit has built a nest in the post-office letter-box. It laid twelve eggs in less than a fortnight, and hatched nine of them.

THE curators of the University of Edinburgh have resolved to postpone the election of a principal till July 6. Dr. Calderwood, of Glasgow, has been elected to the chair of moral philosophy.

SPRING terminated on Sunday morning at 18min. past 4, and summer began astronomically, although the last-named season has anticipated the official date in bringing its characteristic heat.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending June 20, was 2,421; total number since the opening of the museum, free daily (May 12, 1858), 1,814,454.

A PROJECT is said to be on foot for holding a great demonstration at the Crystal Palace on an early day in July, "as a combined public manifestation of all classes on behalf of the scriptural faith restored to England at the Reformation."

THE Burlington and Missouri Railway is now finished to Afton, within a hundred miles of Omaha. Contracts will soon be taken for the construction of the road to that point, to be completed by July 1, 1869.

MR. GLADSTONE, as president of the Statistical Society, has selected from the council the following gentlemen to be vice-presidents:—Colonel Sykes, M.P., Dr. W. Farr, Mr. James Heywood, M.A., and Professor J. E. Thorold Rogers.

FROM a statement published by the Belgian Minister of Finance, the value of the 25-franc gold coins issued by the mint of that country in 1867 was 26,826,140 francs; the 5-franc pieces amounted to 18,465,720 francs; and smaller money to 14,737,000 francs.

THE "New York Evening Mail" says that the largest nail manufactory in the United States is located at Bontoon, N. J. The building covers six acres of ground. 1,500 cords of chesnut-wood are consumed each year in making kegs in which to pack the stock.

A CORRESPONDENT of the "Nord" mentions that the Emperor Napoleon is very fond of taking solitary walks in the Forest of Fontainbleau, and making experiments with Norton's tube well, which has been used with so much advantage in Abyssinia. It is said that his Majesty has discovered by its means a sulphur spring in the forest.

THE "British Workman" for July contains a highly interesting memoir of the late Lord Brougham, not in either of his capacities as the student of science, the writer, the lawyer, the orator, or the politician, but as the friend of the working classes. To the memoir is prefixed a splendid page portrait of his late lordship.

THE Society of Engineers will visit the Chatham Dockyard extension works on Friday next, July 3, by permission of the Lords Commissioners of the Admiralty. A special steamer has been engaged for the conveyance of the members and their friends, leaving Old Swan pier at 9 a.m., and Blackwall at 10 a.m. on that day.

A CATASTROPHE to art has occurred at the Palace of the Luxembourg in Paris. The plasterwork of the fine dome of the library, painted by Eugene Delacroix, has fallen down, and broken to pieces. The fragments have been carefully taken up and conveyed to one of the studios of the Louvre, where Count de Nieuwerkerke is having them placed together again.

THE trials of ploughs and field implements and the preliminary trial of steam cultivators in connection with the Leicester meeting of the Royal Agricultural Society will commence on Thursday, July 9, and will continue till Tuesday, July 14, on farms in the parishes of Knighton and Aylestone, about a mile south of the show-yard. The general meeting will commence on Wednesday, July 15.

THE visitors to the South Kensington Museum during the week ending June 20, 1868, were—On Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 8,032; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,875. National Portrait Exhibition, by payment, 2,093; total—12,000. Average of corresponding week in former years, 12,386; total from the opening of the Museum, 7,462,557.

From the report of the Auditor General of the State of Pennsylvania for the year 1867, we learn that more than two-thirds of the total tonnage of the railways of the State last year consisted of mineral products as follows:—Anthracite coal, 15,482,140; bituminous coal, 4,931,378; petroleum, 834,624; pig iron, 628,779; railway iron, 358,950; other iron or castings, 349,227½; iron and other ores, 1,501,564½; lime and limestone, 735,654½; total, 24,822,317½.

FROM 1857 to 1866, the length of telegraphs in British India increased from 4,162 to 13,390 miles. In the latter year the total expenditure for telegraphs amounted to £253,191, £48,067 of which was for cost of construction, £163,392 on account of working and maintenance, and £41,732 spent in England for stores, freight, &c. The total receipts for the same year amounted to £112,944, £101,306 of which were derived from private messages and other sources, and £11,638 from service messages of all kinds. There has been a large progressive increase of receipts year by year since 1857, except in 1860, and there are now 172 offices open throughout the country for the use of the public.

THE "U. S. Railway Journal" states that the Ringgold (Pa.) Iron Company proposes, under a patent which they hold, to manufacture blooms direct from the ore. One furnace erected last summer has been in successful operation ever since, and with the most flattering results. The company is now erecting five additional furnaces, making six in all, upon land lately purchased at Ringgold, in Jefferson County. The works will be erected contiguous to the Little Schuylkill Branch of the Reading Railway. The tract of land owned in connection with the works contains an abundance of iron ore and limestone.

A SERIOUS explosion of gas occurred at the Theatre Royal Preston, on the evening of Tuesday week. The stage foot-lights are supplied with oxyhydrogen, and this mixture of gases is kept in bags provided specially for the purpose on one side of the stage. Just previous to the commencement of the performance, a man named Catterall and some others were engaged in preparing for the ignition of the foot-lights by arranging the gas bags, &c., when two of them suddenly exploded. Catterall was blown some distance; his clothes were torn in several places, and he was considerably shaken and cut about the chin and face

ON Friday last, the Metropolitan Board of Works received tenders for the construction of that portion of the Thames Embankment (North) between the eastern end of the Inner Temple, and Blackfriars-bridge. They were as follows:—Messrs. Hill and Keddell, £179,000; Thomas E. Ridley, £173,500; Messrs. Eckersley and Bayliss, £159,000; Messrs. Jennings and Co., £146,659; T. Pearson, £144,000; Thomas Docwra and Son, £142,000; Messrs. Brassey and Co., £137,900; Messrs. Kelk, Waring Brothers, and Lucas, £127,000; W. Webster, £126,500. Mr. Webster's tender was accepted.

THE "Ararat Advertiser" records the progress of destruction of forests in that district as follows:—"In another year there will not be one of these trees in the whole district that has not been utterly destroyed by barking. Around the town of Ararat, and for miles around, the various centres of population in the district, there is hardly such a thing as a wattle tree to be seen. Within the last fortnight we believe not less than 500 or 600 tons of wattle bark passed through Ararat in waggons returning from up-country trips."

A NEW local industry, in the shape of a bone mill, has been introduced into Gipps Land. The want of a fertilizer more highly concentrated and richer in ammoniacal salts and the inorganic alkaline substances that give luxuriance to vegetation than the descriptions of manure hitherto available, has long, remarks the "Gipps Land Times," been experienced by the numerous farmers and general produce growers; and as it is universally confessed that the various preparations of bone manure possess combined these valuable properties, the erection of the requisite machinery for manufacturing the article will doubtless be highly appreciated.

GEOLOGICAL change appears to be more rapid, or more obvious, along the coasts of China and Japan, and the country to the northwards, than in other parts of the world. The changes that have taken place within the memory of man are almost incredible. The land is elevated, and gains on the sea. Mr. Bickmore, an American traveller, has made careful observations from Canton up to the mouth of Amoor river, and his general conclusion is that the facts, taken in connection with the dry beds of friths and bays along the Siberian borders of the Arctic Ocean, and the remnant of the old gulf that once washed the eastern flank of the Ural, enable the geologist to form an idea of the large increase of the Asiatic continent within a comparatively recent period.

A CORRESPONDENT of the "Illustrated Australian News" directs attention to a discovery of considerable importance—the existence of an extensive pearl fishery on the north-west coast of Western Australia. He describes the fishing ground as stretching along the coast no less than 1,000 miles. "There had been upwards of 60 tons of pearls obtained up to December, when circumstances obliged me to leave," he writes, "and these were purchased on the spot at the rate of £100 per ton. The banks at Perth will advance £100 per ton, not including the inside pearls, which are valued from £1 to £20 each. When I left the fishery there were about thirty men engaged in pearling. My shells have not reached Melbourne yet, but I will soon have them to submit for examination. I have also a small portion of shells worked, which I will also be glad to have inspected; and I will be glad to furnish any information upon the subject required."

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3493
BUILDINGS AND BUILDING MATERIALS—None.
CHEMISTRY AND PHOTOGRAPHY—None.
CULTIVATION OF THE SOIL, including agricultural implements and machines—3500
ELECTRICAL APPARATUS—None.
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3481, 3489, 3504
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—3499
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c—3486
GENERAL MACHINERY—3490, 3494, 3497
LIGHTING, HEATING, AND VENTILATING—3487
METALS, including apparatus for their manufacture—3502
MISCELLANEOUS—3484, 3485, 3491, 3493, 3496, 3498, 3501, 3503, 3505
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3482, 3488
SHIPS AND BOATS, including their fittings—None
STEAM ENGINES—3495
WARFARE—3492

3466 A. C. STERRY. *Improvements in engines worked by heated air or gas.* Dated December 5, 1867.

This invention has for its object the production of motive power by means of air or gas alternately heated and cooled in separate chambers, and always maintained at a pressure greater than that of the atmosphere, thereby admitting of an engine being driven by air or gas at a lower temperature than when the air or gas is admitted to the compressing pump at the atmospheric pressure, less heat being generated in this pump at the same pressure.—Patent abandoned.

3467 M. TILDESLEY and J. BIRD. *Improvements in annealing furnaces, and in apparatus to be employed therein, parts of which improvements may be applied to certain other descriptions of furnaces and fires.* Dated December 5, 1867.

This invention consists in constructing the firebars of annealing furnaces in such manner that they will slope downwards from front to back. At the bottom of the bars is a chamber some distance from the bottom of the hearth to receive the cinder, which can be withdrawn from the front of the bars; the open front above the bars can be closed up either with slack or with doors, or in any other suitable manner; and by thus constructing the firebars slack may be consumed instead of large coal.—Patent abandoned.

3468 T. J. LEIGH. *Improvements in furnaces, and in effecting the combustion of fuel therein.* Dated December 5, 1867.

This invention relates to a former patent, dated June 12, 1866 (No. 1594). In the specification of this patent the patentee described a method of burning certain combustible materials (such as coal dust, coke, coke dust, charcoal, wood, hydrocarbons, and gases) on and in a stratum, bed, or bath of molten iron, or other metal. In performing the present invention the patentee forms a chamber lined with firebrick, or other refractory substance, which chamber is closed in or arched over, except at two places on opposite sides, where apertures are formed, the one for supplying fuel, and the other for the exit of the flames. This latter aperture leads to the bed of a puddling or melting furnace, or around the sides or through the tubes of a boiler, where the heat is utilized. The chamber is formed with a partition, diaphragm, or hanging bridge which descends from the crown or roof of the chamber to a certain distance from the bottom. Molten slag or molten glass, or a bottom or bed plate of metal covered with molten slag or glass, occupies the bottom of the chamber to a level of a few inches below the partition or diaphragm. The chamber is thus separated into two compartments communicating with one another through the passage between the lower side of the diaphragm and the surface of the molten matters. The side of the first or feeding compartment is either vertical or inclined, and through this side he introduces a blast of air from a fan or other blowing apparatus. This may enter by one tuyere, but he prefers to make it enter by numerous tuyeres at suitable levels. At the top of this compartment he places a fuel hopper, where, by suitable mechanism, the fuel is passed as required for combustion into a shoot, and made to fall upon an inclined metal plate, and thence into the chambers. A stream of cold air is made to play upon the surface of the inclined plate so as to keep it cool, and assist the descent of the fuel into the feeding compartment. The fuel in descending through the compartment is mixed with the air entering by the tuyeres, and being kindled a continuous sheet of flame is thus made to pass over the surface of the molten matter into the other compartment of the chamber, where it issues to the furnace with which it is connected.—Patent completed.

3469 P. G. L. G. DESIGNOLLE and J. CASTHELAZ. *Improvements in the manufacture of explosive and fulminating powders.* Dated December 5, 1867.

The patentees claim the application in the manner described of picrate or carbazotate of potash, of the salts formed by picric or carbazotic acid, of the derivatives of this acid, of their salts, and of the acid itself to the manufacture of powders. They also claim the several compounds described.—Patent completed.

3470 E. A. PONTIFEX. *Improvements in condensers.* Dated December 5, 1867.

The patentee claims constructing surface condensers with pipes bent round so as to form limbs of equal or nearly equal lengths, as described. He also claims the combining surface condensers having pipes over which water is caused to trickle with injection condensers, as described.—Patent completed.

3471 S. GOLDSTEIN. *Improvements in various portions of ladies and gentlemen's wearing apparel.* Dated December 6, 1867.

The novelty of the invention consists in constructing a lady's skirt, when required as a waterproof skirt, in two parts, the upper portion being composed of any suitable material, to which is attached, by buttons or other similar fasteners, the lower portions of the skirt, which is composed of waterproof material, the reverse side of which may be ornamented so as to be worn in fine weather as an ordinary skirt.—Patent completed.

3472 J. W. KENYON and R. A. ARMISTRAD. *Improvements in safety apparatus for steam boilers or steam generators.* Dated December 6, 1867.

This invention is designed for the purpose of lessening the risk of the explosion of steam boilers, arising from a deficiency of water in the said boiler, and consists in an improved apparatus intended to discharge a portion of the water or steam, or of water and steam, into the furnace or furnaces at such times as the "water level" in the boiler is lowered to a dangerous extent.—Patent completed.

3473 J. DURRANS. *An improved material or composition to be employed for covering or coating the interior surfaces of moulds, crucibles, or ducts, previous to their receiving the molten metal in the process of casting, and for other purposes.* Dated December 6, 1867.

This composition consists of carbonized coal or graphite, which may be specially carbonized and pulverized or reduced to powder, and mixed with water or suitable liquid to make it into a paste or solution; or the carbonized coal may be obtained from the interior surface of retorts which have contained coal, and upon which it becomes encrusted. This solution or mixture is to be applied to the surfaces of moulds or channels requiring protection from the molten metal, and allowed to become dry and hard, when it forms a hard heat-resisting surface, and imparts to the casting a fine surface or finish, and when applied to the ducts or channels it assists the flow of the metal therein, and prevents adhesion of "slag" or refuse to the sides thereof.—Patent completed.

3474 C. KERRY. *Improvements in the combination of materials to be used for filtering liquids.* Dated December 6, 1867.

This invention consists in the combination of certain materials for the filtration of liquids, and by the employment of which that operation can be performed with great efficiency. A sheet of linen, calico, or any other textile or felted material possessing the requisite degree of strength and porosity or permeability, is covered with a layer of paper pulp, such as that of which ordinary filtering paper is manufactured, there being no size mixed therewith. Adhesion between the pulp and the fabric is obtained by subjecting the sheet or fabric so coated as before mentioned to the pressure of a hot roller. For the filtration of water containing organic impurities, charcoal in a pulverized state may be combined with the paper pulp, and in like manner other substances which are capable of acting upon the liquid or liquids under treatment, according to well-known chemical principles, may be beneficially combined with the pulp.—Patent abandoned.

3475 W. N. NICHOLSON. *Improvements in machinery for spreading grasses, part of which improvements are also applicable to machines for cutting and collecting grasses.* Dated December 6, 1867.

The first part of this invention relates to machinery for spreading grasses. On the axle of the machine, whether such axle be concentric or eccentric, the inventor mounts an eccentric cylinder or cylinders, and on the external part of such eccentric cylinder or cylinders the fork barrels are made to revolve. By moving such eccentric cylinder or cylinders round the axle, the fork barrels are thrown for either the forward or reverse motions, or are disengaged for travelling, at the same time the height of the fork barrels from the ground can be varied when it is desirable to do so. He also makes the ironwork by which the horse shafts are attached to these machines of channelled or grooved iron. The second part of the invention is for improvements in the travelling wheels of machines for cutting, spreading, or collecting grasses or corn. For the purpose of giving the wheels a firmer bite on the ground, so to increase their power of driving the machinery connected with the same, he makes projections either at right angles, or any other angle or curve, on the edge of the peripheries of the wheels, or makes such peripheries laterally of a zigzag form.—Patent abandoned.

3476 H. J. F. H. FOVEAUX. *An improved construction of cell for galvanic batteries.* Dated December 6, 1867.

This invention consists in constructing cells for galvanic batteries in such manner that, when the cell is in one position the fluid surrounds the battery metals, and when the cell is reversed, the fluid is out of contact with the metals.—Patent abandoned.

3477 F. ROPER. *Improvements in apparatus for driving straw elevators.* Dated December 6, 1867.

The patentee claims applying at the corner of a straw elevator, or, it may be, of a thrashing machine, guide pulleys which are adjustable up and down, so that their position may be suitably intermediate of the driving and the driven pulleys, and so that their axes may be set at right angles to the driving band as it passes on to them. He also claims the application to the straw elevator of a swinging bracket with guide pulleys upon it, so that, by the movement of the said bracket on its centre, the guide pulleys may be transferred from one side of the machine to the other, as may be required. He also claims the general arrangement of the apparatus, substantially as described.—Patent completed.

3478 J. EVANS. *Improvements in couplings for railway trucks.* Dated December 6, 1867.

By this invention the trucks can be coupled without the person effecting the coupling placing himself between the trucks. On that end of the truck which carries the links by which one truck is connected to the back of the next one, the inventor fixes an axis, the said axis being parallel with the end of the truck, and at about the level of the bottom of the truck. The axis has a length somewhat greater than the width of the truck, and has a lever or handle at either end, by which it can be partially turned. Besides a rotary motion, the axis has a sliding motion, that is, a motion in the direction of its length. One or more coiled springs surrounding the axis bring it back to its normal position after it has been moved in the direction of its length. Near the middle of the axis two arms are fixed, the said arms being of a length nearly equal to the length of the coupling chain, or series of links, one of which is hooked to the hook of the next truck. The arms are jointed in the middle, the joint allowing the ends of the arms to rise out of the plane of the other part, but not to descend beyond the line of the other part. These arms are situated respectively on either side of the coupling links, and the extreme ends of the arms are connected with the last link by means of pins on the sides of the link engaging in slots in the ends of the arms. In using the coupling, the axis is turned by one of the levers or handles, and the arms raised somewhat beyond a horizontal position, the axis being at the same time made to slide a short distance in the direction of its length. The end link is thereby raised to a greater height than the hook with which it is to be coupled, and in rising is sufficiently on one side of the said hook to escape it. By now allowing the axis to slide back into its normal position, the link is brought over the hook, and on depressing the handle or lever it falls on to and engages with the said hook, and the coupling of the trucks is complete.—Patent abandoned.

3479 R. JONES and J. ABRAHALL. *Improvements in the manufacture of hollow metallic seamless spheres and ornaments.* Dated December 6, 1867.

This invention has for its object the manufacture of the said spheres and ornaments of thinner metal than can be employed in manufacturing them according to the ordinary method. The invention is also applicable to the manufacture of hollow metallic spheres and ornaments of other metals than gold.—Patent abandoned.

3480 R. W. LINDSAY. *Improvements in machinery for the manufacture of brass and copper tubes.* Dated December 6, 1867.

Here two or more brass or copper tubes can be simultaneously drawn at one draw bench. In arranging or combining the parts of machinery for the simultaneous drawing of two brass or copper tubes, the inventor affixes to the chain by which the drawing is effected a block or waggon, in which two recesses are made for the reception of two pairs of clips or forceps, which grip the mandrils during the drawing process. Or, when tubes are drawn without mandrils, he employs compound plyers or forceps of the kind hereinafter described. The draw plates which he employs consist of square plates of steel, having holes in them of the ordinary kind, the holes through which the two tubes are drawn being made in separate plates. These plates are supported in an upright in a groove in which the said plates are introduced and fixed. The plates have a slight play in the groove, in order to allow them to take an exact position with respect to the clips or forceps during the drawing. The compound plyers or forceps have a movable tongue or projection inserted between their blades. In using these plyers or forceps the movable tongue or projection is placed between the two tubes, and the blades of the forceps or plyers are placed on the outer sides of the two tubes. On closing the said forceps, and fixing them to the drawing clam, the tubes to be drawn are gripped between the blades of the plyers or forceps and the movable tongue or projection. The tubes to be drawn having been passed through the holes in the draw plates, and the tubes or mandrils gripped by the clips or plyers or forceps, the drawing is effected in the ordinary manner.—Patent abandoned.

3481 C. BRAZIL. *Improvements in machinery for sizing cotton and other yarns.* Dated December 7, 1867.

The invention is applicable to the sizing machines known as "tape legs" and "slashers," and consists in an improved combination of a revolving cylindrical brush with one or more revolving smoothing guard rods, a revolving presser rod, and one or more revolving opening rods. The yarn on leaving the size box passes over the first guard rod, then over the brush and under the presser rod, then over the second guard rod, and then it passes to the drying cylinder, being divided into two or more parts by the opening rod or rods. The depth of penetration of the bristles of the brush through the yarn is governed by a regulating set screw passing through the lever in which the press rod revolves.—Patent abandoned.

3482 P. R. HODGE. *Improvements in machinery and apparatus for heating and forming of metals.* Dated December 7, 1867.

This invention relates, firstly, to a peculiar construction, arrangement, and conformation of apparatus for reheating railway wheel tyres, more especially that form of tyre used on a railway wheel patented by Brookes, October 7, 1859 (No. 2286). This peculiar form of wheel tyre has first to be shrunk on to the wheel rim, and afterwards a lip has to be turned down over the bevel part, making the tyre perfectly secure without the use of bolts or rivets. The improved method is to reheat this lip by the agency of a series of compound jets of carburetted hydrogen gas and common air in their proper equivalents, or by any other combination of hydrocarbons in connection with superheated steam or gas, to produce the most intense heat. These jets are brought to bear and impinge on the lip around the periphery.—Patent completed.

3483 R. B. JONES and W. POWELL. *Improvements for the prevention of incrustation in steam boilers.* Dated December 7, 1867.

The patentees claim attracting or collecting the electricity generated in the interior of such boilers, and conducting it to their shells. Also the generator for the prevention of incrustation of steam boilers having conductor points proceeding from its circumference towards the centre, and platina wire or band at its periphery.—Patent completed.

3484 J. B. MORRISON. *Improvements in the construction of operating chairs, more especially designed for dentists, parts of such improvements being applicable for other purposes.* Dated December 7, 1867.

This invention consists, chiefly, first, in a novel mode of raising and lowering a chair or other article; second, in certain novel means for adjusting and securing the same at any required angle; third, in constructing an operating chair with arms adjustable in reference to the seat of the same; fourth, in a novel mode of adjusting the back and arms with reference to the seat; fifth, in the novel construction and manner of adjusting the head rest of an operating chair; and, sixth, in so constructing and combining these various parts in a chair as to enable it to be adjusted to adapt it to adults or children.—Patent completed.

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3485 O. BARRETT and H. LEGGOTT. *An improved knife cleaner.* Dated December 7, 1867.

This invention consists in the employment of one, two, or more cylindrical brushes having leather, buffalo hide, or other suitable substance introduced betwixt the bristles, such brush or brushes being enclosed in a box or casing, so as to be capable of receiving rotary motion. Also in having pads pressed by springs into contact with the surface or surfaces of the said brush or brushes, and removed from contact by cam, lever, or other suitable means for introduction or withdrawal of the knives.—Patent completed.

3486 J. BLAKEY and H. B. FOX. *Improvements in collars, cuffs, anklets, belts, and other like articles of wearing apparel.* Dated December 7, 1867.

The articles made according to this invention may, in short, be said to consist of a flexible picture frame and picture, the edge of the frame being sufficiently flexible to allow a slip or leaf (which is really the representative of the picture) to be easily fitted in and removed, the former being so shaped as to hold the latter securely in position when the article is in use.—Patent completed.

3487 J. PARTINGTON. *Certain improvements in the method of heating buildings, and in the apparatus connected therewith.* Dated December 7, 1867.

This invention consists in the use and application of an air chamber or vessel or vessels situated behind the fire, so as to form the back of the grate in cellars, kitchens, or other suitable positions. The chamber may be of any convenient form, and made of metal, brick, fireclay, or combinations thereof, and from below it is supplied with cold air by means of a pipe and regulating valve, and on the air becoming heated by the action of the fire it ascends up a pipe applied to the upper part of the chamber, which extends up the chimney, and is carried into the various rooms at different heights by branch pipes, which may be opened to allow the hot air to escape into the room, or the heat may be obtained by radiation only.—Patent abandoned.

3488 J. RAE and G. MILLER. *Improvements in railway wheels.* Dated December 7, 1867.

This invention is not described apart from the drawings. —Patent completed.

3489 W. CLISSOLD. *Improved machinery for preparing fibrous substances for spinning.* Dated December 7, 1867.

This invention consists in the applications to the feeds of carding engines or preparing machines of certain means for neutralizing the contractile force of the fibres as they are presented to the feed rollers, thus insuring a more uniform breadth of feed than has heretofore been obtained.—Patent completed.

3490 J. BEATTY. *A new or improved candle-dipping machine.* Dated December 7, 1867.

The patentee claims the general arrangement and combination of parts for dipping candles, whereby they are alternately dipped at each end of the machine, and especially the railway principle as applied to the dipping of candles, viz., the motion of the candles to and from the dipper by any kind of carriage or carriages on fixed declining rails, whereby the candles become cool in their transit, and ready for fresh dipping, substantially in the manner specified.—Patent completed.

3491 C. M. BARKER. *Improvements in socket and flange spigot pipes.* Dated December 7, 1867.

The patentee claims, first, the combination of screwed flanged spigots, and their flat or taper sealing surfaces, with internal screwed sockets, and their corresponding taper cavities, for the purpose of making tight joints in gas and water pipes, by enclosing and compressing any cement, soft lead, or other equivalent material between the junction surfaces, substantially as described. Second, the use of hexagonal or flat-sided bands cast on the pipes for the purpose of presenting flat surfaces, which, together with the back or check nuts, effectually provide for screwing in service pipes without danger of leakage, substantially as described.—Patent completed.

3492 R. WARRY. *Improvements in the construction of breech-loading firearms.* Dated December 7, 1867.

This invention consists in certain improvements in the construction of breech-loading firearms in which the breech-block is hinged at the side of the barrel, and in which central-fire ammunition is employed. The breech-block is of the description known as a "solid" breech-block, and is fixed to a spindle or pin which is mounted in suitable bearings formed on or attached to the exterior of the barrel and breech-plate, and in which it is free to move, thus forming a hinge for the breech-block. The hinge is, by preference, placed on the side of the barrel opposite to that on which the hinge of the breech-block is placed in the "Snider" system of breech-loading firearms, but it may, if desired, be similarly placed; a hole is drilled or formed through the centre of the breech-block, in which is placed the striking piston, or that by which the centre of the cartridge head is percussed, the same working in a direct line coinciding with the axis of the barrel, whilst at the same time it performs the office of a locking bolt for the breech-block. The rear end of the striking piston is formed with a conical base, which is capable of fitting into a corresponding recess formed in the centre of the breech tang or plate. The piston is surrounded by a helical or spiral spring, which is compressed when the piston is forced forwards, and serves to restore the latter to its normal position upon the pressure being removed, when the conical base of the piston, or a portion thereof, enters the before-mentioned recess in the breech-plate and locks the breech-block. The striking piston is actuated in the following manner:—The patentee employs a lever, one end of which is hinged to or placed in the before-mentioned spindle or hinge pin in the rear of the breech-block, and across the breech chamber, the same being constructed with a bevelled face corresponding with and working on the upper portion of the conical base of the striking piston. This lever, upon the hammer being released, is struck thereby, and, pressing upon the conical base of the striking piston, forces the latter forward, thus percussing the centre of the cartridge head, and causing ignition of the ammunition. The hammer is provided with a projecting "nose," which latter, upon the gun being discharged, fits into a slot or hole formed in the breech-block, or in a piece of metal attached thereto, and which before discharge receives a stud or projection upon the transverse lever. Upon discharge taking place, the latter is depressed, and the "nose" of the hammer entering the before-mentioned slot or hole firmly holds the breech-block in the chamber, and prevents any possibility of the same being forced open by any explosive power which may be exerted thereon. In order to extract or remove the expended cartridge case after the discharge has taken place, he adopts the following arrangement:—A small barrel or tube is placed over the partially revolving spindle or hinge pin to which the breech-block is attached, such barrel or tube being free to move thereon, and having formed therein an oblique or inclined groove or slot in which a pin or stud fixed on the spindle works. The barrel or tube is furnished with a projection which acts as the draw cartridge or extractor. Upon the breech chamber being opened by the raising of the breech-block, the barrel or tube carrying the draw cartridge or extractor is by the partial revolution of the spindle or hinge pin, and the stud fixed thereto working in the groove or slot in the barrel or tube, caused to recede from that part of the barrel of the gun which receives the cartridge. When it is desired to use the gun, the cartridge is placed in the breech chamber, and moved forwards into the barrel, the rim of the cartridge head being pressed upon the extractor which is carried forward by the closing of the breech-block. The gun having been discharged, the breech-block is turned back by means of a thumb-piece attached thereto. The barrel or tube to which the draw cartridge or extractor is fixed is thereby actuated, and the cartridge case withdrawn, thus obviating the necessity of a separate movement for that purpose.—Patent completed.

3493 A. M. CLARK. *Improvements in orthopedic apparatus for the prevention and treatment of spinal diseases.* (A communication.) Dated December 7, 1867.

This apparatus consists of a kind of chair mounted on castors, in which a child may either sit or stand, and move in any direction. The shoulders are supported by arms so as to keep them raised without inconvenience, while the head is also supported by a ring and elastic network, which, without preventing any natural movements, at same time relieves the weak parts.—Patent abandoned.

3494 J. A. MUNN. *An improved weighing apparatus.* Dated December 7, 1867.

This invention relates to a weighing apparatus wherein flat springs are used in connection with a dial to measure the weight, and is more especially adapted for use in kitchens, grocers' shops, and other places where small articles or quantities of material are weighed. The invention consists, first, in the employment of a flat spring; or springs with edges concave, or so curved that they shall gradually decrease in width from the ends towards the centre, thereby ensuring the bending of the said springs in lengthened curves, and preventing their breaking off at the ends or points of suspension. Second, in the combination with the said flat spring or springs of adjustable short pieces for increasing or diminishing the length, and, consequently, the stiffness of the spring or springs, to make their action conform to that of the pointer on the dial, so that the latter shall indicate correctly. Thirdly, in the combination with the said flat springs and dial of a set screw for adjusting the rack to set the pointer on the said dial at the proper position, whereby any slight variation in the position in the pointer when at rest may be corrected.—Patent abandoned.

3495 E. KEIRBY. *Improvements in elastic packings for the pistons of steam engines and for other purposes, and in the machinery employed in the manufacture of such packings.* Dated December 9, 1867.

This invention is not described apart from the drawings. —Patent completed.

3496 W. H. COOKE. *Certain improvements in springs to be applied to doors, and for similar purposes.* Dated December 9, 1867.

This invention consists in applying to one end of the ordinary rod or wire a small wheel, the periphery being slotted, drilled, or ratchet toothed, into which slots, holes, or teeth a sliding plate or bolt is introduced, to retain and prevent the wheel yielding to the torsion of the spring and turning, the fitting supporting the end of the wire and wheel being so arranged that the retaining plate or bolt enters into or passes through it, so as to form a strong support for the end of the plate or bolt. Thus, by forming the extremity of the wire square, and applying a key, having previously removed the plate or bolt, the wire may be twisted to an extra degree than when originally fitted, and by replacing the plate the extra torsion remains; or the direction of the torsion may be reversed; or by removing the plate or bolt the wheel wire turns in the fitting without any torsion.—Patent abandoned.

3497 W. CLAPPERTON. *Improvements in machinery for shaping cask headings and similar articles.* Dated December 9, 1867.

This invention is not described apart from the drawings. —Patent completed.

3498 W. CLARK. *A new instrument for clipping or shearing horses or other animals, also applicable to other similar useful purposes.* Dated December 9, 1867.

This invention consists in the arrangement of two steel blades having cutting edges, one of which blades has a comb or series of prongs attached to its back surface arranged along and projecting beyond the cutting edge thereof, while the other blade is made to pass backwards and forwards over the front surface of the first-named blade in such a manner that the cutting edges of the two blades operate with a shearing action in front of the comb. —Patent completed.

3499 L. ROSE. *An improved mode of preserving vegetable juices.* Dated December 9, 1867.

Here the patentee prepares lime juice, lemon juice, and other vegetable juices or medicaments, by employing sulphurous gas, either free or combined (as, for instance, as a sulphite or bi-sulphite).—Patent completed.

3500 W. R. LAKE. *Improvements in excavating machines, more especially designed for making ditches and drains.* (A communication.) Dated December 9, 1876.

This invention consists, first, in so arranging the driver's seat that his weight shall counterbalance that of the plough whereby the earth is loosened. Second, in combining with a flanged wheel two revolving belts between which the earth is elevated when loosened by the plough. Third, in a mode of regulating the depth of the cut, and at the same time changing the seat of the plough point. Fourth, in the substitution of guides for the land sides in common use. Fifth, in a mode of regulating the delivery of the earth excavated. Sixth, in a device for raising the machinery in turning; and also in that for raising the entire machine except the wheels. Seventh, in the use of an adjustable shoe for finishing the ditch to receive drain tiles. Eight, in so constructing the frame that, by folding the same, the distance between the wheels may be made wider or narrower. Ninth, in a mode of suspending the ploughs and frames so as to permit the said ploughs to work at a constantly increasing depth below the surface of the earth. Tenth, in the attachment of the draught at whatever depth the plough may be working. Eleventh, in arranging the plough and the parts connected therewith so as to loosen the earth and throw it between the elevating belts. The machine is more expressly designed for making ditches and drains. Reference to the drawings is essential to a full description of the invention.—Patent completed.

3501 H. BESSEMER. *Improvements in the manufacture of fire-bricks, tiles, and solid or hollow fire-lumps, and in the manufacture of retorts, pipes, crucibles, or other hollow vessels or moulds required to resist a high degree of heat.* Dated December 9, 1867.

The patentee claims, first, the manufacture of fire bricks, tiles, and solid or hollow fire lumps, retorts, pipes, crucibles, and other hollow vessels or moulds required to resist heat, by moulding or forming such articles in granulated burned clay, or in a mixture of clay and other materials that have been previously subjected to a red heat, and causing such granulated materials to cohere by the employment of a soluble silicate acted on by chloride of calcium, in the manner described. Second, the manufacture of ornamental bricks, tiles, quarries, trusses, bases, vases, busts, figures, columns, capitals, bases, cornices, copings, tablets, finials, and other articles of a similiar character employed in building and architectural decorations, by moulding or forming such articles in granulated burned clay, or in a mixture of clay and other materials that have previously been subjected to a red heat, and causing such granulated materials to cohere by the employment of a soluble silicate acted on by chloride of calcium in the manner described.—Patent completed.

3502 C. MARTIN, W. BARRETT, and T. S. WEBB. *Improvements in the treatment and reduction of titaniferous iron ores, and in the manufacture of iron, and in the construction of furnaces to be employed therein.* Dated December 9, 1867.

This invention mainly relates to certain improvements in the treatment of ilmenite, iserine, and other titaniferous iron ores, whereby the same can be more efficiently reduced than by the processes previously adopted, and also to the construction of furnaces for such purposes. The blast furnace or cupola which is employed for the reduction of the ore should be charged in the ordinary manner, and in the order and approximate portions stated in the specification. The details of the invention are voluminous.—Patent abandoned.

3503 C. KERBY. *Improved apparatus for filtering liquids.* Dated December 10, 1867.

We cannot here give space to the details of this invention.—Patent abandoned.

PROVISIONAL PROTECTIONS.

Dated February 6, 1868.

400 G. Roper, Bank House, Aylsham, Norfolk. **An improved screw propeller.** (A communication.)

Dated February 14, 1868.

501 W. E. Gedge, Wellington-street, Strand. **A process having for object the separation of animal from vegetable substances in textile fabrics, rags, or any other material containing them.** (A communication.)

Dated February 20, 1868.

565 W. Weldon, Park Villa, West Hill, Highgate, Middlesex. **Improvements relating primarily to the manufacture of chlorine by means of regenerated oxides of manganese.**

Dated March 14, 1868.

874 J. Petrie, jun., Rochdale, machine maker. **Improvements in machinery for washing wool and other fibrous materials.**

Dated March 24, 1868.

988 G. B. Paterson, Arnold's-place, Francis-street, Walworth, Surrey, machinist. **Improvements in gas meter indexes.**

Dated April 11, 1868.

1215 E. Dubois and E. Casper, Cannon-street, City, merchants. **Improvements in wet gas meters.** (A communication.)

Dated April 18, 1868.

1273 J. E. F. Ludeke, New Cross-road. **Improvements in machinery for obtaining motive power.**

Dated April 24, 1868.

1348 J. Liddard, Birkenhead, Chester, engineer, and G. Buxton, engineer. **Improvements in rails and chairs of railways, and in the method of adapting railway chairs to rails.**

Dated May 6, 1868.

1487 F. T. Hall, Gray's Inn-square. **Improvements in the manufacture of railways and other like tickets to adapt the same as mediums for advertisements.** (A communication.)

Dated May 13, 1868.

1560 M. Seß, Old Broad-street, City, engineer. **Improvements in the method or means for preventing the corrosion or incrustation of marine and other boilers.**

Dated May 16, 1868.

1616 G. Smith, Coalville, Leicestershire. **Improvements in pressing and finishing hollowed or chambered bricks and blocks, either of plastic materials or powdered clay dust, for building purposes, and in the apparatus employed therefor.**

Dated May 19, 1868.

1634 D. Riddell, Glasgow. **Improvements in the manufacture of bread, biscuits, and other preparations from flour, also in the manufacture of flour to be used therefor.**

Dated May 23, 1868.

1695 E. Jones, Redcliffe-street, Bristol. **Improved shadowless lamps.** (A communication.)

Dated May 25, 1868.

1708 T. Craig, Carey-street, Lincoln's Inn. **Improvements in the means or apparatus for hanging and supporting windows, doors, shutters, and other such like movable fittings in houses, vehicles, steamboats, and other places or structures in which such fittings are used.**

1720 H. A. Dufrene, South-street, Finsbury, London. **Improvements in the construction of railway wheels, pistons, and other articles made of wrought iron.** (A communication.)

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Dated May 26, 1868.

1724 J. Adams, Cork. Improvements in machinery for washing or cleansing casks or barrels.

1729 J. Morgan, Kidderminster, Worcestershire, manager of works. Improvements in apparatus for regulating the temperature of and ventilating hothouses, conservatories, and other rooms and buildings.

Dated May 28, 1868.

1752 J. Reidy, Doddington-grove, Kennington Park, Surrey. An improved pick or pickaxes for excavating, mining, and other purposes.

1753 H. and F. Bailey. East Retford, Nottinghamshire, gas engineers. An improvement in the manufacture of valves for the passage of air, water, or any other liquid or fluid.

1755 W. Dalziel, Deptford, Kent, brass founder. An improved combination of cock and valve for controlling the flow of water from constant supply pipes.

1757 T. Drake, Huddersfield. A machine or apparatus to be employed for receiving communications, orders, messages, and appointments.

1759 W. E. Newton, Chancery-lane. Improvements in horse rakes. (A communication.)

1761 T. Greenwood, Leeds, machinist. Improvements in machinery for assorting the fibres of dressed silk. (Partly a communication.)

1763 J. R. Hambling, Norwich-road, East Dereham, Norfolk. Improvements in thrashing machines.

Dated May 29, 1868.

1769 W. Maclean, Glasgow. A new or improved process to be used for producing or depicting designs on textile fabrics.

1771 J. Drabble, Hasland, Derbyshire, and J. S. Raworth, Manchester, engineer. Certain improvements in machinery for the manufacture of roll or twist tobacco.

1773 J. B. Gardner, Kendal, Westmoreland, tobacconist. An improved machine for sifting pulverized tobacco in the manufacture of snuff.

1775 J. Nuellens, Torquay, Devonshire, and M. Neuhaus, urrey-street, Strand. Improvements in portable apparatus for cooling wines or other liquids in bottles or other like receptacles.

1776 L. Hamel, Stoney-street, Nottingham. Improvements in instruments for clipping lace and other fabrics.

Dated May 30, 1868.

1779 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in machines for stitching or sewing the edges of button, eyelet, and other holes in cloth, leather, and other materials, and for stitching or sewing the edges of cloth, leather, and other materials generally. (A communication.)

1780 A. Smith, Glasgow, merchant. Improvements in apparatus for the manufacture of sugar. (A communication.)

1781 R. Luthy, Bolton, Lancashire, engineer. Improvements in the construction and mode of working hydrostatic presses and hydraulic machinery.

1782 T. Burrow and S. Keith, Glasgow. Improvements in weaving, and in the machinery or apparatus employed therefor.

1784 J. Harman, Portman-square, London. A new or improved drawing board for the purpose of stretching drawing paper.

1785 H. Hirzel, professor of chemistry, Leipzig, Saxony. Improvements in the production of inflammable gas, and in apparatus to be used therefor.

1786 N. D. Spartali, Liverpool, steam ship agent. Improved apparatus for consuming hydrocarbon oils in the furnaces of marine and other boilers.

1787 J. B. Harris, Edinburgh. Improvements in pumps for actuating the pulp in paper-making machines.

1789 R. Turner, Dublin, civil engineer. Improvements in the manufacture of umbrellas.

1790 T. Field, Lambeth, Surrey, engineer. Improved arrangements for manœuvring gunboats and other floating vessels.

1791 C. E. Brooman, Fleet-street, City, patent agent. Improvements in the manufacture of central-fire cartridges. (A communication.)

1792 Rev. O. Reynolds, Debach, Woodbridge, Suffolk, M.A. Improvements in apparatus for steam ploughing or cultivating.

1793 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in spirit levels. (A communication.)

Dated June 1, 1868.

1795 J. B. Farrar, Halifax, machine maker. Improvements in, or applicable to, machinery or apparatus for spinning or twisting fibrous substances.

1796 D. Jones, Church-street, Inverness, mechanical engineer. Improvements in furnaces and heating apparatus, having reference to the consumption or prevention of smoke.

1797 G. P. Reed, Boston, Suffolk, Massachusetts, U.S. Improvements in watches.

1798 R. W. Page, Park-walk, Chelsea, Middlesex. Improvements in the construction of hand garden engines and hydropults.

1799 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the manufacture of alum and other aluminous compounds. (A communication.)

1800 C. H. Wells, New York, U.S. A new and improved mode of impregnating wood with oleaginous and saline matters. (A communication.)

Dated June 2, 1868.

1802 J. Tate, Bermondsey, Surrey, machine fitter. A new or improved method of manufacturing points for railways.

1805 J. Avery, Great Portland-street, Marylebone, Middlesex. An improvement in apparatus employed in raising and lowering Venetian blinds, and retaining them in position.

1807 G. A. H. Lillie, of the Junior United Service Club, St. James's. Improvements in street paving.

1809 W. E. Newton, Chancery-lane. Improvements in cans and other vessels for containing liquid and other substances. (A communication.)

1810 J. Law, Edinburgh, dental instrument maker. A new or improved instrument for drawing corks from bottles.

1811 L. Sterne, Great Queen-street, Westminster, engineer. Improvements in the manufacture of driving belts, bands, or straps.

1812 F. Schafer, Piccadilly, manufacturer. A new or improved apparatus for removing wax and dirt from the tops of corks in bottles, and the combination of such apparatus with an appliance for drawing the corks.

1813 F. Roe, Cambridge-terrace, Notting-hill, Middlesex An improvement in smoking pipes, which invention is also applicable to cigar holders.

Dated June 3, 1868.

1814 R. Soans, Stockton-on-Tees, Durham, commercial traveller. Improvements in machines for removing dirt and foreign matters from currants and other fruit, and for afterwards drying the fruit.

1816 J. H. Johnson, Lincoln's Inn-fields. Improvements in pipe joints. (A communication.)

1817 J. H. Johnson, Lincoln's Inn-fields. Improvements in railway trucks or vehicles. (A communication.)

1818 L. W. Wright, Brooklyn, New York, U.S.A. Improvements in meters for water and other liquids.

1819 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the production of iodine. (A communication.)

1820 H. J. Crockett, Kent Villas, Grange-road, East Dalston, Middlesex. Improvements in Venetian blinds, part of which improvements is also applicable to roller blinds.

1823 E. Fairburn, Kirklees Mills, Mirfield, Yorkshire, card maker. Improvements in condensers for working wool or other fibrous substances.

1824 W. E. Everitt, Birmingham, manufacturer. An improvement or improvements in the manufacture of tubes for marine boilers, surface condensers, and other similar purposes.

Dated June 4, 1868.

1826 W. Rye, Low Moor Iron Works, Oldham, Lancashire. Improvements in apparatus for supplying fuel to steam boiler and other furnaces.

1827 D. Foster, Sheffield, engineer. Improvements in combining and casting various qualities of metal in the manufacture of anvils, top and bottom faces for hammers for drawing-out purposes, projectiles, and other articles.

1828 G. Hartley and P. Robertshaw, Bradford, Yorkshire. Improvements in the construction of steam boilers and generating apparatus in connection therewith.

1830 M. Rives, Rue St. Antoine, Paris, merchant. An improved ship's block.

1831 C. E. Brooman, Fleet-street, City, patent agent. Improvements in apparatus for the manufacture or production of carbonic oxide, hydrogen, and carbonated hydrogens. (A communication.)

1832 F. Schafer, Piccadilly, manufacturer. A new or improved appliance for holding a stick of sealing wax.

1833 C. E. Brooman, Fleet-street, City, patent agent. Improvements in the manufacture or transformation of iron and steel, and in apparatus employed therein. (A communication.)

1835 J. Ashton, Fleet-street, City. Improvements in horse shoes.

1836 J. Worth, card maker, and A. Barker, plumber, Rochdale, Lancashire. Improvements in covering rollers and clearers used in machinery for preparing and spinning fibrous materials.

1837 J. Petrie, jun., machine maker, and J. Fielden, engineer, Rochdale, Lancashire. Improvements in obtaining hydraulic motive power, which improvements are also applicable to the propulsion of vessels by jets or streams of water.

1838 N. Salamon, Ludgate-hill, City, sewing machine factor. An improved mode of mounting photographic and other pictures, patterns, and advertisements. (A communication.)

1839 W. Firth, Burley Wood, near Leeds. Improvements in deodorizing petroleum and other oils.

Dated June 5, 1868.

1841 M. Henry, Fleet-street, City. Improvements in converting basic phosphates of lime into soluble acid phosphates of lime, and in obtaining and utilising sulphate of lime. (A communication.)

1842 A. M. Clark, Chancery-lane. Improvements in combination locks. (A communication.)

1843 J. Page, Mott-street, Birmingham. Improvements in corkscrews.

1844 C. D. Abel, Southampton-buildings, Chancery-lane. A new or improved stopping motion for spinning machinery. (A communication.)

1847 T. C. Gregory, Glasgow. Improvements in and connected with springs to be applied to railway rolling stock and otherwise. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated June 12, 1868.

1924 G. Davies, Serle-street, Lincoln's Inn. Improvements in cranes. (A communication.)

Dated June 13, 1868.

1943 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for hulling or scouring wheat and other grain. (A communication.)

Dated June 15, 1868.

1947 W. Leonard, Massachusetts, U.S. An improvement in horse collars.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," June 23, 1868.

431 W. Richardson. Machinery for the manufacture of combs to be used in carding engines.

436 J. A. Nicholson. Water-closets.

446 W. R. Lake. Machine for cleaning grain. (A communication.)

448 G. Jessop and B. Senior. Machinery for preparing wool.

456 T. Smith. Steam engine counters.

460 J. R. Stoney. Appliances for the consumption of smoke.

466 J. S. Williamson. Drying machinery.

468 W. T. Woolley. Fastenings for purses

478 S. B. Tucker. Cartridge boxes. (A communication.)

487 W. E Deverna. Fastener, applicable as a substitute for buckles.

496 H. A. Bonneville. Compound of aniline colours. (A communication.)

497 H. A. Bonneville. Moderator. or carcel lamps. (A communication.)

498 A. Lemasson. Construction of indicators for showing the distance travelled by cabs, &c.

501 W. E. Gedge. A process for the separation of animal from vegetable substances in textile fabrics. (A communication.)

503 G. V. Wisedill. Ring for keys.

508 D. Whittaker. Healds or heddles and other parts of looms.

511 E. Cottam. Breech-loading firearms.

514 J. Barlow. Carriages. (Partly a communication.)

525 J. Walker. Manufacture of ornamental tiles.

526 A. M. Dufilhol. Method of shoeing horses.

534 C. E. Brooman. Breech-loading firearms. (A communication.)

539 W. Weild. Process of treating sewing threads.

543 T. Beeley. Keirs.

544 B. Blezard. Machines for cleaning wheat.

548 E. W. Young. Construction of bridges.

578 L. M. Becker. Manner of indicating the position and supply of fire plugs.

600 S. Firth. Machinery for cutting coal.

603 R. Heathfield. Cut nails.

606 A. Stenger. Umbrellas.

620 J. Elce. Lubricating the spindles of machines for spinning and doubling.

646 J. Perrett. Bottles for feeding infants.

665 W. E. Newton. Pens and pen holders. (A communication.)

667 J. H. Bass. Double cans.

673 J. Livesey. Coupling locomotive carriage wheels.

686 C. Sanderson. Manufacture of iron and steel.

700 W. Barford and T. Perkins. Apparatus for raising and stacking straw.

716 H P. Reynoldson. Portfolios.

730 S. A. Bell and G. H. Higgins. Match boxes.

769 A. V. Newton. Apparatus for cultivating land. (A communication.)

815 W. H. Halsey. Process for making articles from hard rubber.

827 A. Bourdon. Looms for weaving.

845 F. Ryland. Manufacture of pulleys for suspending window frames.

1293 W. Gorse. Preparation of strips of iron and steel for the manufacture of flat-pointed cut nails.

1355 J. Bernard. Preparing and dressing ores.

1485 A. C. Henderson. Mode of manufacturing albumen. (A communication.)

1761 T. Greenwood. Machinery for assorting the fibres of dressed silk. (Partly a communication.)

1763 J. R. Hambling. Thrashing machines.

1775 J. Nuellens and M. Neuhaus. Portable apparatus for cooling wine.

1947 W. Leonard. Horse collars.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed June 19, 1868.

3635 C. G. Wilson	10 W. J. Fraser
3637 J. Davison	26 M. E. Roy and L. Prevett
3642 C. W. Lancaster	
3649 J. Dawkins	58 W. Avery
3660 F. Render	271 J. H. Johnson
3666 W. Hewitt	329 W. E. Newton
3667 G. J. and T. C. Hinde	357 C. E. Brooman
3670 B. and J. B. Bowen	1270 W. Lund

Sealed June 23, 1868.

3645 W. Walker	68 L. Simon
3652 F. A. Abel	138 J. Kidd
3655 P. F. Tranchatt	225 C. E. Brooman
3664 G. E. Allshorn	227 C. E. Brooman
3669 N. Greenhalgh, W. Shaw, and J. Mallison	257 T. L. G. Bell
	291 C. E. Brooman
	323 H. Aland
3673 J. Edge	473 A. F. Bayford
3677 J. M. Rowan	634 G. T. Bousfield
3679 H. Higgins and T. S. Whitworth	711 S. Sharrock
	923 B. E. R. Newlands
3706 M. A. F. Mennons	943 H. Chamberlain, J. Craven, and H. Wedekind
3707 M. A. F. Mennons	
3708 M. A. F. Mennons	
3709 T. Messenger	1057 H. Jones and W. F. De la Rue
7 A. M. Clark	1369 F. C. Hills
12 C. W. May	1400 J. Booth
23 T. P. A. Key	1405 J. H. Johnson
37 J. Nixon	
67 J. Tomlinson	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1641 G. Haseltine	1791 J. W. Swan
1658 J. Scholl	1866 J. P. B. Le Patourel
1679 J. Gale	1902 J. Walton
1719 W. E. Newton	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1539 F. Potts	1562 A. W. Gibson
1547 T. Mellowdew, C. W. Kesselmeyer, and J. M. Worrall	1582 J. Cullen
	1653 J. W. Graham

LIST OF SPECIFICATIONS PUBLISHED,

For the week ending June 20, 1867.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2955	2 8	3047	0 8	3083	0 8	3188	0 4	3208	0 4	3243	0 4
2958	2 2	3049	1 4	3085	0 8	3191	0 4	3209	0 4	3247	0 4
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3041	0 8	3081	0 10	3184	0 4	3207	0 4	3242	0 4	3449	0 4

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